Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

# Business Information Systems

A quality oriented approach towards information requirement determination in equivocal situations

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Thesis Submitted for the Degree of Doctor of Philosophy in the National University of Ireland, Cork

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**August 2016**

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## Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

Signed:

**Acknowledgements**

There are many people who have helped me in completion of this dissertation. Without their help and support it was impossible to accomplish this and I am very grateful for that.

First of all I want to thank my family for their unconditional love and support. My parents Seyed Mahmoud Mousavinejad and Neyereh Aganj. Your trust and confidence in me were always my greatest motivations. My wife, Atieh Zarabzadeh, none of this could be accomplished without you, for long time I did not have time for anything and you did not complain. Thanks a lot for your patience, understanding, emotional and indeed scientific support. My sister, Fahimeh Mousavinejad, you spent a lot of time for me when I needed your help, I know you will say that was nothing but I will never forget.

I also want to thank my friends and fellow PhD students, Robert Gleasure, Yvonne O'Conner, Cathal Doyle, Denis Dennehy, Aonghus Sugrue, Stephen Treacy, Carolanne Mahony, Laleh Kasraeian, Sheila O'Riordan, Frederick Creedon, Timothy O'Sullivan and Ronan McDonnel. You are the smartest and kindest people I ever knew. You helped me to solve the problems when I was stuck and took me out when I was exhausted. THANK YOU.

I must thank Dr John O'Donoghue for your guidance and help and all the parents and IS practitioners who participated in this study.

Finally, I need to thank my research supervisors Dr Karen Neville and Professor Frédéric Adam for your valued insight and guidance.

**Table 0-1: Table of abbreviations**

| Abbreviation | Definition |
|---|---|
| **DSS** | Decision Support System |
| **IDMES** | Individual Decision Making in Equivocal Situations |
| **IQ** | Information Quality |
| **IRD** | Information Requirement Determination |
| **IS** | Information Systems |
| **ISB** | Information Seeking Behaviour |
| **QRD** | Quality Requirement Determination |

## ABSTRACT

Analysis of users' needs is one of the key determinants of any system's success and the foundation of requirement determination process. Yet because of the complexity of human's needs, the process of requirement determination for developing systems to meet human's needs is often ad hoc and poorly understood (Browne & Ramesh, 2002). Poor execution of Information Requirement Determination (IRD) will almost guarantee the failure of the final project, as a result a significant portion of requirement determination activities are dedicated to determining users' information level requirements (Hickey & Davis, 2004) which in this study is referred to as IRD.

There is no commonly accepted IRD method for all situations and therefore IRD methods are ***leaning toward specialised methods, designed for specific contexts and situations*** (Siau & Rossi, 2011). However a significant proportion of IRD literature is focused on organisational context while there are other complex contexts which require researchers' attention. One such situations for which no specialised IRD method could be found in the literature is the context of "***Individual Decision Making in Equivocal Situations (IDMES)***" which in this study is defined as:

> Contexts in which an individual should make important decisions in complex and equivocal situations he/she is not an expert in.

Examples of IDMES could be identified in healthcare where a patient who is not a trained healthcare professional has to choose between several available treatments for a serious health problem. Complexity of decisions a patient needs to make is comparable to the complex decisions that a manager must make in an organisation. The differentiation is that patients are not healthcare specialists but managers are specialists of the area in which they make decisions. In such situations providing higher amount of information to users may actually increase the uncertainty they face (e.g. overloading a patient with information). Therefore, in developing information systems for supporting decision making in such contexts, extra attention should be paid to determining other ***characteristics of users' information needs,*** namely: quality and source.

To establish a theoretical foundation for the IRD method required in this context, a conceptual model labelled as Quality Requirement Determination ***(QRD) model*** has been generated in this study. To develop the QRD model, two concepts of Information Quality (IQ) and Information Seeking Behaviour (ISB) have been leveraged. Although both IQ and ISB are mature topics, their applications in IRD methods are not very well studied (Gharib & Giorgini, 2015; Savolainen, 2007, 2008; Sonnenwald, Wildemuth, & Harmon, 2001).

To evaluate the QRD model, it has been applied to the case of parenting children with autism. This case has been selected because it meets all the characteristics of IDMES, namely because: 1) autism cause and cure are unknown and therefore selecting from the array of available interventions "*is a nightmare for desperate parents*" (Crawford, 2013, p. 53). 2) Parents must individually make decisions in a context in which they are not trained experts even though over time they develop a certain level of practical experience. Seventeen parents were interviewed about their information seeking behaviours when they needed to decide on interventions necessary for a specific problem. The results of the data analysis confirm the existence of the relationships between perceived information needs, source preference behaviour and quality requirements proposed in the QRD model.

The information requirements which arose from the case of parenting children with autism is embodied in the ***QRD presentation matrix***. It leverages a nine cell matrix with each cell representing a cognitive role played by the information sources in the users' information horizon[1]. The QRD presentation matrix along with the QRD model and associated data collection and analysis techniques are called ***QRD method***. To evaluate the usability of determined information by the QRD method, results of an instrumental case study were presented to a group of IS practitioners. The selected IS practitioners have been chosen from variety of expertise involved in developing information systems to reflect the maximum variety of opinions. The interview results demonstrated the value of the QRD method for a number of key practical activities in the IRD process, namely: context study, problem definition, quality requirement analysis, quality implementation, designing information flow and user interface design.

[1] Called application 1 to application 9

# CHAPTER ONE: INTRODUCTION

This chapter introduces the research investigated in this study. Section 1.1 discusses the motivations for this study and an overview of the subjects covered. Section 1.2 provides the research objective and research questions established to explore the gaps identified in the literature, and finally section 1.3 details the structure of this thesis.

## 1.1 An overview of motivations for this study: IRD for systems assisting decision making in equivocal situations

Motivations for this research study are derived from three bodies of literature; Information Requirement Determination (IRD), Information Quality (IQ), and Information Seeking Behaviour (ISB) in equivocal situations. IRD is a part of requirement determination as the most important stage of information system development. Yet because of its complexity there is little agreement between scholars on the importance and details of the activities to be performed during the IRD phase (Shuraida & Barki, 2013). The next three paragraphs outline the motivations for this study derived from these three areas of literature.

**IRD:** To address the requirement determination complexity and limitations, numerous competing IRD methods are available in which there is little agreement between scholars on the importance and the detail of activities to be performed to understand users' information needs. In this "methodology jungle", information analysts tend to use a combination of different IRD methods and techniques, each to determine a few important requirements. In other words, similar to development methods there is no commonly accepted IRD method for all situations and therefore IRD methods are illustrative rather than exhaustive (Browne & Ramesh, 2002; Davis, 1982; G. Fitzgerald & Avison, 2003; Giorgini, Rizzi, & Garzetti, 2005; Henderson & West Jr., 1979; Mazón, Trujillo, Serrano, & Piattini, 2005; Meador, Guyote, & Rosenfeld, 1986; Ross & Schoman, 1977; Shuraida & Barki, 2013; Siau & Rossi, 2011). As a result ***IRD literature is leaning towards the specialised methods, designed for specific contexts and situations*** (Siau & Rossi, 2011). However *for the context of Individual Decision Making in Equivocal Situations (IDMES), no IRD method could be found in existing literature to specifically analyse*

*user' information needs and its' characteristics (i.e. IQ requirements and preferred sources/media).*

**IQ:** IQ is not a new topic in IS. It is one of the constructs of the seminal DeLone and McLean information system success model and the one which has gained a lot of attention from researchers concerned with data and information quality assessment methods (see the review in Batini et al. (2009)). IQ has been described as a key success factor for the "*efficient performance of any system*" (Gharib & Giorgini, 2015). Low attention to IQ in IS development may cause problems specially in uncertain situations as studies indicate that higher uncertainty increases the need for higher IQ (Bin, 2009; Mackintosh, Myers, & Goin-Kochel, 2005; Savolainen, 2008). IQ literature in this study highlights a few points to be considered when measuring the IQ in different contexts which are as follows:

- IQ in general is a, task, user and context sensitive subject (Batini et al., 2009; Delone & McLean, 2003; Lee, Strong, Kahn, & Wang, 2002; Petter, DeLone, & McLean, 2008; Pipino, Lee, & Wang, 2002; Seddon & Staples, 1999; Wang & Strong, 1996; Wilson, 1997) and therefore to determine the IQ requirements, IRD methods need to identify the IQ dimensions specific to the context of interest and to determine their priorities for users.
- Due to the subjective nature of IQ, there is little agreement between scholars on the definition of IQ dimensions (Batini et al., 2009) and therefore little agreement on how these dimensions should be measured and implemented.
- Most available IQ evaluation methods are focused on evaluating the IQ of a system rather than determining users' IQ requirements based on the decisions to be made or the tasks to be performed in their natural context.

The tools and models necessary to determine users' IQ requirements in equivocal situations could be derived from ISB literature and so it has been leveraged in this study to develop the conceptual model.

**Problem-specific Information Seeking Behaviour (ISB):** As indicated above, the need for IQ increases when decision making is associated with high level of

uncertainty. The need for IQ increases even more in equivocal situations in which higher amounts of information may actually increase the uncertainty that decision makers face (Daft & Lengel, 1986). Examples of Individual Decision Making in Equivocal Situations (IDMES) could be identified in healthcare where a patient who is not a trained healthcare professional has to choose between several available treatments for a serious health problem. Complexity of decisions a patient needs to make is comparable to the complex decisions that a manager must make in an organisation. The differentiation is that patients are not healthcare specialists but managers are specialists of the area in which they make decisions. In such situations providing higher amount of information to users may actually increase the uncertainty they face (e.g. overloading a patient with information). Therefore, in developing information systems for supporting decision making in such contexts, extra attention should be paid to determining other ***characteristics of users' information needs,*** namely: quality and source.

A few ISB models are available which include the impact of IQ on seekers' information behaviour but they have not been designed for IRD purposes and do not include all required constructs and relationships. These ISB models need modifications to be used for determining characteristics of potential users' required information including their preferred sources/media, IQ requirements and their relationships with users' information needs.

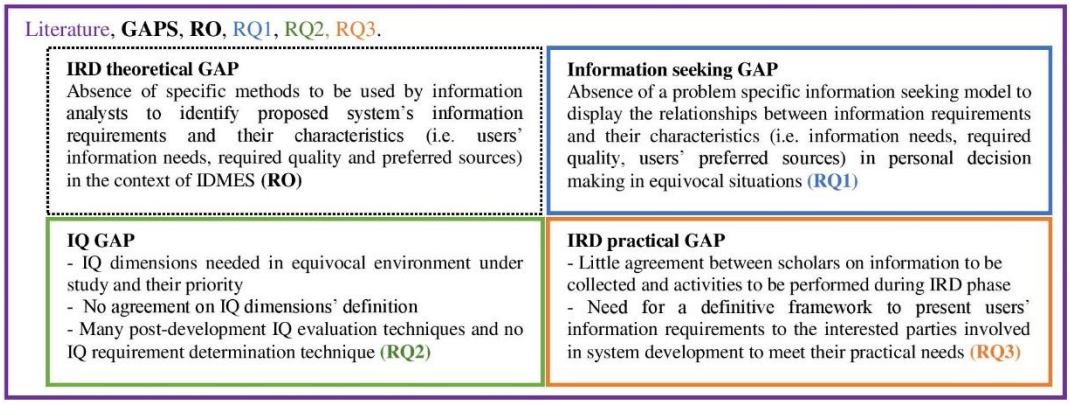
To establish a theoretical foundation for the IRD method required in the context of IDMES, a conceptual model labelled as Quality Requirement Determination ***(QRD) model*** has been generated in this study. This model assists information analysts in determining users' information needs and its characteristics and may increase the IQ within the information systems developed for assisting decision making in equivocal situations.

The next section defines this study's research objective and its operationalisation into a set of research questions.

## 1.2 Research objective and questions

The research objective suggests the main key elements of a study and its design, therefore it is crucial to design and define it precisely (Creswell, 2008). The literature review in chapter two identifies that there is no specialised method for the determination of users' information requirements in the context of "IDMES". Examples that describe equivocal decision making situations can be found in healthcare when a patient who is not a trained expert in healthcare has to choose between several treatment options for a serious health condition. In these cases focusing only on the amount of information may even increase the uncertainty in decision making and overloads patients with information. Therefore, when planning to develop an information system to assist users in making decisions in equivocal situations, extra attention should be paid to determining users' information needs and its characteristics (i.e. IQ and source). Yet no specific IRD method or technique could be found to categorise the information needs and determine users' IQ requirements and preferred information sources in this context. In Figure 1.1 the gaps identified in the literature are detailed.

**Figure 1.1: The gaps identified in the literature, RO and RQs**




To address the identified gaps, the research objective of this study is as follows:

> To define the characteristics of information requirements of information systems in the context of IDMES

Practically the ambition is to develop a specifically designed IRD method from the combination of a theoretical model and its associated data collection, analysis and

presentation techniques, for the context of IDMES. To study characteristics of users' information requirements this study focuses on users' quality requirements and their source preference. Hence three research questions are proposed for this study as follows:

1. **How do users' perceived information needs impact their source/media preference behaviour?**

There is only a limited body of literature on the relationship between perceived information needs and source preference behaviour. Therefore, this relationship is empirically evaluated through a sample context analysis (the case of parenting children with autism).

2. **How should users' information quality requirements be determined?**

Research question two (RQ2) is explanatory in nature. It focuses on explaining users' quality requirement. Information quality includes several dimensions, many of which are subjective and therefore their priority to users and their definitions are task, user and context sensitive (Batini et al., 2009; Delone & McLean, 2003; Herrera-Viedma, 2006; Lee et al., 2002; Petter et al., 2008; Pipino et al., 2002; Seddon & Staples, 1999; Wang & Strong, 1996; Wilson, 1997). Thus, to determine users' IQ requirements prior to an information system development, it is necessary that their required IQ dimensions, dimensions' priority and their subjective definitions and measurements are identified.

3. **What are the practical uses of determining the characteristics of information requirements for IS practitioners?**

The results of any IRD method conducted by information analysts should address the requirements of other interested stakeholders involved in the information system development (e.g. other information analysts, system analysts, designers, system developers, content developers, managers). There is little agreement amongst scholars on the activities which should be performed and the information which should be collected during the IRD phase in different contexts. Therefore, this question focuses on validating the practical uses proposed for the determined

information requirements. This information allows the researcher to identify the important information to be determined and important activities to be performed during IRD phase of system development in the context of IDMES.

To address the first two research questions, the researcher uses the QRD model as the theoretical foundation (created in chapter 3). The generated theoretical model helps the researcher in conceptualising the context, identifying the active constructs and how to measure them. RQ3 on the other hand, begins with a looser understanding of the context. It attempts to evaluate the proposed applications for the developed method and to identify other emergent potential uses.

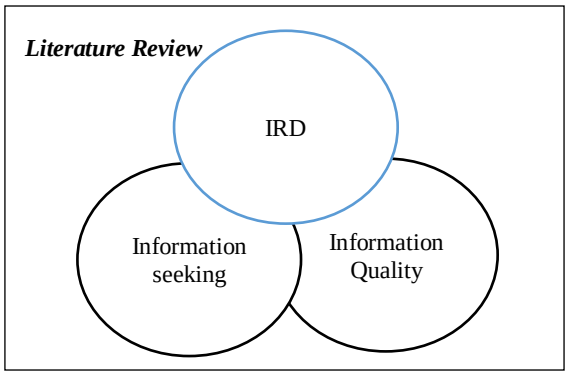
The next section outlines the research design of this study.

## 1.3 Structure of thesis

This thesis consists of six chapters, in addition to this introductory chapter. The content of these six chapters are outlined as follows:

The main objective of **chapter two** is twofold. First to identify the limitations and challenges in determining users' information needs and its characteristics in IRD in the context of IDMES; and second to provide a theoretical foundation to be used for determining users' information needs in such situations. Hence, this chapter reviews three bodies of literature. IRD and IQ literatures were reviewed to identify the gaps in determining users' information needs and its characteristics by information analysts in equivocal decision making situations. ISB literature on the other hand was reviewed to provide the theoretical foundation needed for defining a conceptual model with the ability to analyse users' information needs and its characteristics.

**Figure 1.2: Literature review design**



**Chapter three** leverages the theories and concepts explained in chapter two to establish a conceptual model to be used for determining users' information needs and its characteristics. This model has been named Quality Requirement Determination (QRD) model.

**Chapter four** presents the research design adopted in this study. Following the identification of the theoretical and empirical gaps at the end of chapter two, and designing the QRD model in chapter three, a research objective and three research questions were proposed at the start of this chapter. To evaluate the QRD model and its applicability in determining the prospective users' information requirements, a case study was conducted on case of parenting children with autism. In this case parents were interviewed as potential system users and IS practitioners were interviewed as potential developers of the system to meet parents' information needs. This chapter explains how the data was qualitatively collected, analysed and displayed. Table 1-1 and Figure 1.3 illustrate the methodological and data analysis processes adapted in this study and explained in chapter four.

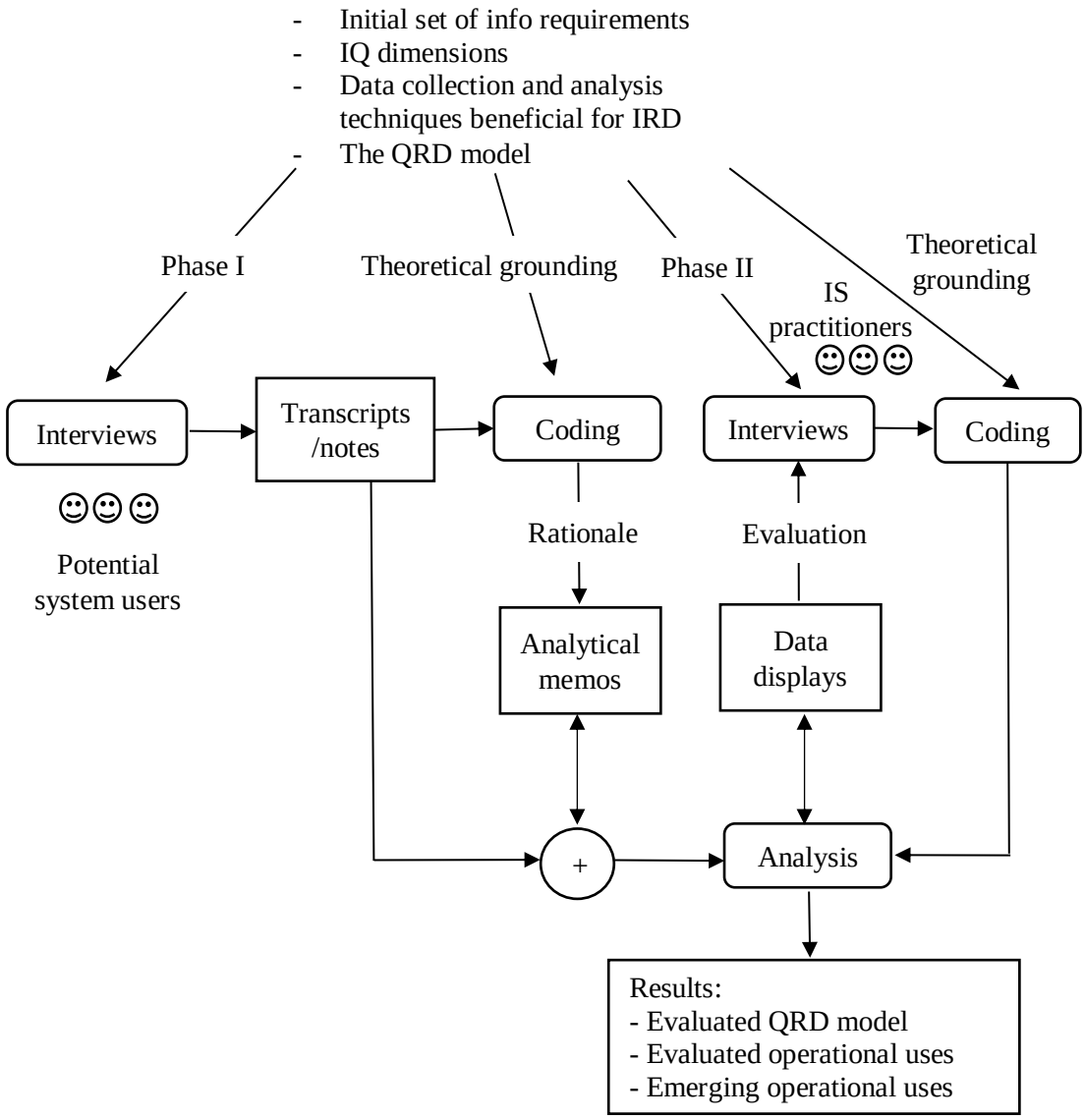
**Table 1-1: Research methodological process**

| Paradigm | Strategy | Methodology | Method | Data collection techniques |
|---|---|---|---|---|
| Post-positivism<br>Critical realism | Explanatory (RQ1 & RQ2)<br>Exploratory (RQ3) | Pluralism[2] | Case study | Semi-structured interviews underpinned by an instrument |

This study required two phases of data collection and analysis, Figure 1.3 outlines the steps taken during the data analysis process employed in this study.

[2] Methodologically, the post-positivist paradigm encourages pluralism believing that there is no one correct method of science instead, there are many (Wildemuth, 1993). In other words pluralism within the post-positivism paradigm emphasizes the importance of applying multiple measures and observations that while each might not be accurate but can provide a better understanding of the reality (W. Chen & Hirschheim, 2004).

**Figure 1.3: Schematic overview of data analysis process employed in this study. Adapted from (Agerfalk & Fitzgerald, 2008, p. 407)**




**Chapter five** analyses and discusses the data collected from both groups of participants. To answer RQ1 and RQ2, it evaluates the new relationships presented in the QRD model and explains users' IQ requirements in detail. The data collected from parents of children with autism has been used to answer these two questions. Finally, RQ3 evaluates the proposed practical uses for the information requirements determined from an instrumental case study. The data collected from the IS practitioners were discussed to answer this question.

At the end of this thesis, **chapter six** synthesises the findings of this study and discusses its theoretical and practical contributions. It also presents final conclusions

pertaining to the QRD method and its intended uses in information system development projects. At the end of this chapter, the researchers' recommendations to future researchers are presented.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

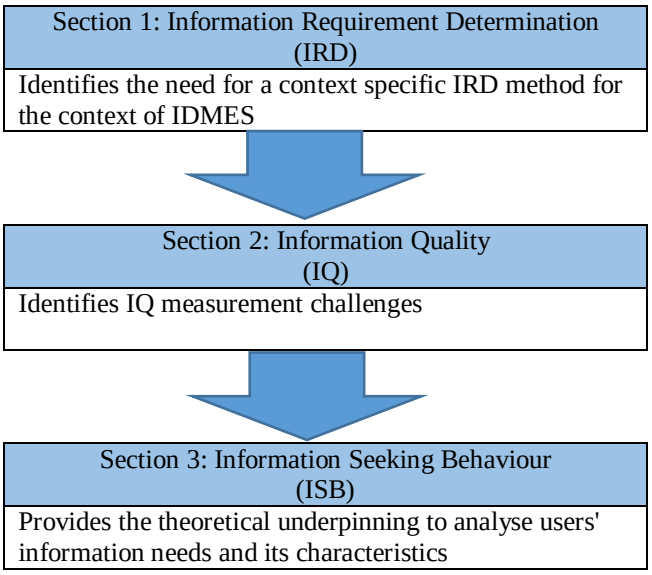
To assist the development of information systems, new methods are constantly emerging. Examples of such methods include object-oriented analysis, open source development, agile modelling, business process re-engineering and service oriented architecture. Despite the standardization efforts made on system analysis and design methods such as Unified Modelling Language (UML) and object-oriented, it is unlikely that one method can meet the needs of all situations (Siau & Rossi, 2011). As a result:

> *there is a trend leaning towards more-specialized [analysis and design] methods and approaches (Siau & Rossi, 2011, p. 249).*

One of the first and vital steps in developing an information system is determining its information requirements. Although, poor execution of Information Requirement Determination (IRD) will almost guarantee the failure of the final project (Hickey & Davis, 2004), it is referred to as a "confusing methodology jungle" where there is little agreement between scholars on the importance and details of activities to be performed during it. Furthermore, many IRD approaches just give a general view of the subject and do not explain the activities that information analysts should perform to determine users' information needs (Shuraida & Barki, 2013).

This chapter starts with reviewing the IRD literature. It explains IRD complexity and highlights the need for specialised IRD methods in section 2.2. In this section the activities involved in determining information needs of individual decision makers in equivocal situations are also identified. In section 2.3, Information Quality (IQ), that includes the majority of users' information needs characteristics, is explored. In this section, the subjective nature of IQ and its dimensions are defined and its measurement difficulties are explained. To address the gaps and challenges identified in sections 2.2 and 2.3, information seeking models and concepts with the ability to map users' information needs and its' characteristics are presented in section 2.4 (see Figure 2.1).

**Figure 2.1: Literature review flow of logic**




The following section starts the literature review by defining the information requirement determination.

## 2.2 Information Requirement Determination (IRD)

Information requirement determination and in a wider perspective, requirement determination, also termed as “requirement elicitation”, “requirement analysis” and “requirement engineering” is defined through several perspectives in the literature. A selection of these definitions is available in Table 2-1.

**Table 2-1: IRD definitions**

| Term used | Definition | Reference |
|---|---|---|
| Information requirement determination | "is the process by which systems analysts build an understanding of users' needs for an information system" | (Browne, 2006, p. 313) |
| Information requirement determination | "is a set of activities used by a systems analyst when assessing the functionality required in a proposed system. Types of information gathered include goals, for the system, business processes. Data needs, design constraints, and behaviors of users" | (Browne & Ramesh, 2002, p. 625) |
| Requirement elicitation | "Covers the capture and discovery of stakeholder needs. Its aim is to identify information determining what features the software system should have" | (Carrizo, Dieste, & Juristo, 2014, p. 644) |
| Requirement elicitation | "Learning, uncovering, extracting, surfacing, or discovering needs of customers, users, and other potential stakeholders." | (Hickey & Davis, 2004, p. 67) |
| Requirements determination | "The process of gathering and modelling information about required functionality of a proposed system by a systems analyst" | (Browne & Rogich, 2001, p. 224) |
| Organisational level information requirements | A master plan to define information system structure and applications to provide complete coverage of the needs. It defines objectives and boundaries of applications, their priorities and orderly development. | (Davis, 1982) |
| Application level Information requirements determination | "defines and documents specific information content plus design and implementation requirements" | (Davis, 1982, p. 6) |
| Requirement analysis | "development of effective information systems (IS) requires thorough analyses of user information needs prior to IS design" | (Byrd & Cossick, 1992, p. 117) |

For the purposes of this study, **Information Requirement Determination** (IRD) is considered as the initial stage of the requirement determination and is defined as:

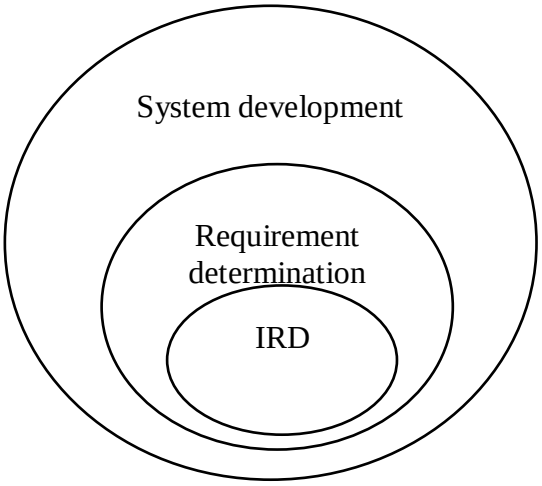
> *A process to discover information needs of potential system users and other stakeholders prior to the information system design in order to define the objectives and required functionality of the proposed system and its applications* (Browne & Ramesh, 2002; Browne & Rogich, 2001; Browne, 2006; Byrd & Cossick, 1992; Carrizo et al., 2014; Davis, 1982; Hickey & Davis, 2004).

Four levels of requirements are identified as 1) goal level requirements, 2) process level requirements, 3) task level requirements, and 4) information level requirements (Browne & Rogich, 2001). To determine the information requirements, this study is focused on information level requirements. However, it is noteworthy that the border between information level requirements and other levels of requirements has been defined in an unclear fashion by the literature. Also, several studies used the term

IRD to address the entire process of requirement determination (Browne & Rogich, 2001; Browne, 2006; Davis, 1982).

The majority of the activities performed in the requirement determination stage of system development aim to determine users' information requirements (Hickey & Davis, 2004). Thus, the results of studies focusing on requirement determination may be applied to IRD and so, the researcher employs the results of requirement determination studies to explain different aspects of IRD. Figure 2.2 illustrates the relationship between system development, requirement determination and IRD.

**Figure 2.2: Relationship between system development, requirement determination and IRD**




Further to IRD, strategy, method, technique and methodology are also common terminologies used in this study which are defined in Table 2-2.

**Table 2-2: Strategy, method, technique and methodology definitions**

| Terminology | Definition |
|---|---|
| **Strategy** | "An approach for achieving an objective. Strategies are general approaches; methods and methodologies are the detailed means for doing it" (Davis, 1982, p. 12). |
| **Method** | "An orderly or systematic procedure" (Davis, 1982, p. 11). "by which one can obtain a desired result. The desired result may be the specification of a more cost-effective way of operating a business, [or] a specification of product requirements" (Wieringa, 2006, p. 5).<br>In system development "a method is an approach to model an aspect of a systems development project, based on a specific way of thinking. Some researchers also include tools and/or resources in the definition" (Siau & Rossi, 2011, p. 251). |
| **Technique** | "All techniques are methods. (…) Usually, techniques prescribe a way of working in detail, whereas methods need not contain detailed instructions" (Wieringa, 2006, p. 5). |
| **Methodology** | "A set of methods and techniques" (Davis, 1982, p. 11). |

This section starts with defining information needs in subsection 2.2.1. Then, in subsection 2.2.2 IRD's importance and complexity are explained in terms of the limitations it faces, activities conducted and stakeholders involved. Finally, in subsection 2.2.3 the need for a context specific IRD for the context of IDMES is defined. Also, the activities that should be performed to determine information needs and its characteristics in this context are discussed.

### 2.2.1 Information needs

To complete a task, its perceived information needs should be met. Information needs reflect the gap that might have existed between a user's interpretation of task's information requirements and user's knowledge. This gap should be filled with information collected from information sources (Byström & Järvelin, 1995). Information needs is described as general recognition of presence of uncertainty and starts with a person's attempt to solve "uncertainties or knowledge insufficiencies" (Lasorsa & Rice-Lively, 2004). Wilson (1999 p. 251) indicates that:

> *Information-seeking behaviour arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services.*

Information needs can be categorised in a number of manners[3]. Regardless of the need's type, the person in need at some point may seek information to answer their queries and satisfy their "unlearned" or "social" motives.

Individuals' information needs is impacted by their role and even within the same role (e.g. managers), information needs are impacted by demographics and type of problem at hand (Guillaume & Bath, 2004). When the problem at hand is a decision to be made, users' information needs is defined by Picot et al. (2002) in Winter and Strauch (2003) as:

[3] Information needs can be categorised based on the need for new information; need to elucidate the information held; and need to confirm information held or it can be categorised based on the type of questions to discover. Therefore, four types of questions can be distinguished: 1) what is happening ("orientation"), 2) questions to check being "on the right track" ("reorientation"), 3) questions to solve a problem ("construction"), and 4) questions to build one's knowledge ("extension") (Wilson, 1997).

> *Type, amount and quality of information that a decision maker or knowledge worker needs to do his/her job (p. 3).*

To measure the information needs it should be considered that need is a subjective experience happening in the mind of a person in need and is not observable directly. Therefore, the need could be collected only by *deducing it from behaviour* or *report of the person in need* (Lasorsa & Rice-Lively, 2004). Burnkrant (1976) proposes that the need is "a cognitive representation of a future goal that is desired". Thus, information needs could be measured by:

> *The queries in mind of the information seeker caused by a need affected by "unlearned" or "social" motives.*

Scholars assume that information needs are the key to understand information behaviour and improve information systems and therefore, information needs should be rationally determined at the initial phases of information system design (Alvarez, 2002; Lasorsa & Rice-Lively, 2004). As a result, learning users' information needs, mainly through communication with system users, improves the outcomes of the information system development (Shuraida & Barki, 2013).

Despite the fact that importance of determining users' information needs through requirement determination is very well supported by the literature, the determined requirement often is the lead cause of system development failure (Davis, 1982; Hickey & Davis, 2004; Hofmann & Lehner, 2001; Shuraida & Barki, 2013).

The next subsection explores how most failures in system development projects are due to poor requirement determination.

### 2.2.2 Importance of IRD and its complexity

Poor execution of IRD will almost guarantee the failure of the final project (Hickey & Davis, 2004). Consequently, requirement determination "has been widely recognized as the most difficult activity of information systems development" (Browne & Ramesh, 2002; Browne & Rogich, 2001, p. 224; Browne, 2006). Despite the fact that the importance of IRD is very well recognised by scholars and that it occupies a major portion of the time spent during the early stages of system

development, poorly determined requirements are often the cause of project failures. Requirements that are poorly determined include "inaccurate or incomplete information requirements". Inaccurate requirements cause project failure as the correction of requirement errors at late stages can cost up to 200 times more than the estimated cost of the project (Browne & Rogich, 2001; Browne, 2006; Davis, 1982; Hickey & Davis, 2004; Hofmann & Lehner, 2001; Klendauer, Berkovich, Gelvin, & Marco, 2012; Meador et al., 1986; Shuraida & Barki, 2013). This is evidenced in a range of domains; for example Mazón et al. (2005) and Giorgini et al. (2005) indicate that "more than 80% of data warehouse projects fail to meet business goals" usually because of poor communication between IT and business professionals during the requirement determination phase. Similarly, Richards and Jones (2008) indicate that 70% of customer relationship management projects do not result in any improvement. The Rigby and Ledingham (2004) study suggests that such failures could be due to unfocused approaches and unrealistic expectations pertaining to the technology prior to implementation.

New system development methods such as object-oriented analysis, open source development, agile modelling, business process re-engineering, and service oriented architecture are constantly emerging to assist the information system development (Siau & Rossi, 2011). A classic system development method, called the waterfall, follows a well-defined series of steps that lead to a final product. However, in recent system development methods, development activities are performed iteratively resulting in a successively sophisticated product. In the waterfall method, requirement determination was performed only at the beginning of development process while in recent development methods it is conducted regularly at the beginning of each iteration (Hickey & Davis, 2004). This indicates that:

> *Regardless of the applied system development methodology, conducting requirement determination is crucial for understanding users' needs and improving the outcomes of the information system development (Davis, 1982; Hickey & Davis, 2004; Shuraida & Barki, 2013).*

Most of the requirement determination methods consider identification of information needs as the starting stage of system development (Alvarez, 2002). To

determine the information needs, some of the IRD methods have indicated sequential steps but in reality these steps are usually conducted iteratively (Hickey & Davis, 2004).

To determine information requirements, numerous competing methods and methodologies are available in a manner that it is labelled as a "confusing methodology jungle". In different IRD methods, there is little agreement between scholars on the importance and details of activities to be performed to understand users' information needs (Shuraida & Barki, 2013). Despite the efforts made on standardising the system analysis and introduction of design methods such as unified modelling language and object oriented, it is unlikely that one method can meet the needs of all situations (Siau & Rossi, 2011). As a result, *scholars have moved toward specialized analysis and design methods, each designed for a specific context to address a group of requirements* (e.g. unified modelling language extensions for website development, component development, open-source development, Yourdon's structured analysis techniques, IBM's business systems planning, data flow diagram, SofTech's structured analysis and design techniques) (Browne & Ramesh, 2002; Castro, Kolp, & Mylopoulos, 2002; Davis, 1982; Hickey & Davis, 2004; Mazón et al., 2005; Meador et al., 1986; Montazemi & Conrath, 1986; Shuraida & Barki, 2013; Siau & Rossi, 2011).

Because of the complexity of human's and organisational needs[4], requirement determination is often ad hoc and poorly understood, and as mentioned earlier, a large number of delivered systems fail to meet their users' expectations and requirements (Browne & Ramesh, 2002; Browne, 2006). So, while it is generally agreed that valid information about user and utilising system (e.g. the organisation implementing the proposed system) should be determined, but there is no standard method to assist analysts in conducting IRD in all situations. Many methods also lack theoretical backgrounds and may not consider the limitations that IRD faces. Absence of commonly accepted IRD methods for all situations and also unreliable IRD methods may result in inaccurate determination of information requirements in which important requirements are being overlooked or incorrectly determined

[4] For instance, different users may perform the same task differently and even same user may do the same task differently over the course of time.

(Browne & Ramesh, 2002; Browne & Rogich, 2001; Browne, 2006; Davis, 1982; Shuraida & Barki, 2013; Siau & Rossi, 2011).

To explain the complexity of IRD, the following subsections outline the limitations that IRD faces, activities to be performed during it and involved stakeholders.

#### 2.2.2.1 Aim of IRD methods and their limitations

The common aim of IRD methodologies is to assist information analysts in determining users' and other stakeholders' information needs. But due to the complexity of IRD, and the absence of commonly accepted IRD methods for all situations and limitations that IRD faces, information analysts have to select or design suitable IRD methods for each project. In many cases one method is not sufficient and therefore information analysts tend to use a combination of IRD methods and techniques (Davis, 1982; Hickey & Davis, 2004; Siau & Rossi, 2011).

There are a series of constraints limiting determination of users' information requirements by information analysts. Ideally information analysts should be able to determine requirements from users "plainly and clearly" (Browne & Rogich, 2001) however,

> *for a variety of cognitive, communicative, and motivational reasons, the information ultimately received and understood by analysts is generally incomplete* (Browne & Rogich, 2001, p. 224).

Studies focusing on IRD limitations suggest specific requirement determination strategies and methods for addressing each limitation. Table 2-3 outlines a selected number of these limitations[5]. To select or design the suitable IRD method to be used in different contexts, these limitations should be considered for determination of complete and accurate requirements.

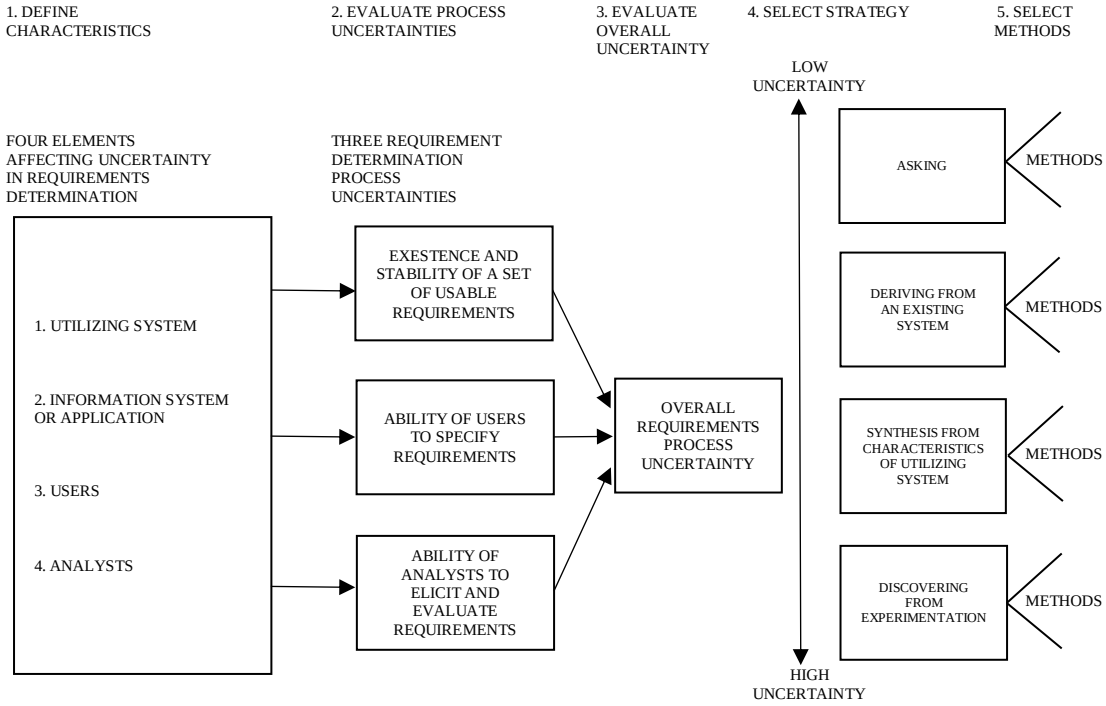
[5] Not all of the limitations that IRD faces are defined in this section as they are beyond the scope of this study.

**Table 2-3: Information requirement determination limitations**

| Limitations | Reference |
|---|---|
| **Information gathering limitations** including: cognitive biases, satisficing, faulty reasoning, automaticity, problems in recall, variety and complexity of requirements, communication problems, motivational biases, Hawthorne effect. **Representation limitations** including: cognitive biases, satisficing, faulty reasoning, problems in recall, variety and complexity of requirements. **Verification limitations** including: cognitive biases, satisficing, communication problems. | (Browne & Ramesh, 2002, p. 627) |
| Short term memory, constructive nature of long-term memory, bounded rationality/satisfying, automaticity, faulty reasoning, cognitive biases. | (Browne & Rogich, 2001, p. 229) |
| The constraints on humans as information processors and problem solvers, the variety and complexity of information requirements, the complex patterns of interaction among users and analysts in defining requirements. | (Davis, 1982, p. 5) |
| Decision makers' difficulty in quantifying the value of the information content of their decision variables. | (Montazemi & Conrath, 1986, p. 46) |

Figure 2.3 illustrates the impact of system and human limitations on users' and analysts' ability in determining the information requirements and how it could be enhanced by IRD strategies and methodologies. Davis, (1982) draws a relationship between the level of uncertainty involved in IRD and the type of IRD strategies and techniques to be used. He categorises information requirements into organisational and application levels. His suggested approach that is based on the limitations in the context (see Figure 2.3) leads the analysts to select suitable IRD strategies and methods. He defines a number of elements and players that impact the uncertainty of the IRD process. The level of uncertainty then leads the analysts in selecting suitable strategies and methods.

**Figure 2.3: Process of selecting IRD strategy adopted from Davis, (1982, p. 21)**




The limitations that IRD faces are noted in this chapter in section 2.2.3.1 and in the sections 4.6.1.3.1 and 4.6.1.3.4 of the methodology chapter.

Depending on the context in which the information system is being developed, several activities should be performed during the IRD phase. The next subsection outlines these activities.

#### 2.2.2.2 Activities performed in IRD

To address the requirement determination complexity and limitations, numerous competing IRD methods are available in which there is little agreement between scholars on the importance and the detail of activities to be performed to understand users' information needs. In this methodology jungle, information analysts tend to use a combination of different IRD methods and techniques each to determine a few important requirements. In other words, similar to development methods *there is no commonly accepted IRD method for all situations and IRD methods are illustrative rather than exhaustive* (Browne & Ramesh, 2002; Davis, 1982; G. Fitzgerald & Avison, 2003; Giorgini et al., 2005; Henderson & West Jr., 1979; Mazón et al., 2005;

Meador et al., 1986; Ross & Schoman, 1977; Shuraida & Barki, 2013; Siau & Rossi, 2011).

There are many studies conducted on IRD methods and each has included a few activities to be performed during the IRD phase. Table 2-4 lists a number of requirement determination studies and outlines the activities/information they indicated to be performed/collected during the requirement determination phase. Due to the overlap of the definitions of requirement determination and IRD, the activities indicated in this table may partially fall out of the scope of IRD.

**Table 2-4: Activities to be performed/information to be collected during requirement determination phase**

| Activities to perform/information to collect | Reference | Context |
|---|---|---|
| Consideration of objective and subjective information needs, information demand, information supply and their relationships. | (Winter & Strauch, 2003) | Data warehousing projects |
| What the product does (behaviour), why it does it (functionality), how it does it (implementation). | (Wieringa, 2006) | Computer based information system |
| (1) Elicitation: discovering needs of users, (2) analysis: generate a list of candidate requirements from elicited information, (3) triage: determining which subset of the requirements is appropriate to be addressed in specific releases of a system, (4) specification: documenting the desired external behaviour of the system, and (5) verification: determining lack of defects in a set of requirements. | (Hickey & Davis, 2004, p. 67) | Software development |
| "(1) [Knowledge of] the current problem, solution, and project characteristics, (2) the awareness of which requirements are known and which are still to be determined, and (3) knowledge of the relationship of the current problem, solution, and project characteristics". | (Hickey & Davis, 2004, p. 67) | Software development |
| To determine user needs and organisational tasks "analysts who encourage the use of concrete examples, testing, and validation, and who solicit feedback about users' business processes are likely to better understand users' tasks". | (Shuraida & Barki, 2013, p. 482) | Agile system development applied to one pharmaceutical co and one insurance co., both replacing old systems |
| (1) Understanding requirement dependencies, (2) business value, risk, (3) "'delivery stories', which complement user stories with technical implications, effort estimation and associated risk", (4) vendors' domain knowledge, and (5) "type of project outsourcing arrangement". | (Daneva et al., 2013, p. 1333) | Agile system development (outsourcing software development) |
| (1) Pre-Elicitation: manage expectations of the users, (2) Elicitation, requirements are elicited from documents and users (their experience, preference), (3) representation: requirements are presented into a physical form (e.g. Data Flow Diagram, Unified Modelling Language), and (4) verification, Information analyst verifies that determined requirements correctly reflects users' needs and experience. | (Browne, 2006) | General |
| (1) Assist an analyst to constrain and structure the problem space (takes 75% of the analysts' time), (2) assist in | (Davis, 1982, pp. 11–12) | General |

| | | |
|---|---|---|
| searching efficiently within the problem space (It should aid in discovering requirements), (3) assist in overcoming biasing factors such as recency, concreteness, and small samples, (4) provide assurance that requirements are complete and correct. | | |
| (1) Critical decisions are defined, (2) critical information necessary to support these decisions is defined, and (3) information is characterized in terms of importance, frequency of use, and source. | (Henderson & West Jr., 1979, p. 47) | Decision support system planning |
| (1) High priority applications, (2) high level function requirements for those applications, (3) information characteristics and requirements, (4) appropriate fundamental approaches to addressing user needs, including system architecture and detailed technical requirements, and (5) orientation of users to DSS concepts and their relevance to supporting users' jobs." (Information collected). | (Meador et al., 1986, p. 160) | Decision support system planning |
| Define decisions to be made and their information requirements specifications like response time, accuracy and frequency, define how the information requirements answer the problem, define involved parties and their responsibilities for IRD, and define information flow and type of DSS needed. | (Locander, Napier, & Scamell, 1979) | Decision support system planning |
| (1) "The data to be presented to end users", (2) "The language and formats used in presenting "displayed information" to end users". | (Byrd & Cossick, 1992, p. 124) | General |
| An analyst (1) working with end users to establish an understanding of organizational information processing needs, (2) developing IS objectives, (3) designing and evaluating IS alternatives, (4) communicating the results of analyses to superiors, other analysts, and end users, and (5) performing a systems audit." | (Byrd & Cossick, 1992, p. 117) | General |
| Analysis of current operations, problem statement, economic assessment of sensitivity factors, proposed functions, provide performance parameters, provide expected economic impacts, and presentation of information requirements. | (Ross & Schoman, 1977) | General |
| (1) A generic understanding of systems which is scientifically sound, (2) a notation and structure of documenting specific system knowledge in a rigorous, easy-to-read form, (3) a process for doing analysis which includes definition of people roles and inter- personal procedures, and (4) a way to technically manage the work. | (Ross & Schoman, 1977, p. 8) | General |
| Information gathering, representation and verification stages goals for the system, business processes, data needs, designs constraints, and behaviours of users. | (Browne & Ramesh, 2002, p. 625) | General |
| (1) Functional specification (2) System context, constraints, and assumptions. (3) Performance specification (4) Measurement and test conditions to verify system is behaving properly. | (Sibley, Yadav, Bravoco, Chatfield, & Rajkumar, 1988, p. 1091) | General |
| "Functional architecture, system context, performance specification, measurement, and test conditions". | (Sibley et al., 1988, p. 1091) | General |
| An IRD technique "should provide mechanisms (1) to develop a functional model of the object system, (2) to define various components of the model, and (3) to specify performance and test conditions". | (Sibley et al., 1988, p. 1092) | General |
| The procedures users follow to perform their responsibilities and the types of information they require to do their jobs. | (Browne & Rogich, 2001) | General |
| Displayed information, interface design, inputs, stored information, objects and events and their relationships, data attributes, validation criteria, computations. | (Browne & Rogich, 2001) | General |

The diversity between the activities considered important by different scholars in the extant literature is shown in Table 2-4. Leading on from this table, frequently stated activities are listed in Table 2-5.

**Table 2-5: Frequently stated IRD activities**

| Activities to perform/information to collect | Reference |
|---|---|
| Study users' needs, experience, expectation, preference, stories | (Browne, 2006; Byrd & Cossick, 1992; Daneva et al., 2013; Hickey & Davis, 2004; Shuraida & Barki, 2013) |
| Presentation of determined information, simple to present information requirements | (Browne & Ramesh, 2002; Browne & Rogich, 2001; Browne, 2006; Byrd & Cossick, 1992; Ross & Schoman, 1977) |
| Verification of required information with users | (Browne & Ramesh, 2002; Browne & Rogich, 2001; Browne, 2006; Hickey & Davis, 2004; Shuraida & Barki, 2013) |
| Domain knowledge, context analysis, problem definition | (Daneva et al., 2013; Davis, 1982; Hickey & Davis, 2004; Ross & Schoman, 1977; Sibley et al., 1988) |
| Information characteristics | (Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986) |

One of the dimensions increasing the complexity of IRD is involvement of several stakeholders in the process. A number of techniques such as "DSS[6] team approach development" by Locander et al., (1979) are built around this fact and categorise IRD activities based on the stakeholders responsible for performing each. Other methods also consider the interested stakeholders by highlighting the present-ability of the requirements as an important criterion for IRD methods. The next section outlines the stakeholders involved in requirement determination and their responsibilities.

#### 2.2.2.3 Stakeholders involved in IRD

Addressing users' information requirements is the ultimate goal of an information system. To achieve this, all stakeholders involved in system's development (e.g. content developers, designers, and managers) should understand users' information requirements to be able to provide the right information through the right solutions and services (Ross & Schoman, 1977). In information system development, determining information requirements and users' information needs have been described as responsibilities of information analysts (Locander et al., 1979). Information analysts must assure that requirements are presented in a form understandable by the development team without them having any knowledge about the context or the users (Klendauer et al., 2012).

[6] Decision Support System

Scholars have named several stakeholders who are involved in the requirement determination phase. These stakeholders include: ***users, project managers, data managers, information analysts, system analysts, designers, implementers, testers, database administrators, commissioners, management science analysts, project coordinator and involved departments representatives*** (Browne & Ramesh, 2002; Browne & Rogich, 2001; Byrd & Cossick, 1992; Klendauer et al., 2012; Locander et al., 1979; Ross & Schoman, 1977; Shuraida & Barki, 2013; Sibley et al., 1988; Winter & Strauch, 2003). The results of IRD performed by ***information analysts*** will be used by other stakeholders in later stages. For instance, managers need this information for decision making purposes, and designers and developers need it for selecting and developing the system's applications and services. Therefore, while the main focus of IRD is on users' information needs, it should also address the information needs of other stakeholders involved in the information system development. Table 2-6 outlines the responsibilities of the stakeholders involved in information system development. It should be noted that different studies might have selected different names for relatively similar responsibilities (e.g. information analyst, analyst, requirement analyst).

**Table 2-6: Stakeholders involved in the requirement determination phase**

| Role | Definition |
|---|---|
| Information analyst | "Definition of information requirements and the human use of information" (Locander et al., 1979, p. 54) |
| Requirements analyst | "involves an analyst (1) working with end users to establish an understanding of organizational information processing needs; (2) developing IS objectives; (3) designing and evaluating IS alternatives;(4) communicating the results of analyses to superiors, other analysts, and end users; and (5) performing a systems audit" (Byrd & Cossick, 1992, p. 117). |
| Systems analyst | "Systems analyst must generate a set of decisions that encompasses the information needs of all the organizational subunits. He or she must then map a potentially large number of needs onto a manageable set of critical decisions." "The analyst must strive to maximize involvement of decision makers. Maximizing involvement not only reduces risk of omission, but increases the likelihood that the final plan will be acceptable." (Henderson & West Jr., 1979, p. 46) information gathering, analysis and representation (Browne & Ramesh, 2002). |
| Analysts | "Analysts translate … need statements into potential information systems" (Henderson & West Jr., 1979, p. 45) they need to figure out a way in which elicited requirements should be captured (coding elicited information from users) and also to know when they have gathered everything they need to design the system to stop information gathering (Browne & Rogich, 2001; Shuraida & Barki, 2013) "they are expected to seek out requirements from experts among the other parties concerned" "requirements definition effort must embody multiple viewpoints. These viewpoints may be overlapping and, occasionally, contradictory." (Ross & Schoman, 1977, p. 10) "act as a catalyst to get the assorted information on paper and to structure from it adequate requirements documentation." (Ross & Schoman, 1977, p. 9) |
| Technical people | "Technical people usually include functional architecture, system context, performance specification, measurement, and test conditions as part of the total requirement specification." (Sibley et al., 1988, p. 1091) |
| Systems designer/implementer/ system developer | Their role "is more computer oriented or technology oriented and functions to specify hardware and software requirements" (Locander et al., 1979, p. 54) They are responsible for implementation of the system (Browne & Ramesh, 2002; Ross & Schoman, 1977; Sibley et al., 1988) |
| Managers | Managers could be the system users and are involved by articulating "their information needs in terms of supporting particular decisions" (Henderson & West Jr., 1979, p. 45). They also could be final decision makers for the systems to be implemented and so they need that the system requirements to be presented to them (usually verbal statement is sufficient) (Sibley et al., 1988) |
| Users | Validation of analysed requirement (Browne & Ramesh, 2002) requirements are elicited from the users (Browne & Rogich, 2001) |
| Tester | Conducts the "statistical usage testing of programs" (Wieringa, 2006, p. 375) |
| Database administrator | (Locander et al., 1979). "Responsibilities include designing, implementing, and maintaining the database system; establishing policies and procedures pertaining to the management, security, maintenance, and use of the database management system" (TechTarget, 2005). |
| Customer | Is an organisation with a need for a system (Ross & Schoman, 1977) |
| Commissioner | Responsible to acquire the system required by customer (Ross & Schoman, 1977) |

As explained in the past three sections, during IRD 1) a variety of information needs should be determined, 2) many activities must be performed, 3) several

stakeholders are involved and 4) a number of limitations must be considered. This leads to the lack of a commonly accepted IRD method applicable to all situations and so "*there is a trend leaning towards more-specialised [analysis and design] methods and approaches*" (Siau & Rossi, 2011, p. 249). One of the situations for which no specialised IRD method or technique could be found in the literature is the context of ***Individual Decision Making in Equivocal Situations (IDMES)***. The following section defines this context and tries to identify the important information to be determined, activities to be performed and manners through which data can be presented in this context.

### 2.2.3 IRD in the context of individual decision making in equivocal situations

IRD methods cannot be considered apart from the context which they are going to be applied to (Munro & Davis, 1977). As stated in section 2.2.2, enormous number of competing IRD methods are available with little agreement between scholars on the importance and the detail of activities to be performed for understanding users' information needs. Moreover, despite the efforts made on standardising the system analysis and design methods such as Unified Modelling Language (UML) and object-oriented, it is unlikely that one method can meet the needs of all situations (Siau & Rossi, 2011). As a result, *scholars have moved toward specialized analysis and design methods, each designed for a specific context to address a group of requirements* (Browne & Ramesh, 2002; Castro et al., 2002; Davis, 1982; Hickey & Davis, 2004; Mazón et al., 2005; Meador et al., 1986; Montazemi & Conrath, 1986; Shuraida & Barki, 2013; Siau & Rossi, 2011).

The primary focus of IRD literatures is on organisational context and more specifically on the organisations' and their staff's (e.g. managers) information requirements. However, there are other complex contexts that require researchers' attention too. For example, the complexity of decisions a patient needs to make regarding the treatment options is comparable to the complex decisions that a manager must make in an organisation. The differentiation is that patients are not healthcare specialists but managers are specialists of the area in which they make decisions. The focus of this study is on the context termed as ***Individual Decision Making in Equivocal Situations (IDMES)*** and is defined as:

*Contexts in which an individual should make important decisions in complex and equivocal situations he/she is not an expert in.*

The term ***equivocality*** is adopted from the Daft & Lengel (1986) study and is defined as:

*A messy, unclear field. An information stimulus may have several interpretations. New data may be confusing, and may even increase uncertainty (p. 554).*

Examples of equivocal decision making situations could be identified in many instances in everyday life scenarios. For instance when a postgraduate student needs to decide between available options to pursue her/his studies, the decision could be very equivocal. He/she is not a trained professional in neither of fields, his/her plans for his/her future career may not be very clear and there are endless number of options available in all over the world. In such situations providing higher amount of information to users may actually increase the uncertainty they face (e.g. overload student with information).

This study focuses only on situations where decision making is the responsibility of an individual (e.g. a student deciding between available Masters/PhD options) and does not consider the group decision making processes common in organisations. Therefore, the decision in this study has not been considered as the output of team work. Even in situations that decision making appears as team work (e.g. a couple making decisions), the researcher have considered one party as the decision maker and the others as information sources.

Determining users' information needs is a challenging task in equivocal situations as in these situations decision makers may not be able to simply verbalise the specific queries they are seeking[7]. Hence, it is not expected that they can specify the information requirements. Information analysts also may not be the experts in the context[8] and so overlook collecting some of the valuable information in the field. On the other hand, meeting users' information needs in equivocal situations could be

[7] For example a patient dealing with a rare and critical health problem that should choose between a few available options may not be able to specify what information exactly he/she needs.

[8] It would be a hard task to find an IS practitioner with experience in cancer treatment for example.

very complex. For instance, in web health information sources while completeness of information is one of the key factors to be met by web information sources, at the same time extra information may overburden users with information (Eysenbach, Powell, Kuss, & Sa, 2002). Therefore, determining users' information needs in such situations to design information systems assisting them in decision making requires a rigorous IRD plan (Davis, 1982; Rigby & Ledingham, 2004; Ross & Schoman, 1977).

As defined in subsections 2.2.2.1, 2.2.2.2 and 2.2.2.3, information analysts during the IRD phase must consider several limitations, determine several types of information, perform many activities and finally present the results to the stakeholders involved in the development project to meet their information needs. For these reasons and to avoid overlooking important information, information analysts tend to work "*systematically*" (Klendauer et al., 2012). Ideally, information analysts may prefer to use an exhaustive and specialised IRD method or technique to define all the activities necessary to be performed but instead most of available methods and techniques are illustrative. Hence, information analysts may choose one primary and a few other complementary methods to determine the information requirements in the context in which the proposed system is going to be developed (Browne & Ramesh, 2002; Davis, 1982; Siau & Rossi, 2011).

Five activities that appeared frequently in reviewed IRD methods are already shown in Table 2-5, section 2.2.2.2. Because of the popularity of these activities among scholars, it could be argued that these five activities and the information requirements they determine can be nominated for determination in the context of IDMES. These activities are:

1. Determination of users' information needs, expectations and experience
2. Validation of determined information with users
3. Determination of the characteristics of required information
4. Context analysis and problem definition
5. Presentation of the analysed information

A common weakness of IRD techniques is that they fail to explain the process through which they have selected their methods (Hickey & Davis, 2004). To

overcome this weakness, in this study the process of selecting high level methods and the activities to be conducted in the IRD phase of information system development in the context of IDMES is explained through the following steps:

1. Defining the known IRD limitations in the context and taking suitable steps for addressing them
2. Identifying users' key information needs
3. Performing the required IRD activities for collecting and analysing users' information needs (the above five activities)
4. Designing the manners through which users' information needs should be presented
5. Addressing the needs of all stakeholders by the IRD method

The following subsections explain these five steps.

#### 2.2.3.1 Addressing IRD limitations by selecting suitable high level strategies

There are limitations preventing information analysts from collecting accurate information requirements from users (Browne & Ramesh, 2002; Browne & Rogich, 2001; Davis, 1982; Montazemi & Conrath, 1986). To overcome these limitations in equivocal situations, specifically designed methods and techniques are required to determine users' information needs in detail. To assist scholars and practitioners on selecting suitable high level strategies and methods for building the foundation of an IRD method, Davis, (1982 p. 20) indicates three sets of process uncertainties to be considered. These three sets of process uncertainties are "*existence and stability of a set of usable requirements*", "*ability of users to specify requirements*" and "*ability of analysts to elicit and evaluate requirements*".

Davis, (1982) identifies four elements impacting the level of uncertainty in IRD: utilising system, information system, users, and analysts. First element is the ***utilising system***. Utilising system is the high level system that is developing the proposed solution for its needs. For example, if an organisation is going to develop a decision support system, the organisation is the utilising system and decision support system is the ***information system***. In this scenario, ***users*** are the organisation's managers and staff who are going to use the system and ***analysts*** are the

professionals responsible for analysis of information requirements. Table 2-7 briefly defines how these elements affect the uncertainty in the requirement determination process.

**Table 2-7: Contextual elements impacting uncertainty in IRD process adopted from Davis, (1982, p. 22)**

| Elements in development process | Examples of characteristics that: | |
|---|---|---|
| | Reduce uncertainty | Increase uncertainty |
| Utilizing system | Stable, well-defined system not in process of change<br><br>Programmed activities or decisions | Unstable, poorly understood system in the process of change<br>Nonprogrammed activities or decisions |
| Information system or application system | Traditional, simple set of requirements<br>Clerical support system | Complex or unusual set of requirements<br>Management support system |
| Users | One or few users<br>High users system experience | Many users<br>Low user system experience |
| Analysts | Trained and experienced with similar information system | Little prior training or experience with similar information system |

To determine the level of uncertainty IRD faces in the context of IDMES, these four elements (Table 2-7) are discussed in this context as follows.

***Utilising systems*** is the higher-level system that is planning to develop an information system. If the utilising system is stable, the decisions to be made by the system users are relatively clear and there might be a solution already in place to assist them that is worth analysing (e.g. assigning a number of assistants to provide the manager with specific type of information in organisations). Based on the definition provided for the context of IDMES, the utilising system in such situations is assumed to be relatively stable (e.g. a national health organisation) and so the decisions to be made by individuals are known and there are already solutions in place to assist them in the decision making. For these reasons in the context of IDMES, the utilising systems do not increase the uncertainty in IRD process.

***Information system*** is to assist decision makers in making critical decisions in equivocal situations. Requirements for these systems are assumed to be complex and unusual since they should work in a complex (equivocal) situation. Therefore, this element increases the level of uncertainty in IRD process.

***Users*** in the context of IDMES, are not the trained staff of an organisation, but they are customers or clients of the organisation (e.g. real estate customers, patients). In such situations the number of users are usually high and it is likely that clients have little system experience. As a result, this element increases the IRD process uncertainty.

***Analysts*** are often only specialised in IRD and not in the context of interest (e.g. treatment of cancer). As a result, this element also increases the level on uncertainty in IRD process.

Comparing the context situation with IRD process uncertainty elements indicated in Davis, (1982), illustrates the high level of uncertainty in the IRD phase in the context of IDMES. Thus, strategies based on the "*synthesis from characteristics of the utilizing system*" and determining information requirements from "*experimentation with an evolving information system*" could serve as suitable solution options for this context.

From the two solution options, "*synthesis from characteristics of the utilizing system*" strategy has been selected. Synthesis from characteristics of the utilising system means that, for example, studying characteristics of an organisation is the best way to understand the information requirements of an information system to be developed for that organisation. Therefore, in the context of IDMES, the best way to determine the decisions to be made by users is to derive it from the characteristics of the utilising system (e.g. what decisions a hospital let patients make about their treatment options, what decisions customers can make regarding the loan they need for buying a property).

Following the derivation of the decisions, system's information requirements must be determined through the analysis of information needs of users who should make those decisions. Users' information needs then are often determined through the communication between analysts and users (Davis, 1982; Shuraida & Barki, 2013).

As described in section 2.2.2.2, there are numerous IRD methods explaining the activities to be performed to determine the users' information needs. The following

subsections define the information needs and the activities necessary to determine them in the context of IDMES.

#### 2.2.3.2 Information needs, expectations and experience

To make a decision, a decision maker needs information for several purposes such as identification and evaluation of his/her available options (Brown & Paschoud, 2005). Determining the users' information needs is the main goal of the IRD methods which is usually done through the communication between the information analysts and users (Davis, 1982; Shuraida & Barki, 2013). In cases where the proposed system is going to assist decision makers, determining the users' information needs often involves the following steps:

1. Identifying and describing the decision.
2. Defining the decision algorithm or decision process through diagrams such as decision flowcharts.
3. Defining the information required for the decision process.
4. Characteristics of the required information (e.g. source, frequency of use, importance).
5. Approaches to address users' information needs.

(Davis, 1982; Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986)

Wilson (1999 p. 251) indicates that "*information-seeking behaviour arises as a consequence of a need perceived by an information user*". Therefore, to analyse users' information needs, one way is to analyse it through users' information seeking behaviour.

> *Information seeking behaviour is the purposive seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems (such as a newspaper or a library), or with computer based systems* (Wilson, 2000, pp. 49–50).

Multiple factors[9] have an impact on users' information seeking behaviour, among which are expectations and experience. Given the close relationship between information seeking behaviour and information needs, Information Seeking Behaviour (ISB) serves as the theoretical foundation for the methods to be used for the analysis of users' information needs, expectations and experience in the context of IDMES.

#### 2.2.3.3 Characteristics of information needs

In IRD methods used for developing information systems that are supporting decision makers, determining characteristics of information needs is one of the frequently stated activities (Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986).

In equivocal situations information may be interpreted differently by various people. In such situations providing users with extra information may even increase the level of uncertainty in their decision making (Daft & Lengel, 1986). Therefore attention to information characteristics becomes extremely important in such situations. Examples of such situations can be traced in healthcare when a patient, who is not a healthcare professional, has to choose between several treatment options for his/her health condition. In such cases providing an extra amount of information may overburden the patient with information (Eysenbach et al., 2002) that he/she may not even understand and so increase his/her level of uncertainty in decision making. Therefore, in such situations the need for quality information is more important than the amount of information.

Information Quality (IQ) has been described as a key success factor for the "*efficient performance of any system*" (Gharib & Giorgini, 2015). It is considered as the extent to which "information at hand fits consumer requirements" (Lukyanenko & Parsons, 2015). IQ is specifically vital for the systems providing critical

[9] For example, task complexity, expectations, beliefs, experience, demographics, salience, time, income, literacy level, type of need (affective, cognitive and physical), socio-cultural environment, politico-economic environment, role related barriers, emotional variables, and characteristics of information needs (Abram & Dowling, 1979; Byström & Järvelin, 1995; Dervin, 1998; Johnson & Meischke, 1993; Jr & Durio, 1983; Kogan et al., 2008; Mackintosh et al., 2005; Rogith et al., 2016; Savolainen, 2008; Wilson, 2006b, 1997).

information (e.g. healthcare information, financial information). Yet, there are very limited number of IRD methods that are addressing users' IQ requirements and most of them do not address the *intention behind the use for information*, "which is essential to define the required level of quality that information should meet" (Gharib & Giorgini, 2015).

From the individuals' perspective, in the context of decision making, information needs is defined as: type, amount and quality of information that a decision maker or knowledge worker needs to do his/her job ((Picot et al., 2002) in (Winter & Strauch, 2003)). In order to satisfy this need, the person in need "makes demands upon formal or informal information sources or services" (Wilson, 1999b, p. 251). As a result, characteristics of information needs in this study are considered to include information ***amount***, ***quality***, ***type*** and ***source,*** among which ***information quality*** has received a lot of attention in the literature (Gharib & Giorgini, 2015; Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986; Picot et al., 2002; Winter & Strauch, 2003). IQ is identified as one of the factors impacting individuals' information seeking behaviour that is the consequence of users' information needs. Therefore, to design an IRD method for the context of IDMES, both concepts of IQ and information seeking behaviour has been studied in this chapter in separate sections to unpack the *required characteristics of users' information needs.*

#### 2.2.3.4 Context analysis and problem definition

Context analysis and problem definition have been described amongst the most important activities to be performed in IRD (Daneva et al., 2013; Davis, 1982; Hickey & Davis, 2004; Ross & Schoman, 1977; Sibley et al., 1988). To highlight the importance of problem definition, Ross & Schoman, (1977) indicate that "*a problem unstated is a problem unsolved*" and "*a problem well-stated is well on its way to a sound solution*" which accords with the results of empirical studies in other disciplines such as CRM (Rigby & Ledingham, 2004).

Context analysis is defined as the "*reasons why the system is to be created*" (Ross & Schoman, 1977). Context analysis has been explained in the following example. In a sample organisation, an information system project has been defined to replace a manually performed operation by an automated one. Context analysis will begin by

the analysis of the manual operation. Currently the "manual operation has a system architecture, composed of people, organizations, forms, procedures, and incentives" even though it is not using computers. Also, the manual operation has a functional architecture defining the goals for which the system exists. The replacement automated system will implement the same functional architecture but with a different system architecture. To determine the system's functional architecture, system's functions should be linked to the manual operations which are learnt in the context analysis (Ross & Schoman, 1977). The next section explains how the findings of the context analysis should be presented to the stakeholders involved in the information system development.

#### 2.2.3.5 Presentation of information requirements to different stakeholders

Presentation has been considered as a means to present the information requirements to others. Analysts collect the information from users and then translate and simplify it to be presented to:

- Users for verification
- Managers as system users or project decision makers
- Other analysts for discussion
- System developers, database admins and testers for development purposes

(Browne & Ramesh, 2002; Browne, 2006; Byrd & Cossick, 1992; Ross & Schoman, 1977; Sibley et al., 1988)

In equivocal situations, information needs and their characteristics could be more complex, and presenting them to several stakeholders with different professions may make it even more complicated. To describe information needs and its characteristics to all stakeholders, a common language and terminology are required. Furthermore, some stakeholders such as system analysts and developers may have limited knowledge about the context and need to learn the problem through a simple and understandable structure. IQ dimensions can be used to describe the characteristics of information needs and also as a common terminology to explain the needs and problem to different stakeholders.

#### 2.2.3.6 Verification of determined information with users

Several scholars indicated that determined information requirements should be verified with users and considered "verification of determined information" as an IRD activity (Browne & Ramesh, 2002; Browne & Rogich, 2001; Browne, 2006; Hickey & Davis, 2004; Shuraida & Barki, 2013). This activity could be performed during data collection or after the data analysis phase in IRD in order to verify that collected and analysed data reflect what users intended to say.

In the context of IDMES, ISB and IQ topics are found to have the ability to provide the theoretical foundation needed to design an IRD method and also the common terminology to present its results to different stakeholders involved in the information system development. Section 2.3 and section 2.4 provide an overview of these two topics.

## 2.3 Quality of required information

IQ is considered as the extent to which "information at hand fits consumer requirements" (Lukyanenko & Parsons, 2015). Information or data[10] quality is one of the constructs of the seminal DeLone and McLean information system success model and one which has absorbed a lot of attention from researchers concerned with information and data quality assessment methods (see the review in Batini et al. (2009)). Although IQ is a mature topic, its application in IRD methods is not very well studied, and often ignored (Gharib & Giorgini, 2015). Along with information amount, type and source, IQ has been described as one of the characteristics of users' information needs (Gharib & Giorgini, 2015; Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986; Picot et al., 2002; Winter & Strauch, 2003).

This section defines IQ, explains its subjective nature and describes the most frequently used dimensions identified in different contexts for evaluating IQ. Following these, challenges in implementing and evaluating IQ are discussed. Finally, the gaps found in IQ literature regarding its use for IRD purposes are illustrated.

[10] This study considers a distinction between data and information. Although since data and information quality assessment methods share similar aspects, we tend to use both information and data quality assessment methods in many instances in this study.

### 2.3.1 Information Quality (IQ) definition and its evaluation dimensions

IRD literature identifies quality of required information as one of the factors which should be analysed prior to information system design in equivocal situations (see section 2.2.3.3). In decision analyse literature, quality information has presumed to have positive impacts on the quality of decision making. In this regard O'Reilly, (1982) states that:

> *Quality information allows a decision maker to justify the basis of the decision to others [or him/herself], arguing that if the information used is timely, accurate, and reliable, then any decision made is likely to be a good one* (p. 757).

Earl and Hopwood, (1980) defines this presumption as:

> *We have tended to presume, for example, that the specification and analysis of information precedes decision-making, that the roles played by information in decision making are invariant across a multitude of different decision situations (...) Such presumptions are however little more than abstractions from the complex reality of information processing* (p. 7).

From another angle Delone & McLean (2003) state:

> *IQ, measures "success of the information in conveying the intended meaning"* (p. 10).

Definition of IQ requires the term "information" to be defined as well. In information and data quality domains, the distinction between two terms of "data" and "information" may be found confusing. Some scholars use them interchangeably (e.g. Pipino et al., (2002)) and others use them for different purposes (e.g. Tushman and Nadler, (1978)). In this study, information and data have been considered different but closely relevant, as explained as follows:

> ***Information:*** "relevant, accurate, timely and concise" data. ***Data*** is "raw number of facts" (Alavi & Leidner, 2001; Mackay, 1969; Tushman & Nadler, 1978). In other words, information is structured combination of isolated facts (data) in a context to affect a change in individual's knowledge or

understanding of reality (Daft & Macintosh, 1981; Davenport & Prusak, 1998; Tushman & Nadler, 1978).

Information and data quality is a very broad domain. Data itself has been categorised into three types of ***structured, unstructured, and semi-structured*** data (Batini et al., 2009). Examples for these types of data could be relational tables, plain text and XML, respectively. This study focuses on ***unstructured data/information*** being represented by information sources in different formats for ***human use***. This assumption is vital to understanding the meaning of IQ in this study and to narrow the focus down.

Regardless of information structure, its quality usually has been defined in the literature by explaining its evaluation dimensions. Table 2-8 outlines a variety of such evaluation/measurement dimensions accompanied by context of study and their users. In Table 2-8, "Literature review" in the context or users columns denotes that the study is a review or IQ dimensions are the result of its literature review section not the empirical study.

**Table 2-8: IQ evaluation dimensions**

| Author(s) | IQ Evaluation Dimensions | | Context | Users |
|---|---|---|---|---|
| (Batini et al., 2009) | 1. Accuracy<br>2. Completeness<br>3. Consistency<br>(Most frequently mentioned dimensions) | 4. Timeliness | (N/A) Literature review | (N/A) Literature review |
| (Gharib & Giorgini, 2015) | 1. Accuracy<br>2. Completeness<br>3. Timeliness | 4. Consistency<br>5. Accessibility<br>6. Trustworthiness | (N/A) Literature review | (N/A) Literature review |
| (Eysenbach et al., 2002) | 1. Accuracy<br>2. Completeness<br>3. Readability<br>(Most frequently mentioned dimensions) | 4. Design<br>5. Disclosures<br>6. References provided | Online e-health information | (N/A) Literature review |
| (Li, 1997) | 1. Accuracy<br>2. Reliability<br>3. Timeliness | 4. Realisation of user requirements (includes IQ, by literature review)<br>5. Clarity<br>6. Instructiveness | literature review and several industries* in the U.S. | User staff, IS staff, managers of both groups |
| (Seddon & Kiew, 1996) | 1.Timeliness<br>2.Accuracy<br>3.Relevance<br>(Research focuses on model relationships not measures, but accepts these four dimensions as IQ measures) | 4.Format | University | Users of departmental accounting systems |
| (Delone & McLean, 2003) | 1.Completeness<br>2.Ease of understanding<br>3.Personalisation | 4.Relevance<br>5.Security | e-commerce | (N/A) Literature review |
| (Doll & Torkzadeh, 1988) | 1. Information content<br>2.Accuracy<br>3.Format | 4.Timeliness | Several Industries** | Top and middle management, first level supervisor, |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | professional employees, other personnel |
| (Sedera & Gable, 2004) | 1. Availability<br>2. Usability<br>3. Understand-ability | 4.Relevance<br>5.Format<br>6.Conciseness | | Australian State government agencies & Higher education | Oracle users (not specified) |
| (Etezadi-Amoli & Farhoomand, 1996) | 1.Accuracy<br>2.Ease of understanding<br>3.Completeness<br>(Quality of output) | 4.Availability | | Organisations (Their type is not specified) | Managerial, professionals, clerical /secretarial, others |
| (O'Reilly, 1982) | 1. Accurate<br>2. Accessible<br>3. Specific | 4. Timely<br>5. Relevant<br>6. Sufficient quantity | | (N/A) Literature review | (N/A) Literature review |
| (J. Bailey & Pearson, 1983) | 1. Accuracy<br>2. Timeliness<br>3. Precision | 4. Reliability<br>5. Currency<br>6. Completeness | 7. Format | Eight different organisations | Middle managers |
| (Gable, Sedera, & Chan, 2003) | 1. Importance<br>2. Availability<br>3. Usability<br>4. Understand-ability<br>5. Relevance<br>6. Format<br>7. Content | 8. Accuracy<br>9. Conciseness<br>10. Timeliness<br>11. Uniqueness<br>12. Usefulness#<br>13. Completeness#<br>14. Informative# | 15. Currency#<br>16. Reliability##<br>17. Readability###<br>18. Clarity###<br>19. Appearance ### | Government Agencies in Australia | Management, users, technical staff |
| (Pipino et al., 2002) | 1. Accessibility<br>2. Appropriate amount of data<br>3. Believability<br>4. Completeness<br>5. Concise representation | 6. Consistent representation<br>7. Ease of manipulation<br>8. Free of error<br>9. Interpretability<br>10. Objectivity | 11. Relevancy<br>12. Reputation<br>13. Security<br>14. Timeliness<br>15. Understand-ability<br>16. Value-added | Bank, consumer good industry and data production organisation | Subjective and objective measurement of quality including the final users and data specific evaluations |
| (Lee et al., 2002) | 1. Accessibility<br>2. Appropriate amount<br>3. Believability<br>4. Completeness<br>5. Concise representation | 6. Consistent representation<br>7. Ease of operation<br>8. Free-of-error<br>9. Interpretability<br>10. Objectivity | 11. Relevancy<br>12. Reputation<br>13. Security<br>14. Timeliness<br>15. Understand-ability | Organisations | Information collectors, consumers and IS practitioners |

* Information has been collected from several areas e.g. banking, electronic data processing (EDP) services, education, government, insurance, manufacturing, medical, printing, retailing, utilities, and wholesaling, etc.
** Manufacturing, finance & banking & insurance, education, wholesale & retail, transportation & communication & utilities, government agencies, health services/hospitals, and other.
# Found to overlap with single measure of Relevance (IQ5)
## Found to overlap with the measure of Content Accuracy (IQ7)
### Found to overlap with single measure of Format (IQ6)

In addition to clarifying the most frequent mentioned IQ dimensions, Table 2-8 illustrates the complexity and existence of different dimensions to assess the quality of information in varied contexts. For example, dimensions reported by Petter, Delone & Mclean (2008) in the IS success area (i.e. availability, usability, understandability, relevance, format and conciseness) are different from dimensions reported in the Eysenbach et al. (2002) review of e-health information seeking in the web (i.e. accuracy, completeness, readability, design, disclosures, and references

provided). In addition to the variety of IQ evaluation dimensions, scholars do not have a common and operational definition for each of these dimensions (Batini et al., 2009; Eysenbach et al., 2002).

To measure IQ in different contexts several methods are available. Some of these methods use a predefined list of IQ dimensions for all contexts, in contrast to some other methods include an additional step to identify a list of dimensions for IQ measurement in the context of study prior to the final evaluation (see Batini et al. (2009) on data quality assessment methods). However, the IQ measurement methods usually are not sufficiently tested empirically and in stages like context study rely heavily on the researcher's expertise. Another problem with them is that most of these methods are focused on structured data and so are not applicable for unstructured information (Batini et al., 2009). Apart from the process of selecting the appropriate IQ assessment method, two additional challenges are identified in the IQ domain as follows:

1. There are many IQ evaluation dimensions available, but the challenge is identifying the most ***important dimensions*** to evaluate IQ in the ***context*** of interest and their ***weight of importance***,
2. ***Subjective nature*** of IQ makes it impossible for scholars to have unified and applicable definitions for each evaluation dimension (Batini et al., 2009; Eysenbach et al., 2002).

The following section focuses on IQ's subjective nature and how it complicates the measurement of the phenomenon.

### 2.3.2 Subjective and objective IQ evaluation dimensions

Data/information quality is a multi-dimensional concept defined by subjective and objective dimensions (Batini et al., 2009; Lee et al., 2002; Pipino et al., 2002). For example, completeness of the same piece of information can be evaluated subjectively differently by varied individuals. Even the same individual in different situations may evaluate completeness of the same piece of information differently. On the other hand IQ dimensions such as publish date will objectively be evaluated the same by all individuals. The way through which an individual evaluates/measures

the quality affects his/her perception of it. Scholars report that most of IQ evaluation dimensions are subjective and dependent on the context and users (Delone & McLean, 2003; Herrera-Viedma, 2006; Lee et al., 2002).

The information provider should meet both subjective perceptions of individuals to reflect their needs and objective quality of information based on the dataset or the information in question. Pipino et al. (2002) clarify that ***information user behaviour will be influenced if they evaluate the information quality as poor***. Therefore, it is very important to learn user's perception of quality (subjective quality) in the context, as providing information with only high objective information quality is not sufficient.

From a system design perspective, IQ may be defined based on its fitness for use. However, there is no clear definition for fitness for use especially when more than one user should use the system. In such situations, that are very common, each system user may have different and even conflicting IQ requirements (Gharib & Giorgini, 2015) which makes priority/importance of IQ dimensions a subjective topic too.

IQ dimensions have been categorised by scholars into five groups of intrinsic, contextual, representational, accessibility, and meta-quality as follows:

**Intrinsic IQ** addresses the objective quality of information and assumes information has its own quality. The main evaluation dimension of this category is the "accuracy" of information. Other dimensions are believability, reputation, and objectivity (Herrera-Viedma, 2006; Lee et al., 2002; Wang & Strong, 1996). As argued by Pipino et al., (2002) one of the challenges of objective quality is identifying its dimensions and how to measure them.

**Contextual IQ** includes subjective dimensions and considers the importance of the context of task/problem at hand. These IQ dimensions should be considered for information needed to handle a task. Information "must be relevant, timely, complete, and appropriate in terms of amount, so as to add value to the tasks for which the information is provided". Dimensions of this category include relevance,

value added, completeness, timeliness, and appropriate amount (Herrera-Viedma, 2006; Lee et al., 2002; Wang & Strong, 1996).

**Representational IQ** concentrates on the characteristics of the information source/channel. When information source is an IS solution, the representational IQ dimensions are often in relation to technical aspects of structure of information. Information is required to be presented in such a way that meets dimensions of this category. Some of these dimensions are understandability, interpretability, easy to manipulate, concise representation, and consistent representation (Herrera-Viedma, 2006; Lee et al., 2002; Wang & Strong, 1996).

**Accessibility IQ** emphasises the dimensions that provide access to information. It requires information source to be accessible but secure, and highlights the role of the system. Accessibility and secure access are among dimensions of this category (Herrera-Viedma, 2006; Lee et al., 2002; Wang & Strong, 1996).

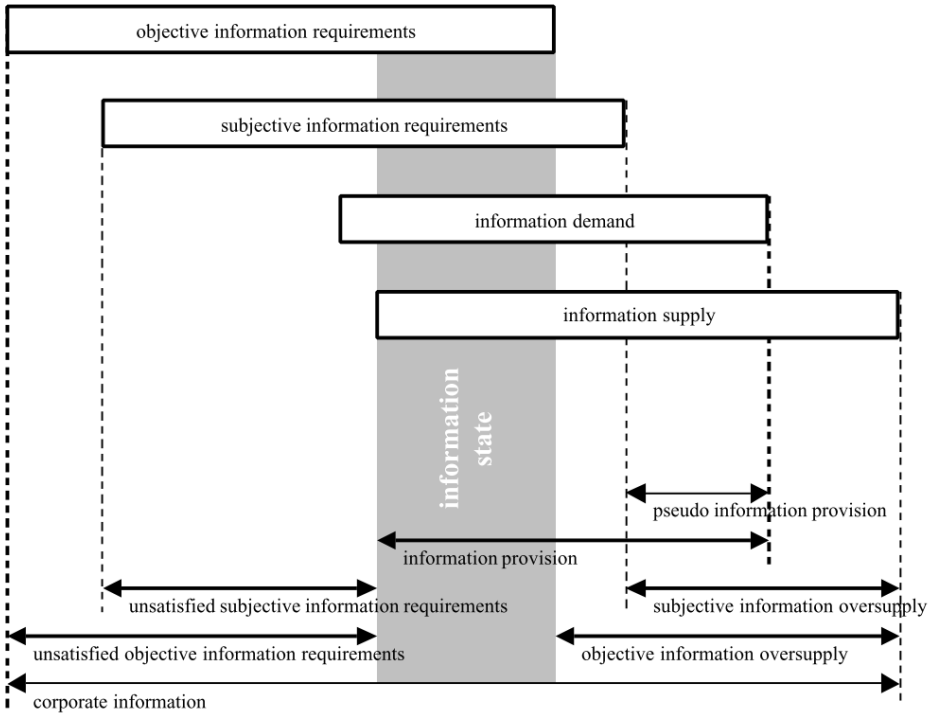
**Meta-quality,** also labelled as recursive quality, reflects the quality of subjective and objective quality measurement dimensions (Wang, Kon, & Madnick, 1993).

Divergence between users' and professionals' perceptions about IQ in different contexts highlights the complexity of developing quality content. Users tend to prefer information sources which they find to have good quality however contents with presumed high quality developed by content developers will not necessarily be evaluated similarly by users (Pipino et al., 2002). This divergence highlights the importance of knowing users' subjective definition of each IQ dimension in the context of interest. Therefore, professionals know, how they should meet users' needs when they are developing the content. This statement also accords with Eysenbach et al., (2002) call for practical definitions for IQ dimensions. Winter & Strauch, (2003) exemplify the divergence between users' and professionals' perceptions of amount of information as one IQ dimension. Figure 2.4 compares the subjective and objective amount of information being required and also outlines what happens if this information need is being over or under supplied.

Winter & Strauch, (2003) define ***objective information requirements*** as all the relevant information, as opposed to ***subjective information requirements*** which is all

the information that the decision maker believes relevant. However, decision makers can only articulate a portion of their information requirement. They also may request information that they do not necessarily need but collect it for precaution (information demand). Information supply, on the other hand, is defined as the available information to decision makers.

**Figure 2.4: Subjective and objective amount of information requirement adapted from Winter & Strauch, (2003, p. 3)**




Users also may have different insights toward the priority of IQ dimensions and the IQ requirement for different types of information (Wang et al., 1993). Batini and Cappiello (2009) highlight the complications that IQ evaluation and improvement methods attempt to address in different contexts. These concerns include:

- Needs for understanding the data context
- Set quality targets based on users' and administrators opinions
- Identify the critical areas to be assessed (the areas of concern)
- Quality evaluation dimensions found by users and administrators

The next section briefly explains the practical difficulties associated with evaluating and implementing information quality in different contexts.

### 2.3.3 Practical difficulties to implement and evaluate IQ

As explained in previous sections, a large body of knowledge is available on IQ and its dimensions, yet in practice implementing IQ is not a straight forward task. For instance, by 2002, 70% of studies state that quality is a problem in e-health information seeking (Eysenbach et al., 2002). This section, explores the difficulties in IQ implementation.

#### 2.3.3.1 Task, user and context sensitiveness nature

IQ in general is a task, user and context sensitive subject (Batini et al., 2009; Delone & McLean, 2003; Lee et al., 2002; Petter et al., 2008; Pipino et al., 2002; Seddon & Staples, 1999; Wang & Strong, 1996; Wilson, 1997). Contextual IQ definition indicates that the purpose of information is to add value to the task in hand. For instance, when a patient (user) who is dealing with cancer is seeking information (context) about his/her treatment options (task), the IQ dimensions he/she considers will be different from when the same person seeks information about beneficial herbs for his/her illness. Task characteristics particularly show its impact on source use when task in hand involves a high level of uncertainty. Bin, (2009) indicates that:

> ***Task characteristics*** *moderate the effects of source characteristics on information source use. Specifically, task uncertainty moderates the effect of source accessibility on use frequency…. The positive relationship between source accessibility and use frequency of information sources is stronger when task uncertainty is low than when it is high* (p. 527).

***Users' characteristic*** also impacts the information sources they use and the dimensions through which they evaluate and choose information sources (O'Reilly, 1982). There are many personal dimensions which could impact user information behaviour and their source preference behaviour (e.g. education, experience, demographic, economics) (Wilson, 1997). For instance, experienced users may know the reliable information sources and the IQ dimensions which are the most important in their search context. Different stakeholders participating in information system

development, may have different interpretation of IQ requirements and considered different dimensions to evaluate it (Gharib & Giorgini, 2015).

Comparison between IQ measures indicated in Delone and McLean (2003) (i.e. accuracy, completeness, readability, design, disclosures, and references provided) and Eysenbach et al. (2002) (i.e. completeness, ease of understanding, personalisation, relevance, and security) illustrates the ***context sensitiveness*** nature of the IQ evaluation dimensions. Interestingly both of these studies have been carried out in the web context and IQ has been part of both. Furthermore, both are outstanding studies receiving over 1000 citations and been conducted in similar period of time (2002 and 2003). However, only completeness is included in both studies and the rest of the dimensions are different. This difference may be due to their focus on different web contexts.

The next two sections explain how the number of available IQ dimensions and diversity in their definitions make quality evaluation difficult.

#### 2.3.3.2 IQ evaluation dimensions: diversity, priority and definitions

Enormous number of dimensions have been indicated by scholars to evaluate IQ in different contexts and there is no agreement between scholars on dimensions to be used to assess IQ in each context (Batini et al., 2009). Advance of information systems from monolithic to network-based systems has caused a growth on the number of the data sources and their sizes. As a result of this evolution, complexity of data management and consequently the number of quality evaluation dimensions has increased. Web sources have increasingly amplified the complexity of IQ evaluation dimensions and added new dimensions to it such as accessibility and reputation (Batini et al., 2009). Moreover, as IQ is a user and context sensitive subject, to increase the precision of IQ evaluation, IQ dimensions priority and weight in different contexts and for different users should be included in the evaluation (Eppler & Muenzenmayer, 2002; Pipino et al., 2002).

Beside the number of IQ evaluation dimensions and their varied importance in different contexts, scholars also have no general agreement on their definitions

(Batini et al., 2009). In a compelling expression Batini et al., (2009) review on data quality assessment methods, indicate that:

> *No general agreement exists either on which set of dimensions defines the quality of data, or on the exact meaning of each dimension* (p. 16:6).

In this regard another very well cited review study; Eysenbach et al., (2002) also indicates that:

> *Operational definitions of quality criteria are needed* (p. 2691).

Information users interpret IQ dimensions in varied contexts differently. For example, students and lecturers as two groups of users who use university website's information may have different perceptions about the information quality of the same source. There is an uncertainty about how each IQ dimension should be defined in different contexts since each user may have different definitions for each dimension (Gharib & Giorgini, 2015; Wang et al., 1993). These definitions are important because they affect the factors through which IQ dimensions are measured (Eppler & Muenzenmayer, 2002). Therefore, to have the ability to evaluate information quality precisely in each context, there should be explicit definitions for IQ dimensions derived from the context of use.

The following section highlights the identified gaps in the IQ literature in relation to IRD and concludes this section.

### 2.3.4 Gaps identified in IQ requirement determination literature

One of the aspects to be considered in IRD is the information characteristics which includes its ***amount***, ***quality***, ***type*** and ***source*** (Gharib & Giorgini, 2015; Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986; Picot et al., 2002; Winter & Strauch, 2003). IQ (including amount) shapes an important portion of information characteristics but a few shortcomings have been identified in the IQ literature impacting its use for IRD. These shortcomings are described as follows.

**a) Many post-development system-oriented quality evaluation methods and no predevelopment decision/task-oriented IQ requirement determination methods**

As explained in IRD section (2.2), no IRD method or technique could be found in the literature with the ability to address the IQ requirements of individual decision makers in equivocal situations. In the IQ literature also similar shortcoming was identified. Most of studies in this domain are focused on measuring or evaluation of IQ in an active information source and no study was found to be focusing on determination of IQ requirement of a proposed information source. Moreover, *most of available IQ evaluation methods are focused on evaluating the IQ of a system rather than analysing IQ requirements based on the decisions to be made or the tasks to be performed.*

Analysing user's information behaviour and determining the task specific IQ requirements could enable designers and developers to effectively design solutions and develop contents to meet user's IQ requirements. System-oriented IQ evaluation methods are source specific and do not consider quality advantages of other sources available in the information horizon that are providing the same type of information.

**b) Absence of IQ requirement determination methods to determine context specific quality requirement dimensions in the context of IDMES**

In equivocal and complex situations, information characteristics are more important than the amount of information since the extra information may actually increase the uncertainty that decision makers face (Daft & Lengel, 1986). IQ in general is a task, user and context sensitive subject (Batini et al., 2009; Delone & McLean, 2003; Lee et al., 2002; Petter et al., 2008; Pipino et al., 2002; Seddon & Staples, 1999; Wang & Strong, 1996; Wilson, 1997). Therefore, to determine the IQ requirements, IRD methods need to identify the IQ dimensions specific to the context of interest and determine their priorities.

It should be noted that context specific IQ evaluation methods are available already but they have not applied for IRD purposes in the context of IDMES.

**c) No agreement on IQ dimensions' definitions**

Due to the subjective nature of IQ, there is no general agreement between scholars on definition of IQ dimensions (Batini et al., 2009), and therefore, no agreement on how these dimensions should be implemented. This shortcoming might be the reason for the Eysenbach et al., (2002) call for the need of "operational definitions of quality criteria" (p. 2691).

System-oriented view towards IQ evaluation methods has drawn the focus of information/data quality studies to structured data quality (e.g. databases). By the constant progress of web technologies, nowadays most of information sources are web-based and carry unstructured information. So, the quality of unstructured data/information has become a concern for scholars (Batini et al., 2009). Considering the shift towards the unstructured information and also noting the context dependent nature of IQ dimensions, the need for measurement factors for developing quality unstructured information in each context is highlighted.

As discussed in the previous two sections, IQ is one of the factors that should be analysed at the IRD stage in system development. However, no IRD method or technique could be found to determine users' IQ requirements and address its complex nature in the context of IDMES. To analyse the task specific IQ requirements in IRD, ISB models has been leveraged to provide the needed theoretical foundations. The following section reviews the problem specific ISB literature.

## 2.4 Leveraging problem-specific information seeking for determining information requirements

In section 2.2, the need for context specific IRD methods to elicit users' required information was discussed. Following that, section 2.3 unpacked one of the major characteristics of users' information needs which has been overlooked in most of IRD methods (Gharib & Giorgini, 2015). In this study, problem-specific Information Seeking Behaviour (ISB) is selected to provide the theoretical foundation necessary for analysing users' information needs and its characteristics. ISB has been selected for this purpose based on the ***presumption*** that:

*the specification and analysis of information precedes decision-making, that the roles played by information in decision making are invariant across a multitude of different decision situations (...) Such presumptions are however little more than abstractions from the complex reality of information processing* (Earl and Hopwood, 1980; p. 7).

In addition to IQ, users' ***type*** of information needs and users' preference regarding information ***sources*** that are providing the information are amongst the important aspects to be addressed at IRD stage. Type of users' information needs and information sources that they prefer also impact required IQ (Gharib & Giorgini, 2015; Henderson & West Jr., 1979; Locander et al., 1979; Meador et al., 1986; Picot et al., 2002; Winter & Strauch, 2003). To determine the system's information requirements, users' approach in obtaining their information needs could be used. Analysing users' information behaviour also could help information analysts in determining the suitable system characteristics to meet users' required information characteristics. Therefore, this section leverages the concept of problem-specific information seeking behaviour for the analysis of users' information needs and its characteristics in the context of individual decision making in "equivocal situations[11]".

In equivocal situations, in general, individuals need to make their decisions based on the ill-defined information they gather from their surrounding environment. To solve a specific problem or to make a specific decision in such situations decision makers tend to use a set of complementary information sources delivered through a range of media (Daft & Lengel, 1986; Savolainen & Kari, 2004; Savolainen, 2007, 2008; Sonnenwald et al., 2001).

To analyse the context and define the problem, one way is to determine the information requirements through modelling users' information seeking behaviour. Therefore, information seeking has been defined as:

[11] "Equivocality presumes a messy, unclear field. An information stimulus may have several interpretations. New data may be confusing, and may even increase uncertainty" (Daft & Lengel, 1986, p. 554).

> *The purposive acquisition of information from selected information carriers. Information carriers may include a variety of channels, a variety of sources within channels, and a variety of messages contained within these sources* (Johnson, Case, & Andrews, 2006, p. 570).

This purposive seeking for information is a consequence of a need to satisfy some goal (Wilson 2000 p.49). "In information seeking, information-as-thing is collected and assimilated in the hope of a positive change in information-as-knowledge" (Byström & Järvelin, 1995, p. 191).

To find information about a specific problem, individuals perform problem-specific information seeking. Problem-specific information seeking is one of the most common types of information seeking in complex situations. For instance, the majority of information seeking behaviours in online health information seeking are problem-specific (Fox & Raine, 2002). Problem-specific information seeking has been defined as:

> *an ISB to obtain the information needed to solve individual's problems* (Savolainen, 2007).

Problem-specific information seeking is a type of ISB and general rules and stages involved in ISB are applied to problem-specific ISB too.

This section provides the theoretical underpinning for analysing decision makers' information behaviour for the purpose of determining their information sources preference and required information characteristics for different uses in equivocal situations. To serve this purpose, this section first defines information seeking and problem-specific ISB. Then, it discusses ISB in more details and addresses the information users' perception of use for the information, and how it is related to IQ requirements. Following that, the ways through which source preference behaviours and users' IQ requirements can be explained using information seeking models are explained. Finally, the relationship between problem-specific information seeking, IQ and IRD is described.

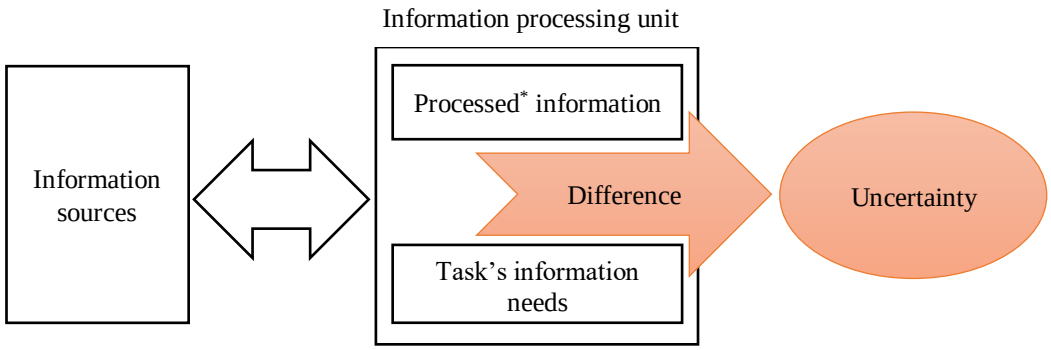
### 2.4.1 Information seeking stages

Many incidents may trigger an ISB. For instance, Cotten and Gupta (2004) have mentioned that a doctor visit may trigger a health ISB. They also report that the final goal in a health ISB is to decrease the uncertainty regarding the health issue. Scholars indicate information needs and uncertainty as the reasons for information seeking (Lasorsa & Rice-Lively, 2004; Wilson, 1999b). In equivocal situations in addition to uncertainty, there is one more factor which drives the information seeking and that is "equivocality". To solve a specific problem or to make a specific decision in such situations, decision makers tend to use a set of complementary information sources delivered through a range of media (Daft & Lengel, 1986; Savolainen & Kari, 2004; Savolainen, 2007, 2008; Sonnenwald et al., 2001). Some of these sources may be used to resolve equivocality and break large queries into small ones then refer the seeker to other sources for resolving the uncertainty and provide the answers for information needs (Daft & Lengel, 1986; Sonnenwald et al., 2001). This section defines these stages in more details.

#### 2.4.1.1 Uncertainty

Uncertainty is defined as "the difference between information processed and information required to complete a task." (Tushman & Nadler, 1978, p. 615). "Uncertainty is a cognitive state which causes anxiety and stress and that can be expected in the early stages of the information search process" (Sonnenwald, 1999, p. 1). ISB is said to begin with uncertainty about a problem area. This stage is associated with seeking background (domain) information. After the formation of uncertainty follows the recognition of the need for information (Wilson, 2000).

**Figure 2.5: Uncertainty, derived from Tushman and Nadler (1978)**




* Processing information refers to "gathering, interpreting, and synthesis of information"

Theoretically, the rise of task uncertainty increases the need for information and especially for quality information as in uncertain situations the need for quality overcomes the impact of accessibility (Bin, 2009; Tushman & Nadler, 1978). Information needs and uncertainty have been indicated as the reasons for information seeking. However, as mentioned earlier, in equivocal situations seekers may not be able to clearly interpret the received information and so providing more information may not be beneficial. The next section defines equivocality in ISB.

#### 2.4.1.2 **Equivocality**

In different stages of ISB, users have evolving perceived information needs as at the beginning of the behaviour they do not exactly know what they are looking for (Lasorsa & Rice-Lively, 2004). Daft & Lengel, (1986) introduce the term equivocality for the early stages of ISB and the explain equivocality, uncertainty and their relationship in an organisation through an example:

> *Uncertainty is a measure of organisation's ignorance of a value for a variable in the space. Equivocality is a measure of the organisation's ignorance of whether a variable exists in the space. When uncertainty is low, the organization has data that answer questions about variables in the space. When equivocality is low, the organization has defined which questions to ask by defining variables into the space…. Equivocality leads to the exchange of existing views among managers to define problems and resolve conflicts through the enactment of a shared interpretation that can direct future activities. Uncertainty leads to the acquisition of objective information about the world to answer specific questions* (Daft & Lengel, 1986, p. 557).

Just like organisations in equivocal situations, individuals process information for two reasons which are "uncertainty and equivocality resolution". Gathering information from different sources is expected to fill the lack of information and responds to uncertainty. On the contrary in equivocal situations like healthcare, extra information may even increase the uncertainty and overburdens seekers with information (Daft & Lengel, 1986; Eysenbach et al., 2002). Equivocality resolution is being performed by the discussion of the relevant issues and not by providing information. Equivocality is not the result of lack of information but is associated

with multiple interpretation and conflicting views towards the same subject. In organisations, "managers will talk things over, and ultimately enact a solution. Managers reduce equivocality by defining or creating an answer rather than by learning the answer from the collection of additional data" (Daft & Lengel, 1986, p. 554).

Examples of individuals who make decisions in equivocal situations can be found in healthcare. For instance, patients who are diagnosed with cancer, may or may not seek information, but the ones who do, look for several types of information (e.g. general information, causes, symptoms and treatments) (Rutten, Squiers, & Hesse, 2006). Many of patients are looking for making an informative decision regarding the treatment they receive, which for a patient with no healthcare expertise is an equivocal task. In this situation, providing extra information about available treatment options may not necessarily help patients in decision making since they may not yet have formulated the questions in their minds and know what exactly they need to know to make a decision. In short, as a result of equivocality, patients may not know exactly what they should be looking for.

Another example of individuals who make decisions in equivocal situations can be found in real estate. Individuals who decide to buy a property for the first time are not real estate professionals. It is often a critical decision making for them because it strongly impacts the decision makers financially. The high number of available options and the factors that must be considered (e.g. quality of the property, costs, loans, income security) makes this decision equivocal.

To help decision makers in finding the information they need in equivocal situations, equivocality should be resolved first. Figure 2.6 illustrates the process of equivocality resolution.

**Figure 2.6: Equivocality resolution steps (created by the researcher)**

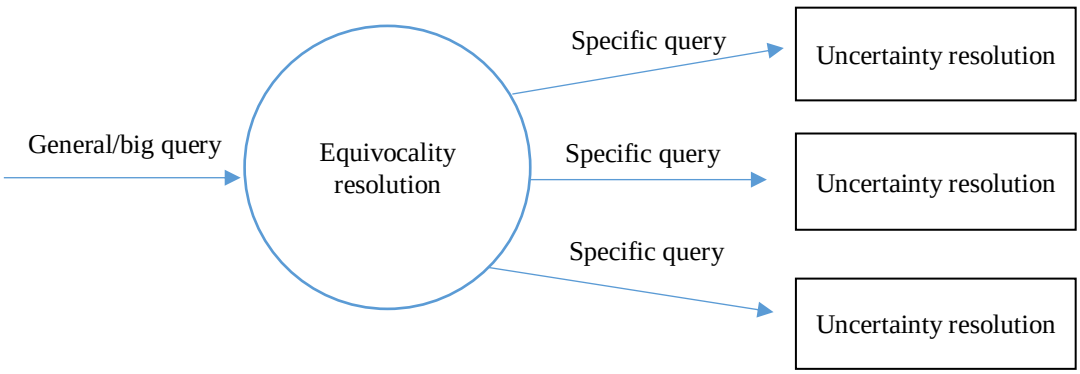
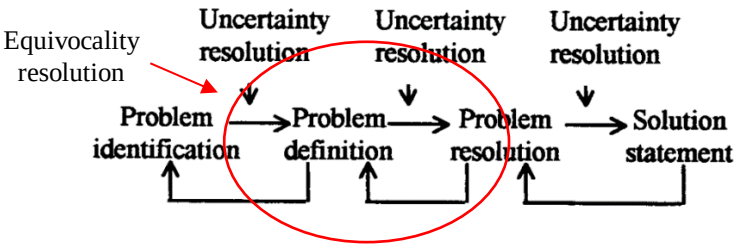



Figure 2.7 identifies four stages in the route to certainty. These are 1) *problem identification* (what kind of problem do I have?), 2) *problem definition* (what is the nature of my problem in details?), 3) *problem resolution* (how to find an answer to my problem?), and 4) possible *solution statement* (pragmatic rather than theoretically based solution) (Wilson, 1999a). *It can be suggested that in equivocal situations the problem definition and part of problem resolution could be categorised as equivocality resolution* since in these steps problems which are to be solved are defined in details and seekers learn how to answer them. Therefore, in the following step the queries are more specific and focused.

**Figure 2.7: A problem solving model of the information seeking and searching process. Adapted from Wilson (1999 p.266)**




The following section explains how seekers may show different ISB based on the type of their information needs.

### 2.4.2 Categorising information needs

Most of IRD methods have overlooked the intention behind the information use which could impact the IQ requirements (Gharib & Giorgini, 2015). To categorise information based on its use in different environments, few methods are available. If information is to be considered as a need (which logically in information seeking

environment is), then information needs also can be categorised based on the person in need's motives (e.g. physical, cognitive, social). Another method is to categorise information based on its use or its perceived use for the user. Byström & Järvelin, (1995) categorises information into:

> *Domain information (e.g., known scientific facts), problem information (i.e., the problem characteristics), and problem-solving information (i.e., expertise in problem treatment)* (p. 192).

Byström & Järvelin, (1995) define domain, problem and problem solving types of information as follows:

> ***Problem information*** *describes the structure, properties, and requirements of the problem at hand. For example, in bridge construction, information on the type and purpose of the bridge and on the site where it must be built constitute problem information. It is typically available in the problem environment but in the case of old problems it may also be available in documents.* ***Domain information*** *consists of known facts, concepts, laws, and theories in the domain of the problem. For example, in bridge construction, information on the strength and thermal expansion of steel constructs belongs to domain information. This is typically tested scientific and technological information published in journal articles and textbooks.* ***Problem-solving information*** *covers the methods of problem treatment. It describes how problems should be seen and formulated, and what problem and domain information should be used (and how) in order to solve the problems. For example, in bridge construction, the design engineer's heuristics concerning the pros and cons of various bridge design types constitute problem-solving information. It is instrumental information, and typically available only from knowledgeable persons (or experts)* (pp. 195-196).

Serola (2006) in a study on 17 city planners uses Byström and Järvelin (1995) categories for information needs and finds that for each type of information they use different information sources. Therefore, it can be argued that seekers' IQ requirements for different types of information could be different too. This topic has been discussed in the following section.

### 2.4.3 Information source preference and IQ requirements

Information seekers tend to use more than one source, as one source alone cannot meet all their information needs. Seekers select information sources based on the purpose (goal) for information seeking, level of uncertainty involved and quality of the source (Bin, 2009; O'Reilly, 1982; Tushman & Nadler, 1978; Wilson, 1999b). Different studies report interpersonal sources amongst the most favoured sources that users are willing to seek information from (e.g. friends, doctors). However, more recent studies indicate the growing importance of internet sources for problem-specific information seeking and demonstrate that new and traditional sources have been used in a complementary manner (O'Reilly, 1982; Savolainen, 2007, 2008; Sonnenwald et al., 2001).

In a study conducted on 18 environmental activists, their reason to use different information sources are explained through an IQ lens. *Human sources* have been favoured by seekers usually because of their capability to deliver *filtered and experience based* information. Human sources are also popular due to their *accessibility* and ability to *simplify complicated issues in an interactive way and provide immediate feedback*. A challenge associated with human sources is their subjective opinions. Each human information source, may have a different interpretation of the problem and a different opinion regarding the question. Those will impact the information he/she provides. *Internet* as another type of information sources is often used because of the *content and accessibility*. Internet also provides a platform for providing feedback through online forums. Problems associated with the internet have been described as *trust issues* and lack of users' knowledge to filter the data obtained from it. In situations involving complicated problems, internet can give only the "first aid" (Savolainen, 2008).

Quality is amongst the important variables impacting information seekers' source preference. Amongst the identified quality dimensions, "content quality" dimensions are reported regularly (Savolainen, 2008). Table 2-9 illustrates users' source preference dimensions identified by scholars in different contexts.

**Table 2-9: Source preference dimensions in different contexts**

| Context | Source Preference Dimensions | Author |
|---|---|---|
| Internet information seeking | - Accessibility<br>- Quality | (Savolainen & Kari, 2004) |
| Environmental activists doing everyday life information seeking | - Content of information (IQ)<br>- Availability of information | (Savolainen, 2008) |
| Environmental activists in seeking orienting information seeking | - Content of information (IQ)<br>- Availability of information<br>- Accessibility | (Savolainen, 2007) |
| Organizational decision making | - Accessibility to the source<br>- Information quality | (O'Reilly, 1982) |
| Everyday life information seeking | - Accuracy of information<br>- Understandability of information<br>- Good experience with the source | (C. Chen & Hernon, 1982) |
| Teachers and industrial workers | - Availability<br>- Accessibility<br>- Ease of use | (Savolainen, 1995) |
| Everyday life information seeking<br>(one person in ten weeks) | - Ease and speed of use<br>- Value of information | (Julien & Michels, 2004) |

To analyse complex information seeking behaviours and address source quality concerns, scholars in the ISB domain usually take advantage of descriptive or cognitive models to map individuals' behaviour when seeking information. A few of these models have the ability to display how IQ impacts information seeking steps and source preference behaviour. These models usually use theories to analyse individuals' ISB and then model it in a graphical form. The following section covers a few of such models which are contributing to the development of this study's conceptual model.

### 2.4.4 Information seeking models and concepts mapping IQ requirements

Three categories of practical difficulties involved in measuring IQ have been explained in section 2.3.3. To address these difficulties and to design an IRD method to determine IQ requirements, a theoretical foundation is needed (Siau & Rossi, 2011). Multiple studies in different disciplines have been conducted on user's information seeking among which a few leveraged source preference behaviours and illustrate the impact of IQ on seekers ISB (examples are outlined in Table 2-10 and Table 2-11). These ISB models and concepts can be used as the theoretical foundation and tools to facilitate measuring IQ and analyse the relationships between characteristics of users' required information (i.e. IQ, type and sources).

This section covers information seeking models and concepts which are addressing IQ measurement difficulties and the important variables impacting source preference behaviour (i.e. perceived use, source and IQ). Two models 1) information source horizon and information pathways in the context of seeking problem-specific information, and 2) activity, actions and operations model, and the information source horizon concept have been selected and explained in this section. Each model addresses users' information needs and a few concerns in relation to IQ in information seeking. These models, married with the information source horizon concept, form the basis of the final conceptual model and shape the theoretical underpinning for IRD method. Table 2-10 lists these models. Further explanation is provided in subsequent sections.

**Table 2-10: Models and concepts with the ability to map quality requirements in users' ISB**

| Model/Concept name | Area | Concerns addressing | Type of contribution | Author |
|---|---|---|---|---|
| Information source horizon concept | Information source preference | - Clarifies position of IQ in Information seeking behaviour<br>- High number of IQ evaluations | - Provides theoretical background to analyse the problem, collect data and analysis<br>- Describes the idea of source preference through information source horizons and pathways | (Sonnenwald, 1999) (Sonnenwald et al., 2001) |
| Information source horizon and information pathways in the context of seeking problem-specific information | Information source preference | - Puts structure on source preference behaviour in problem specific information seeking<br>- High number of IQ evaluations | - Provides the core structure with the capability to address IQ and sources preference concerns | (Savolainen, 2008) |
| Activity, actions and operations model | Activity theory | - Recommends adding goals (queries) constructs to Savolainen's model | - Theoretical background. Adds to the richness of Savolainen's model when used as an activity theory[12] lens | (Leont'ev, 1978) |

Sonnenwald (1999)'s concept of "information source horizons" provides a robust structure to explain seekers' information source preference behaviour. Later on in another study conducted by her and her colleagues, Sonnenwald et al. (2001) introduce a technique and few tools to collect and analyse data about the information

[12] This paper follows the recommendation of Wilson, (2006a) on using activity theory as conceptual framework and for its coherent terminology in the area of information seeking behaviour.

source preference behaviour of information users using the information source horizon concept as its underlying theories.

Savolainen (2008) conceptual model is a recent example of applying Sonnenwald (1999) concept and Sonnenwald et al. (2001) data collection and analysis technique in the field of "problem-specific information seeking". The conceptual model generated in his research has been used to establish this study's conceptual model.

Leont'ev (1978) activity, actions and operations model is a very highly cited model generated from the activity theory. This model, and in general the activity theory, has been recommended by Wilson, (2006a) to be used in information seeking domain as a common ground. This model has the ability to enrich the Savolainen (2008) model and forms a more sophisticated model to be used for equivocal situations.

The briefly described models and concept have been explained in more details in the following two sections. Section 2.4.4.1 covers the concept of information horizons and the Savolainen (2008) model and section 2.4.4.2 covers the Leont'ev (1978) activity, actions and operations model.

#### 2.4.4.1 Information horizons and pathways as ISB measurement tools

Sonnenwald (1999) and Sonnenwald et al. (2001) develop a structured method to study user's ISB for exploratory or explanatory purposes, naming information horizons. Following that, Savolainen & Kari (2004), Savolainen (2007) and Savolainen (2008) add source preference criteria to Sonnenwald et al. (2001) information horizon method which enables researchers to study IQ and other source preference criteria in their studies. Table 2-11 presents a number of studies using information horizon data collection and analysis method.

**Table 2-11: Sample studies using information horizon**

| Context and user | Method/Outputs | Author |
|---|---|---|
| Undergraduate students on recent scientific and career information seeking | Uses source horizon concept, they list information sources students have used, seekers satisfaction with information they have found and sequence of use.<br>They provide a list of sources, their popularity and the general role they play within the information horizon (e.g. starting, recommending, ending source) | (Sonnenwald et al., 2001) |
| 17 city planners seeking information needed for their daily work | Uses source horizon concept as data collection method<br>Lists information sources being used for each type of perceived information need | (Serola, 2006) |
| 20 individuals active environmental activists, doing seeking orienting information seeking | Information source horizon concept has been used<br>Most information sources and factors impacting this preference has been found | (Savolainen, 2007) |
| 18 environmental activists doing problem specific information seeking | Information source horizon concept has been used<br>Most information sources and factors impacting this preference has been found | (Savolainen, 2008) |
| Finnish and Swedish archaeology professionals | Information horizon concept have been used to develop analytical information horizon diagrams, which proved to be useful in visualising use of information sources and organizing information activities | (Huvila, 2009) |

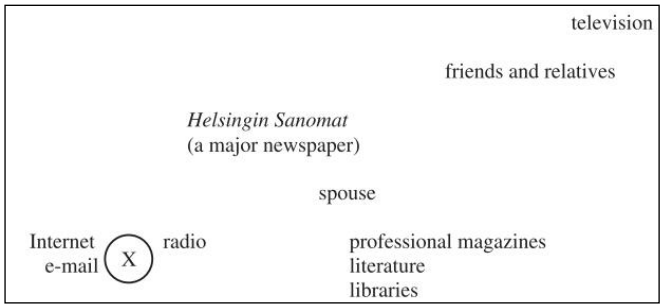
The concept of information horizon was originally introduced by Sonnenwald (1999). She proposes that "within a context and situation there is an "information horizon" in which we can act" (Sonnenwald, 1999, p. 8). *An information horizon may include a variety of information sources including human resources, documents, websites and observations from the world* (Sonnenwald et al., 2001). Shaping information horizons is the consequence of complex judgments concerning information and source quality and accessibility. It is assumed that such judgments puts information sources in their dedicated place at individuals' information horizon. These horizons obviously impact individuals' information seeking strategies as they suggest sources to be preferred or avoided (Savolainen & Kari, 2004). "This evolving framework incorporates cognitive, social, and system perspectives and builds on theories in information and library science, communication, sociology, and psychology. Human information behaviour, including information exploration, seeking, filtering, use, and communication, are included (to varying degrees) in the framework". Information horizon framework is recommended to guide IS designs to support human information behaviour (Sonnenwald, 1999, p. 10).

Information horizon and information fields are similar subjects. "Information fields contain resources, constraints, and carriers of information. … information field and in large part determines the nature of information individuals are exposed to on a regular basis". Information fields or horizons impact the possibility of using an information source by users. Johnson et al., (2006) explains:

> *[Individuals] make choices about the nature of their fields, the types of media they attend to, the friendships they form and the neighbourhoods they live in, which are often based on their information needs and preferences. The nature of an individual's stable information field can shape his/her more active information seeking. ... As individuals become more focused in their information seeking they change the nature of their information field to support the acquisition of information related to particular purposes (p. 571).*

Savolainen and Kari (2004) define information horizon as ***an imaginary boundary within broader context including all information sources seeker is aware of or have the experience of using***. Seeker tends to position most relevant known information sources in horizons closer to himself/herself and peripheral ones farther away. This placement is based on some criteria such as accessibility and content quality. Chosen sources may be placed closer or farther from seeker based on their significance to him/her. Figure 2.8 provides an example of how the importance of information sources to users has been investigated by leveraging the concept of information horizons. The X in this figure represents the seeker. The closer information sources are to the user, the more important they are.

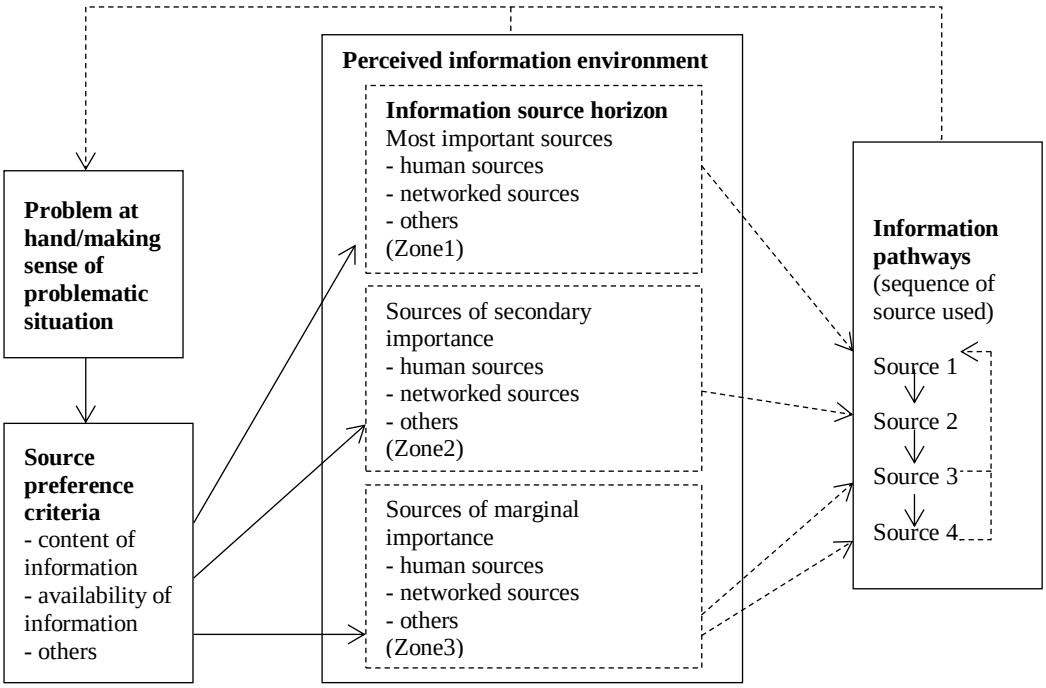
**Figure 2.8: An example of information source horizon diagrams adopted from Savolainen (2007 p.1714)**




Savolainen (2008) study with the subject of "source preferences in the context of seeking problem-specific information" is about the source preference behaviour of

13 environment activists. He uses the concept of information horizon and Sonnenwald et al. (2001) method for data collection and analysis. This study also takes advantage of critical incident technique by asking interviewees to recall an incident that required ISB. The conceptual model developed in Savolainen (2008) study has been leveraged to establish the conceptual model employed in this study. Savolainen (2008) conceptual model is shown in Figure 2.9.

**Figure 2.9: Information source horizon and information pathways in the context of seeking problem-specific information. Adapted from Savolainen (2008) p. 279**




Information horizons determine the information sources that information users are aware of. Information pathways has been proposed by Johnson et al. (2006) and explain the sequence through which the information sources have been used. Sonnenwald et al. (2001) also has included information pathways (not with the same name) in information horizons concept to study the sequence of access to information sources (Savolainen, 2008).

Three major preference zones are identified in Figure 2.9. These zones are: 1) the most significant zone (Zone 1), 2) partially important zone (Zone 2), and 3) peripherally important zone (Zone 3). It should be considered that multiple sources may be places in the same zone (Savolainen, 2008). Savolainen (2008) suggests that the information seekers consult the information sources in the same order of their importance, which means they access the most important source first (zone 1) then

partially important sources (zone 2) and finally peripherally important sources (zone 3). He also recommends that experience in using information sources also may change the perception of problem at hand and may impact source preference criteria through problem redefinition. In Figure 2.9, the dashed line on the right side of information pathway construct suggests that user may return to the sources they have used earlier.

There are few challenges identified in Savolainen (2008) model. He has indicated a challenge in the data collection phase which limited him in meeting the critical incident method conditions. So, he draws the attention of future researchers to the challenges they may face.

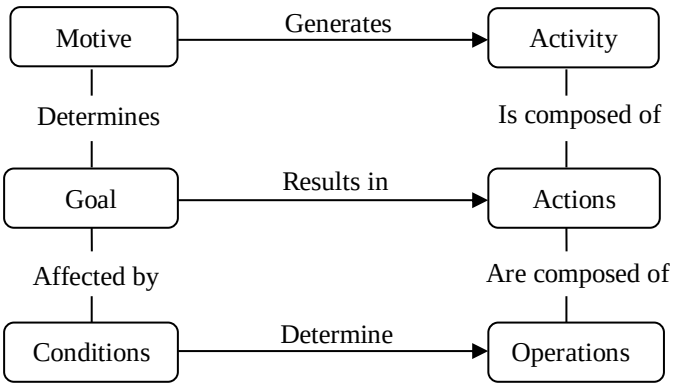
> *One of the challenges of the future studies of source preference criteria is to develop more focused research settings by recruiting interviewees whose articulations of critical incidents would concentrate on* ***specific topics*** *such as health problems. There is also a need to investigate in greater detail the ways in which information* ***source horizons change*** *when information seekers move along information pathways, for example, during the health-related problem solving process* (Savolainen, 2008, p. 291).

To enrich Savolainen (2008) model in this study, Leont'ev (1978) model has been borrowed from the activity theory domain. This model is called activity, actions and operations model and has been explained in next section.

#### 2.4.4.2 Activity, actions and operations model

Wilson, (2006a) recommendation on taking advantage of activity theory in information seeking studies has been found beneficial for modifying Savolainen (2008) model. Each step in Savolainen (2008) source preference model represents a construct in Leont'ev (1978) model. Interestingly, overlooking the goal and activity in the Savolainen (2008) conceptual model could be the cause of challenges being reported by him for future researchers.

**Figure 2.10: Leont'ev activity, actions and operations model adopted from Wilson (2006b) p.13**




Leont'ev (1978) model has been developed based on distinguishing the long term "object-oriented" activities and short term "goal-directed" actions (Engeström, 2000). Leont'ev suggests a distinction amongst concepts with particular value to ISB. He distinguishes motive, activity and operations and relates them to activity's motive, goals and conditions, respectively.

> *The concept activity is necessarily connected with the concept of motive. Activity does not exist without a motive; "non motivated" activity is not activity without a motive but activity with a subjectively and objectively hidden motive. Basic and "formulating" appear to be the actions that realize separate human activities. We call a process an action if it is subordinated to the representation of the result that must be attained, that is, if it is subordinated to a conscious purpose. Similarly, just as the concept of motive is related to the concept of activity, the concept of purpose is related to the concept of action. Actions are not special 'units' that are included in the structure of activity. Human activity does not exist except in the form of action or a chain of actions. For example, work activity exists in work actions, school activity in school actions, social activity in actions (acts) of society, etc. If the actions that constitute activity are mentally subtracted from it, then absolutely nothing will be left of activity* (Leont'ev (1978) para 3.5) in (Wilson, 2006a, p. 13).

Taking advantage of the information seeking models explained in this section enables researchers to collect, analyse and display the individuals' information seeking behaviour to determine their information needs and IQ requirements.

The subsequent section concludes the literature review chapter.

## 2.5 Chapter summary

IRD literature is leaning towards the specialised methods, designed for specific contexts and situations (Siau & Rossi, 2011). To design an information system to assist decision makers in equivocal situations, determining users' information needs and its characteristics is vital, yet no specific IRD method or technique could be found to analyse users' information needs and determine their IQ requirements and preferred information sources. To address this gap and design an IRD method specifically designed for this context, a theoretical foundation is required (Siau & Rossi, 2011) that ISB domain can provide.

Many scholars have indicated that analysing information users' ISB can be beneficial for information system development but have not described how (Savolainen, 2007, 2008; Sonnenwald et al., 2001; Sonnenwald, 1999; Wilson, 2006b). Sonnenwald (1999 p. 10) has gone one step further and urges future researchers to elucidate the applicability of her ISB analysis *"framework and exploring how the framework may guide the design of systems to support human information behaviour*". To provide the theoretical foundation required for the IRD method for the context of IDMES, the ISB model must have the ability to analyse users' information needs and determine their IQ requirements and preferred information source. This model should be able to address the difficulties of IQ measurement and display the impact of information needs and its perceived use on seekers' information behaviour/actions.

The gaps identified in all three IRD, IQ and ISB literatures, illustrate the need for an IRD method to analyse system users' ISB in order to obtain their information needs and its characteristics. This method should assist analysts in determining users' IQ requirements and source preferences based on the type of information they need.

# CHAPTER THREE: TOWARDS A THEORETICAL MODEL FOR IRD IN EQUIVOCAL SITUATIONS

## 3.1 Introduction

As described in the previous chapter, no specific IRD method could be found for the context of IDMES. In section 2.2.3, the activities to be performed in this context were outlined. It was also explained that ISB and IQ literature can provide the theoretical foundation for the IRD method and introduce a common terminology to present the results.

To provide the required theoretical foundation for an IRD method in this context and address one of the shortcomings of many IRD methods that is absence of a theoretical foundation (Siau & Rossi, 2011), a conceptual model is introduced in this chapter. It is assumed that most utilising systems in the context of IDMES are relatively stable and so the decisions to be made by the users of information systems are relatively clear (e.g. patients may decide between the available treatment options). Therefore the *source of equivocality is not the unclear decisions to be made but is how to obtain the right information and how to make the informed and right decisions*. As a result in the context of IDMES:

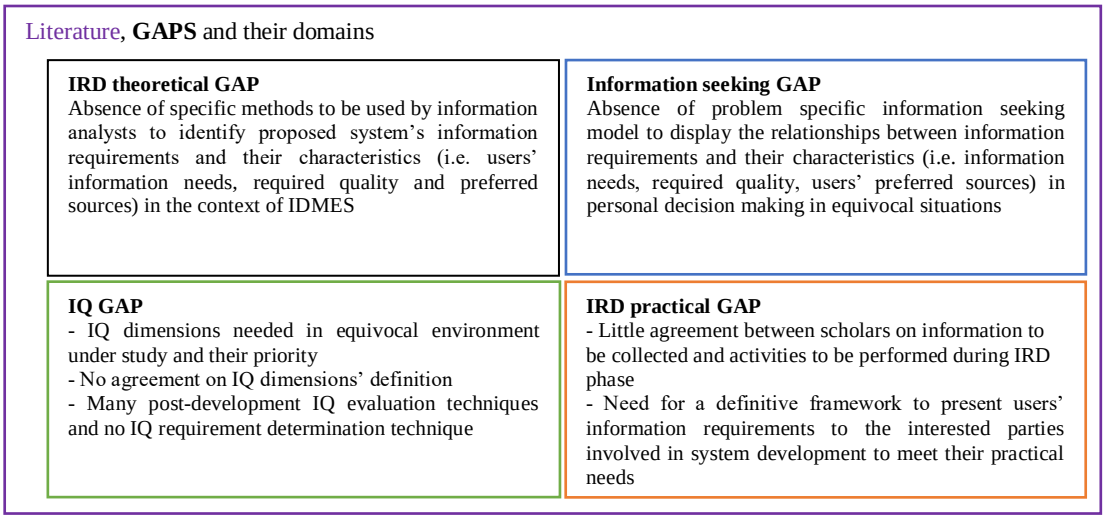
> *Individuals' activities to obtain their information needs shape the context or the problem environment.*

As described in section 2.4.3, to solve a specific problem or to make a specific decision, individuals tend to use a set of complementary information sources delivered through a range of media with varied abilities (Daft & Lengel, 1986; Savolainen & Kari, 2004; Savolainen, 2007, 2008; Sonnenwald et al., 2001). There are several information sources that individuals are aware and use in their ISBs (Sonnenwald, 1999), these information sources and individuals' ISBs performed to obtain information from these sources can be used to study the problem environment.

To define the problem and also to determine information needs and its characteristics, a repeatable and detailed theoretical model is required with the ability to analyse all determined aspects in section 2.2.3. Such models need to be

underpinned by reputable theories. Taking advantage of the thoroughly studied concepts of IQ and ISB could assist researchers in designing such models. However, these concepts also carry limitations and implementation difficulties regarding what is expected from them by an IRD method. For example, in IQ literature little agreement exists between scholars on the definitions of IQ dimensions. On the other hand, in information seeking literature there are a limited number of models that represent the relationship between the constructs of information needs (outlined in section 2.4.4). Figure 3.1 displays the gaps identified in the literature in the domains of IRD, IQ and ISB.

**Figure 3.1: The gaps identified in the literature**




To cover the IRD theoretical gap and to provide a theoretical foundation for the IRD methods, Quality Requirement Determination (QRD) model is established in this chapter. The QRD model takes advantage of activity theory, information horizon and information pathways concepts and is designed specifically for developing an IRD method for the context of IDMES. *The QRD model has been used as the theoretical foundation for developing an illustrative IRD method to determine users' required IQ, information needs and preferred information sources in the context of IDMES.*

To address the IRD practical gap, a presentation structure has been developed to present the results of applying the QRD model for IRD. This structure presents the important information which should be determined in the context of IDMES

leverages a six cell matrix with each cell representing a cognitive role played by the information sources in the users' information horizons.

Two models and two concepts have been used in this chapter to develop the QRD model. These models and concepts are previously explained in chapter 2. In this chapter, their contribution to the conceptual model, developed through this research, is explained. Following the introduction of the QRD model in section 3.2, the QRD model constructs and the relationships between them have been respectively explained in section 3.2.1 and section 3.2.2. Following the explanation of the theoretical model, its usability and data presentation matrix is explained in section 3.2.5. Finally, section 3.3 concludes this chapter.

## 3.2 The Quality Requirement Determination (QRD) model

In general, a conceptual model and framework "explains, either graphically or in narrative form, the main things to be studied – the key factors, constructs or variables – and the presumed relationships among them" (Huberman & Miles, 2002, p. 18). *Graphical conceptual model in this study is used to simplify a complicated situation* (Siggelkow, 2007) *and assist information analysts in analysing the context and determine system users' information requirements*. Moreover, in line with qualitative research nature, the QRD model helps information analysts in the process of data collection, finding patterns and analysing the findings (Hair, Money, Samouel, & Page, 2007).

The core of the QRD model is shaped by Savolainen (2008) model for information source preference. He urges researchers to "concentrate on ***specific topics*** such as health problems" and also to study "the ways in which information ***source horizons change*** when information seekers move along information pathways" (Savolainen, 2008, p. 291). To follow Savolainen (2008) recommendations and to address users' IQ requirements, the guidance obtained from Wilson (2006a), Wilson, (2006b) , Wilson (2000) and Leont'ev (1978) have been leveraged to modify the Savolainen (2008) model. One of the main modifications made to the Savolainen (2008) model is based on Wilson (2006a) recommendation to use activity theory in information seeking. In this regard, Leont'ev (1978) activity, actions and operations model has been used to add to the richness of the Savolainen

(2008) model. Table 3-1 outlines the contributing models and concepts and their type of contribution in establishing the QRD model.

**Table 3-1: Models and concepts leveraged to establish the QRD model**

| Model/Concept name | Area | Contribution to QRD model | Source |
|---|---|---|---|
| Information source horizon concept | Information source preference | Provides theoretical background to analyse the problem, data collection and analysis. | (Sonnenwald, 1999) (Sonnenwald et al., 2001) |
| Information source horizon and information pathways in the context of seeking problem-specific information | Information source preference | Provides the core structure with the capability to address IQ and sources preference concerns. | (Savolainen, 2008) |
| Activity, actions and operations model | Activity theory | Theoretical background. Adds to the richness of Savolainen model when used as an activity theory[13] lens. | (Leont'ev, 1978) |
| Organizational information requirements, media richness and structural design | Media richness and structural design | Recommends equivocality and uncertainty resolutions as the stages toward certainty. Made a good connection to type of sources recommended by Sonnenwald (2001). | (Daft & Lengel, 1986) |

The focus of the QRD model is on identifying users' information needs, required IQ and preferred information sources. It displays relationships between perceived uses for information, IQ requirements and preferred sources measured by information horizons and pathways concepts. This model also notes the impact of problem at hand as the motive on information seeking behaviour. This impact suggests problem at hand as the reason for triggering the information needs and the following source preference behaviour.

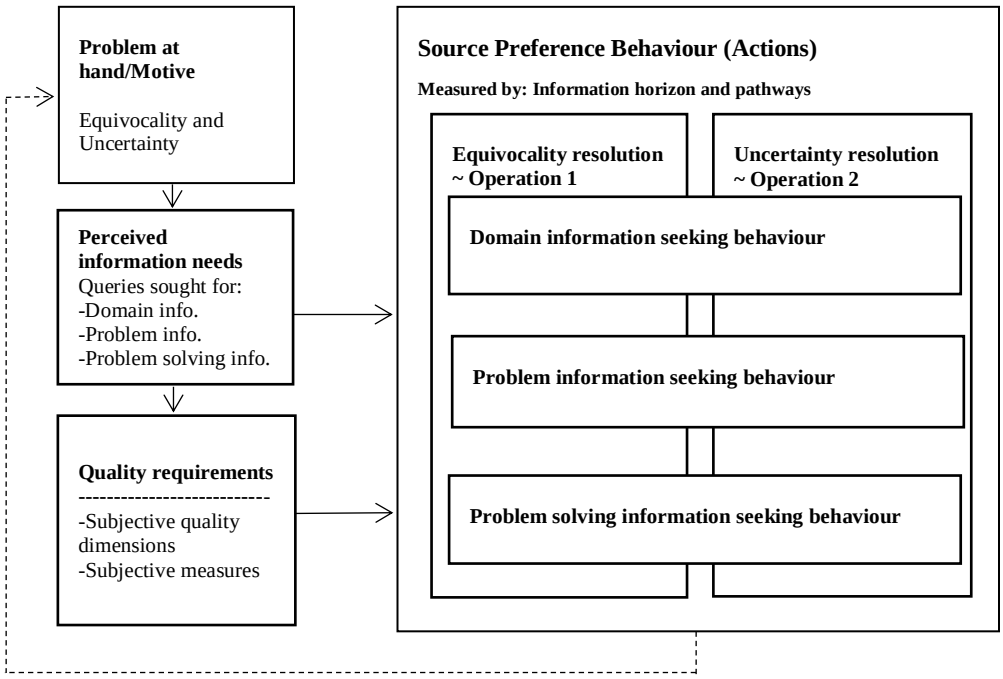
The QRD model is theoretically pinpointed by two major domains of information source preference and activity theory. Leveraging Leont'ev (1978) activity, action and operation model from the activity theory domain, and terminologies and concepts borrowed from Daft & Lengel (1986), enabled researcher to enrich a number of Savolainen (2008) model constructs and replace a few others.

To develop the QRD model's constructs and the relationships between them, the equivalent of every constructs in the Leont'ev (1978) activity, actions and operations model has been defined in the QRD model. ***Problem at hand*** as the motive triggers the information seeking ***activity*** that is composed of all iterations of source preference actions conducted to solve the problem at hand. Information seeking

[13] This study follows the recommendation of Wilson (2006b) on using activity theory as conceptual framework and for its coherent terminology in the area of information seeking behaviour.

activity may be conducted in several iterations that one of which is outlined in the QRD model displayed in Figure 3.2. The motive could be the need for information, cope with stress of not knowing or any other motives. Seeking for perceived information needs then can be named as ***actions*** or ***behaviour***. ***Goal*** for those actions could be finding the answers for the queries in the seekers' mind which represents the ***perceived information needs***. Within the action construct there are two ***operations*** predicted, one is ***equivocality resolution*** and the other is ***uncertainty resolution***. These operations, and consequently the actions they form, are affected by ***conditions***. When the queries in mind of the seeker are general or vague, the equivocality resolution operation is required. If the queries are well structured, then an uncertainty resolution operation is performed. The results of these two operations generate actions which impact the problem at hand and consequently the queries in the mind of the seeker.

**Figure 3.2: Quality Requirement Determination (QRD) model for equivocal situations**




The QRD model's constructs and the relationship among them have been explained in detail in the following sections.

### 3.2.1 Constructs of the QRD model

**Problem at hand/Motive**

Impact of motive on ISB have been indicated in a number of studies (Leont'ev, 1978; Savolainen, 2007, 2008). Leont'ev (1978) indicates that there is no activity without a motive. In a problem-specific ISB, solving the problem at hand is considered as the motive. Therefore, in the context of IDMES, reducing the level of uncertainty and equivocality surrounding the decision to be made has been considered as the motive for generating the entire information seeking activity that is represented by the QRD model.

**Perceived information needs/Goals**

Burnkrant (1976) suggests that need is "a cognitive representation of a future goal that is desired". Thus, perceived information needs can be considered as the equivalent to the goal construct in Leont'ev (1978) activity, action, operation model. Information needs can be categorised into three groups of domain, problem and problem-solving information (Byström & Järvelin, 1995; Wilson, 1999b). Similar categorisation of information needs has been used in other studies as well to study the impact of type of information needs on informants' information behaviour (Serola, 2006).

Need, in general, is a subjective experience which happens in the mind of the person in need and is not observable directly. The information needs could be collected only by *deducing it from behaviour* or *report of the person in need* (Lasorsa & Rice-Lively, 2004). Therefore, information needs can be measured by the queries in the mind of the information seeker.

**Source preference behaviour/Actions**

Based on Leont'ev (1978) model, actions are composed of operations. Daft & Lengel, (1986) suggest equivocality and uncertainty as the two forces influencing the information processing. Therefore, in equivocal situations, source preference actions are proposed to be composed from two operations conducted for equivocality

resolution and uncertainty resolution. Information horizon and information pathways are the tools used to measure users' source preference actions.

Three types of actions (behaviour) shape source preference behaviour construct. Each of these behaviours represents the actions undertaken to seek one type of information needs. These three categories of actions (domain, problem and problem solving ISB) are composed of equivocality and uncertainty resolution operations and are measured by information horizons and pathways.

**Equivocality and uncertainty resolution/Operations**

At different stages of information seeking behaviour, users have different and evolving perceived needs for information as they are not clear what exactly they are looking for at the beginning of the behaviour (Lasorsa & Rice-Lively, 2004). For instance when a patient first visit the doctor because of having a chest pain, his/her queries could be the need to know the condition that he/she may have and its treatments. At that visit doctor may ask the patient to undertake some tests. Patient's queries at this stage may evolve into queries regarding the tests he/she is undertaking.

In equivocal situations, individuals process information for two reasons: "uncertainty and equivocality resolution". Gathering different types of information from a variety of information sources or media usually fulfils the lack of information, which in turn leads to uncertainty resolution. By contrast, equivocality resolution usually takes place through discussion of the relevant issues and not by providing information. Equivocality is not the result of lack of information but is associated with multiple interpretations, and conflicting views of the same subject. In organisations "managers will talk things over, and ultimately enact a solution. Managers reduce equivocality by defining or creating an answer rather than by learning the answer from the collection of additional data" (Daft & Lengel, 1986, p. 554).

Comparing equivocality and uncertainty resolution operations to sense making model, suggests that users try to resolve the equivocality to learn about the situation, build the ability to interpret it and select the path towards acquiring the required

information. Uncertainty resolution then is the operation needed to resolve the clearly defined queries (Daft & Lengel, 1986; Lasorsa & Rice-Lively, 2004). The process through which the appropriate information sources for uncertainty and equivocality resolution are selected and used by information users, form equivocality and uncertainty resolution operations.

**Information horizon/Measurement tool**

As introduced in section 2.4.4.1, information horizon includes the list of information sources that information user is aware of, or has used during the performance of ISB. By grouping information sources based on their importance to users, information sources can be categorised into three zones (i.e. most important, partially important and peripherally important sources) (Savolainen & Kari, 2004; Savolainen, 2007, 2008).

Leveraging the concept of information horizon to analyse users' ISB enables information analysts to determine the information sources that users are currently using and rate their importance. Sections 4.6.1.3.4 and 4.6.1.5.2 define how information horizon concept is used to collect and analyse users' ISB.

**Information pathways/Measurement tool**

As indicated in section 2.4.4.1, information pathways pertain to the sequence in which individuals use information sources (Savolainen, 2008). Using this concept to define users' source preference behaviour enables information analysts to understand users' expectations of an information source. Information pathways is the tool which has been leveraged to differentiate equivocality resolution sources from those that reduce uncertainty. Sections 4.6.1.3.4 and 4.6.1.5.2 define how information pathways are used to collect and analyse users' ISB.

**Quality requirements/Conditions**

Based on Leont'ev (1978) model, conditions are affected by goals and, in turn, impact operations. Therefore, the "source preference criteria" construct in Savolainen (2008) model has been considered as conditions in the QRD model and is called "quality requirements" (Leont'ev, 1978; Savolainen, 2008). Since "equivocality and

uncertainty resolution" constructs are considered as "operations", then both of them can be determined by "quality requirements[14]".

Because of the subjective nature of quality, to measure quality requirements in the QRD model, priority of IQ dimensions (subjective quality dimensions) to users and their definitions to them (subjective measures) are considered vital requirements to be determined.

After explaining all the constructs of the QRD model, the relationships between these constructs are explained in the following section.

### 3.2.2 Relationships between constructs of the QRD model

**Problem at hand – Perceived information needs**

Information needs are described as general recognition of presence of uncertainty and begin with people's attempt to solve "uncertainties or knowledge insufficiencies" (Lasorsa & Rice-Lively, 2004). In the context of IDMES there are uncertainties and equivocality surrounding the decisions that the decision makers should resolve. Equivocality and uncertainty result in a number of questions to be answered (perceived information needs) (Daft & Lengel, 1986). Therefore, based on Leont'ev (1978) model, since solving the problem at hand is assumed to be the motive for the information behaviour, it determines the perceived information needs as goals.

Another support for this relationship can be found in the literature where scholars report that the increase in task uncertainly (motive) impacts the information needs (Bin, 2009; Tushman & Nadler, 1978). These perceived information needs, if satisfied, are assumed to resolve the equivocality and uncertainty and result in the more certain decisions.

[14] This study does not include the impact of users and situational characteristics on users' source preference behaviour by applying suitable sampling strategies, as explained in the methodology chapter.

**Perceived information need – Source preference behaviour**

Source preference behaviour (actions) consists of selecting the appropriate information sources to meet users' information needs. Leont'ev (1978) model suggests that a relationship exists between goals and actions which in the QRD model has been interpreted as a relationship between perceived information needs and source preference behaviour. There are a few studies conducted on evaluating this relationship; for instance Serola (2006) identifies a relationship between categories of information needs (i.e. domain/problem/problem solving information) and city planners' source preference behaviour (actions). Another example for the impact of perceived information needs on users' source preference behaviour could be traced in Wilson (1999a) where he indicates that patients rely on different information sources for their distinct types of information needs. For example, patients would rely on their physicians for professional knowledge and their families for emotional support.

Information horizon can be used as a tool to illustrate the relationship between source preference behaviour and individuals' information needs as information seekers

> *Make choices about the nature of their fields [(information horizons) and] the types of media they attend to … often based on their information needs and preferences. … As individuals become more focused in their information seeking they change the nature of their information field to support the acquisition of information related to particular purposes* (Johnson et al., 2006, p. 571).

**Perceived information needs – Quality requirements**

The intention behind the use for information is indicated to be "*essential to define the required level of quality that information should meet*" (Gharib & Giorgini, 2015). In Leont'ev (1978) model, goal is affected by conditions. In the QRD model, meeting perceived information needs is assumed as the goal, therefore the dimensions considered to evaluate the quality of the potential answers to information needs are the conditions. In a larger perspective, Savolainen (2008) proposes that

problem at hand is related to the source preference criteria (quality requirements). Based on Leont'ev (1978) model and by assuming the information needs (goals) as pieces of the larger motive, it could be suggested that the same relationship between perceived information needs and quality requirements exists.

**Quality requirements – Operations**

The relationship between quality requirements (source preference criteria) and users' information horizons and pathways has been empirically tested in a number of studies (Savolainen & Kari, 2004; Savolainen, 2007, 2008). Leont'ev (1978) model also theoretically supports the relationship between conditions and operations. In the QRD model, this relationship has been interpreted as the relationship between the quality requirements construct and equivocality and uncertainty resolution operations. This relationship has been suggested to be measured by the information horizon and information pathways tools.

The impact of quality requirements on users' source preference behaviour has been indicated in a number of references. Table 3-2 indicates the source preference dimensions identified by scholars that have an impact on users' source preferences behaviour.

**Table 3-2: Source preference dimensions in different contexts**

| Context | Source Preference Dimensions | Author |
|---|---|---|
| Environmental activists doing everyday life information seeking | - Content of information (IQ)<br>- Availability of information | (Savolainen, 2008) |
| Environmental activists in seeking orienting information seeking | - Content of information (IQ)<br>- Availability of information<br>- Accessibility | (Savolainen, 2007) |
| Organizational decision making | - Accessibility of the source<br>- Information quality | (O'Reilly, 1982) |
| Everyday life information seeking | - Accuracy of information<br>- Understandability of information<br>- Good experience with the source | (C. Chen & Hernon, 1982) |
| Teachers and industrial workers | - Availability<br>- Accessibility<br>- Ease of use | (Savolainen, 1995) |
| Everyday life information seeking<br>(one person in ten weeks) | - Ease and speed of use<br>- Value of information | (Julien & Michels, 2004) |

**Source preference behaviour (actions) – Problem at hand**

The dashed line in the QRD model, is adopted from Savolainen (2008) model. It indicates that the output of information seeking actions affects users' interpretation of problem at hand and may impact their next iterations of seeking behaviour (Savolainen, 2008). For instance, when seeker is faced with a new problem, he/she may focus on domain information seeking actions. The results of this action impact the problem at hand and consequently the queries in the mind of the seeker. Therefore, at the next iteration of seeking behaviour, seeker's focus may be shifted towards problem and problem solving information seeking actions.

### 3.2.3 Measurements

To explain the constructs of the QRD model and the relationships between them in practice, there should be means available to measure all the presented constructs. Followings are the suggested measures:

1. Problem at hand is the decisions that the individual users should make. It is measured by identifying the problems that users need to make decisions for. Problems could be derived from the utilising system's structure and/or indication of users.
2. Perceived information needs are measured and categorised by the *queries* being sought for each type of information needs (i.e. domain, problem, and problem solving information).
3. Source preference behaviour is measured by information horizon and pathway tools. Information horizons are leveraged to identify the *information sources* being used for each category of queries and identify their *importance* to users. Information pathways on the other hand are used to define the *sequence* through which users have used the information sources. Information pathways are leveraged to differentiate equivocality resolving sources from uncertainty resolving ones.
4. Quality requirements are measured by the *IQ dimensions* that are considered by information seekers to evaluate the quality of information or information sources that they have used. Because of the subjective nature of quality, priority of IQ dimensions to users and also their subjective measurement

factors have been considered to measure quality requirements in the QRD model.

The QRD model has been presented to facilitate the process of IRD in the context of IDMES. As a result the data which is collected and analysed by it must be usable by the IS practitioners involved in the information system development. The following section outlines how the QRD model can be useful in practice.

### 3.2.4 **Usability**

The information processed by the QRD model in the context of IDMES must include the important information required to be determined in the context and also must be usable by the IS practitioners for developing information systems. To evaluate usability of the information analysed by the QRD model, six[15] hypotheses are defined which are explained as follows.

- H1: Users' categorised queries represent seekers' information needs and are useful for content development.

Learning the queries in the mind of the users will allow the content developers to learn the questions which should be answered by their provided information.

- H2: Categorised information sources and IQ dimensions are useful for context analysis and defining the problem space.

Many scholars identified context analysis and defining the problem domain as important activities which should be done during the IRD phase (Daneva et al., 2013; Davis, 1982; Hickey & Davis, 2004; Ross & Schoman, 1977; Sibley et al., 1988). Analysing the "current operations" to state the problem is an activity estimated to take 75 percent of analysts' time (Davis, 1982; Ross & Schoman, 1977). To analyse the problem domain, the following factors are of interest to analysts:

[15] One hypothesis has been added to these six during the data analysis conducted to answer RQ2. (H7: Analysis of users' information behaviour change over time/experience is useful to identify the gaps in the information horizon (problem definition)). H7 has been explained in section 5.5.1

*The facts, rules, beliefs, algorithms, procedures, etc. pertinent to the problem. Factors that may prohibit design, development, and implementation of solutions. Explanations of why specific actions are or are not to be taken. Comparisons of current problem states against desired problem states. Abstract representations of the problem domain maintained by experts and end users. The particular global goals to be achieved by an implemented IS …. Description of the existing technological environment that can be applied to support the system to be developed* (Byrd & Cossick, 1992, p. 124).

To design and develop the information systems needed in the field, Sonnenwald et al., (2001) indicate that "*access to multiple information resources could be or should be integrated in information systems to support users' preference patterns*" (p. 10). Categorising users' information horizons based on their responsibilities is proposed to give IS practitioners 1) a better understanding of the users' preference patterns, 2) their expectations of the proposed system and 3) requirements that should be met by system's applications.

Therefore categorised information sources and IQ dimensions are proposed to be useful for context analysis and defining the problem space in a high (organisational) level.

- H3: Identifying potential users' IQ requirements is useful to develop quality information systems.

In equivocal and complex situations, information characteristics are more important than the amount of information since the extra information may actually increase the uncertainty that decision makers face (Daft & Lengel, 1986). IQ include the majority of information characteristics and in the QRD model is used as a lens to investigate the users' logic for their source preference behaviour.

One of the difficulties in IRD methods has been reported to be the difficulties in measuring the problems (Ross & Schoman, 1977). IQ dimensions are proposed to have the ability to serve as a measurement for quantifying the problems and users' expectations and therefore enable IS practitioners to develop high quality systems.

- H4: Identifying IQ dimensions measurement factors is useful for implementing IQ dimensions.

Since there is no general agreement between scholars on IQ dimensions' definitions and how to measure them (Batini et al., 2009), identifying users' subjective measurements for IQ dimensions could be beneficial in implementing IQ dimensions in proposed information systems.

- H5: Identifying equivocality and uncertainty resolution sources assist designers and developers in developing the information flow in their systems.

Sonnenwald et al., (2001) indicates the importance of following users' source preference patterns in designing information systems. Analysing users' logic for their source preference behaviour can assist IS practitioners to design information sources that follow the same logic.

- H6: The QRD method is applicable in other contexts.

It is proposed that the QRD method derived from the QRD model can be useful for information system development projects in contexts other than the case study context. To be more specific, this hypothesis suggests that there are similarities between all the cases in which an individual must make decisions in equivocal situations. Therefore using the QRD method could be beneficial for all such contexts.

There are several stakeholders involved in the information system development, therefore information analysts must be able to present the information analysed by the QRD model to them. Following section defines a structure to be used for presenting the information analysed by the QRD model.

### 3.2.5 QRD presentation matrix

As discussed in section 2.2.2.2, one of the important activities to be performed during IRD phase is the presentation of determined information to the interested stakeholders involved in information systems development. This information must be presented in an understandable fashion and include the important aspects which is needed to be determined in the context of interest.

The QRD model suggests that in the context of IDMES, users seek to resolve the equivocality first to define the questions to be sought and then use other sources to resolve the uncertainty (Daft & Lengel, 1986; Sonnenwald et al., 2001). Therefore, within a single information system some applications should be available to resolve the equivocality and some to reduce the uncertainty. The equivocality resolution applications should have the ability to break the large questions into the smaller ones which are easier to address (Daft & Lengel, 1986; Ross & Schoman, 1977). Uncertainty resolution applications on the other hand are required to provide the specific queries formed during the equivocality resolution, with answers. To present the information analysed by the QRD model to the interested stakeholders involved in information system development ***QRD presentation matrix*** uses the same flow (see Table 3-3).

The information presented in the QRD presentation matrix provides a high level understanding of the problem environment. The QRD presentation matrix presents the important information which should be determined in the context of IDMES and leverages a six[16] cell matrix with each cell representing a cognitive role played by the information sources in the users' information horizons.

The main purpose of creation of the QRD presentation matrix is to simplify the presentation of the information obtained from conceptualising the context through the QRD model. The QRD model suggests that type of users' information needs impacts their source preference behaviour. Therefore the QRD presentation matrix dedicates one row to the information sources that users use to obtain each type of their information needs (i.e. three rows, one for domain, one for problem and one for problem solving information needs). On the other hand the QRD model suggests that in the context of IDMES two types of source preference actions must take place to find the answers for the problems at hand, these actions are equivocality and uncertainty resolution. By combination of these two types of categorisation for users' source preference behaviour, six cognitive roles are identified for the information sources in users' information horizons in the context of IDMES. The sources presented in each cell of the matrix are responsible for a specific role. For instance in the context of IDMES there should be sources available to specifically resolve the

[16] Three extra cells were added to the proposed presentation framework during the data analysis.

equivocality associated with the problem information. In the QRD presentation matrix these sources must be displayed in the cell number 4. The QRD model also suggests that quality requirements has an impact on users' source preference behaviour. From that it can be concluded that for distinct types of information needs, users should have different quality requirements. Cells 3, 6 and 9 in the QRD presentation matrix are dedicated to display these requirements.

**Table 3-3: QRD presentation matrix**

| | Equivocality resolution | Uncertainty resolution | Quality requirements |
|---|---|---|---|
| **Domain information** | Information sources (Cell 1) | Information sources (Cell 2) | Quality dimensions (Cell 3) |
| **Problem information** | Information sources (Cell 4) | Information sources (Cell 5) | Quality dimensions (Cell 6) |
| **Problem solving information** | Information sources (Cell 7) | Information sources (Cell 8) | Quality dimensions (Cell 9) |

The following section provides a summary for this chapter.

## 3.3 Chapter summary

This chapter was focused on developing the QRD model (Figure 3.2) as the theoretical foundation required for the QRD method to determine users' information needs, IQ requirements and preferred information sources in the context of IDMES. Accompanied with the data collection, analysis and presentation methods and techniques, the QRD model will form the QRD method. This method may assist information analysts in overcoming the limitations identified for determining system's information requirements. The next chapter explains the research design of this study from the research questions and objectives to the analysis methods.

# CHAPTER FOUR: THE RESEARCH PROCESS DESIGN

## 4.1 Introduction

This chapter explains the research design and strategy applied in this study. There are many approaches available to conduct an IS research study which are impacted by the philosophical perspectives adopted by the researcher and the requirements of the research. Furthermore considering the available research approaches help researchers to identify the most appropriate research approach for their studies.

To design the research process, this chapter starts with outlining the research objective and questions in section 4.2. Following that, section 4.3 provides an overview of research paradigms employed in IS research. Section 4.4 explains the available research options in the IS domain and compares the advantage and disadvantages of case study and field study. It also outlines the sampling strategies that could be employed in either of case or field studies. Section 4.5 highlights the ethical considerations for this study. In section 4.6, the process of designing the suitable research approaches for this study has been explained in two phases. Each phase attempts to address the research protocol, data collection and data analysis methods for each group of participants. Finally, section 4.7 provides a summary of the research approach employed for this study.

## 4.2 Research objective and questions

The research objective suggests the main key elements of a study and its design, therefore it is crucial to design and define it precisely (Creswell, 2008). The literature review in chapter two identifies that there is no specialised method for the determination of users' information requirements in the context of "IDMES". Examples that describe equivocal decision making situations can be found in healthcare when a patient who is not a trained expert in healthcare has to choose between several treatment options for a serious health condition. In these cases focusing only on the amount of information may even increase the uncertainty in decision making and overloads patients with information. Therefore, when planning to develop an information system to assist users in making decisions in equivocal situations, extra attention should be paid to determining users' information needs and

its characteristics (i.e. IQ and source). Yet no specific IRD method or technique could be found to categorise the information needs and determine users' IQ requirements and preferred information sources in this context.

To address this gap and design an IRD method specifically designed for this context, a theoretical foundation is required (Siau & Rossi, 2011). To provide this theoretical foundation, the researcher leveraged the IQ and ISB literatures to establish a conceptual model named Quality Requirement Determination (QRD) in chapter three (Figure 3.2). The QRD model takes advantage of activity theory, information horizon and information pathways concepts (Table 3-1) and is designed specifically for developing an IRD method in the context of IDMES. The QRD model includes four main constructs naming: problem at hand, perceived information needs, quality requirements and source preference behaviour. As a theoretical foundation, the QRD model's constructs and the relationships between them must be applicable for performing IRD activities in the field (e.g. context analysis, determining users' information needs). As a result, the research objective of this study is as follows:

> To investigate the applicability of the QRD model in determining and presenting system users' perceived information needs, quality requirements, preferred sources or media and the relationships between these constructs for information requirement determination in the context of IDMES.

Practically the ambition is to develop a specifically designed IRD method from the combination of the QRD model and its associated data collection, analysis and presentation techniques, for the context of IDMES.

To meet the research objective, Miles & Huberman (1994) argue that a few research questions should be derived from the research objective to provide a structure for the data gathering phase of the study. Hence three research questions are proposed for this study as follows:

1. **How do perceived information needs impact users' source/media preference behaviour in the QRD model?**

To investigate this relationship, the first step is to evaluate the existence of this relationship between these constructs in the QRD model. As explained in section 3.2.2, the relationship between quality requirements and source preference behaviour has been tested in several studies. However there is only a limited body of literature on the relationship between perceived information needs and source preference behaviour. Therefore, this relationship is empirically evaluated through a sample context analysis (the case of parenting children with autism) using the QRD model.

Research question one (RQ1) is explanatory in nature. To answer it, in addition to evaluating the existence of the relationship between the constructs of the QRD model, this relationship must be explained too. The explanations provided are used to evaluate the applicability of this relationship for determining users' information requirements in the sample context and meet part of the research objective. The expected outputs of this question are: the information sources users have preferred to use for each category of their information needs, equivocality resolution and uncertainty resolution.

2. **How does the QRD model unpack users' information quality requirements and its relationship with information needs in equivocal situations?**

Research question two (RQ2) is explanatory in nature. It focuses on explaining the QRD model's quality requirement construct in depth to address its measurement difficulties. Following the measurement of users' quality requirements, its relationship with perceived information needs should be evaluated since this relationship of the QRD model also does not receive strong support from the literature.

Information quality includes several dimensions, many of which are subjective and therefore their priority to users and their definitions are task, user and context sensitive (Batini et al., 2009; Delone & McLean, 2003; Herrera-Viedma, 2006; Lee

et al., 2002; Petter et al., 2008; Pipino et al., 2002; Seddon & Staples, 1999; Wang & Strong, 1996; Wilson, 1997). Thus, to determine users' IQ requirements prior to an information system development, it is necessary that their required IQ dimensions, dimensions' priority and their subjective definitions and measurements are identified. The expected outputs of this question are: the high priority quality dimensions impacting users' source preference behaviour, users' subjective definitions and measures for evaluating the quality dimensions and the evaluation of the relationship between quality requirements and information needs in the sample context.

3. **What are the practical uses of the QRD model for IS practitioners when determining information requirements?**

The results of any IRD method conducted by information analysts should address the requirements of other interested stakeholders involved in the information system development (e.g. other information analysts, system analysts, designers, system developers, content developers, managers). There is little agreement amongst scholars on the activities which should be performed and the information which should be collected during the IRD phase in different contexts. Therefore, this question focuses on validating the practical uses proposed for the determined information requirements. This information allows the researcher to identify the important information to be determined and important activities to be performed during IRD phase of system development in the context of IDMES.

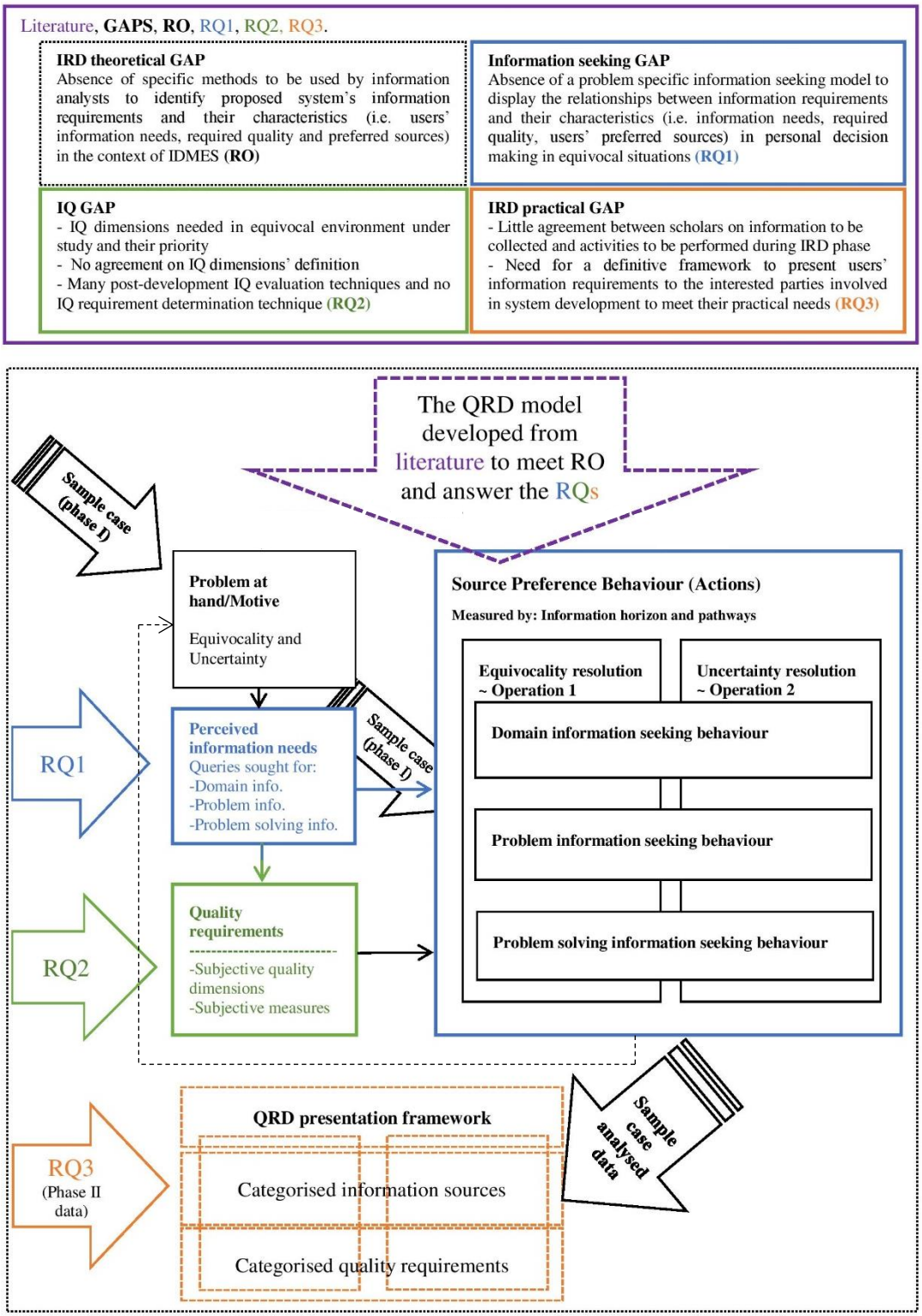
Research question three (RQ3) is an exploratory question. It begins with evaluating all of the proposed hypotheses for the anticipated uses for the QRD method. It is followed by exploring the other potential emergent uses arising from the application of the QRD method[17] in practice (as evidence by the data collected in RQ3). The expected outputs of this question are: the practical applications of QRD model in IRD phase of information system development.

In Figure 4.1 the gaps identified in the literature are detailed and their relationships with the research objective, research questions and the QRD model are graphically displayed. Figure 4.1 colour codes the constructs and relationships that

[17] The QRD presentation framework along with the QRD model and associated data collection and analysis techniques are called QRD method

each research question addresses. Furthermore, it illustrates how the data collected has been leveraged to evaluate the QRD model in the study.

**Figure 4.1: The relationship between the gaps identified in the literature, RO, RQs and the QRD model**



To address the first two research questions, the researcher uses the QRD model as the theoretical foundation. This helps the researcher in identifying the active constructs and how to measure them. Therefore, the researcher's focus is on explaining the constructs and the relationships displayed in the model. RQ3 on the other hand, begins with a looser understanding of the context. It attempts to evaluate the proposed applications of using the QRD model for IRD, and to identify other emergent potential uses.

The following section provides an overview of the research philosophies and paradigms that the researcher has leveraged to address the three defined research questions.

## 4.3 Overview of IS research philosophies and paradigms

A large number of research methodologies are available with the ability to be applied to Management Information Systems (MIS) research (Jenkins, 1985). To adopt the right strategy, an understanding of the philosophical views and their associated research paradigms is required. This section is dedicated to establishing a brief understanding of the research philosophies and associated paradigms.

### 4.3.1 Research philosophies and paradigms

Understanding the research philosophies underpinning IS research helps researchers to select the most appropriate design for their study. In choosing the research paradigms, while researchers should act based on their ontological and epistemological preference, they also must be aware of the inherent weakness of their preferred approaches (Remenyi & Williams, 1995).

A research paradigm represents a set of assumptions regarding ontology, epistemology and methodology (Guba & Lincoln, 1994). This paradigm defines the researcher's belief about reality. By extension, a research paradigm also provides the context through which readers may understand research findings, or provides a set of basic beliefs that shapes a "common language" through which researchers may unify their efforts (Benbasat & Weber, 1996; Patton, 1990).

The researchers' beliefs impact the ways through which they design the research, collect the data and analyse it. So, it is important for researchers to choose a research paradigm to help them determine their position in the research and justify their research design decisions (Guba, 1990). There is no single research paradigm to be followed in the IS research. Researchers may select an appropriate research paradigm based on their ontological, epistemological and methodological preferences. Guba & Lincoln (1994) define the three levels of paradigmatic beliefs as follows:

1. **Ontology:** What is the form and nature of reality and therefore what is there that can be known about it?
2. **Epistemology:** It refers to assumptions about knowledge and how it can be obtained. It is about construction of knowledge and nature of knowing (W. Chen & Hirschheim, 2004).
3. **Methodology:** This is about ***how*** researchers can find what they believe can be known.

By identifying their paradigmatic beliefs, researchers may choose the research paradigm suitable for their research and beliefs. Hay (2002, p. 64) outlines the relationship between these beliefs as shown in Figure 4.2.

**Figure 4.2: Relationship between paradigmatic beliefs adopted from Hay (2002, p.64)**

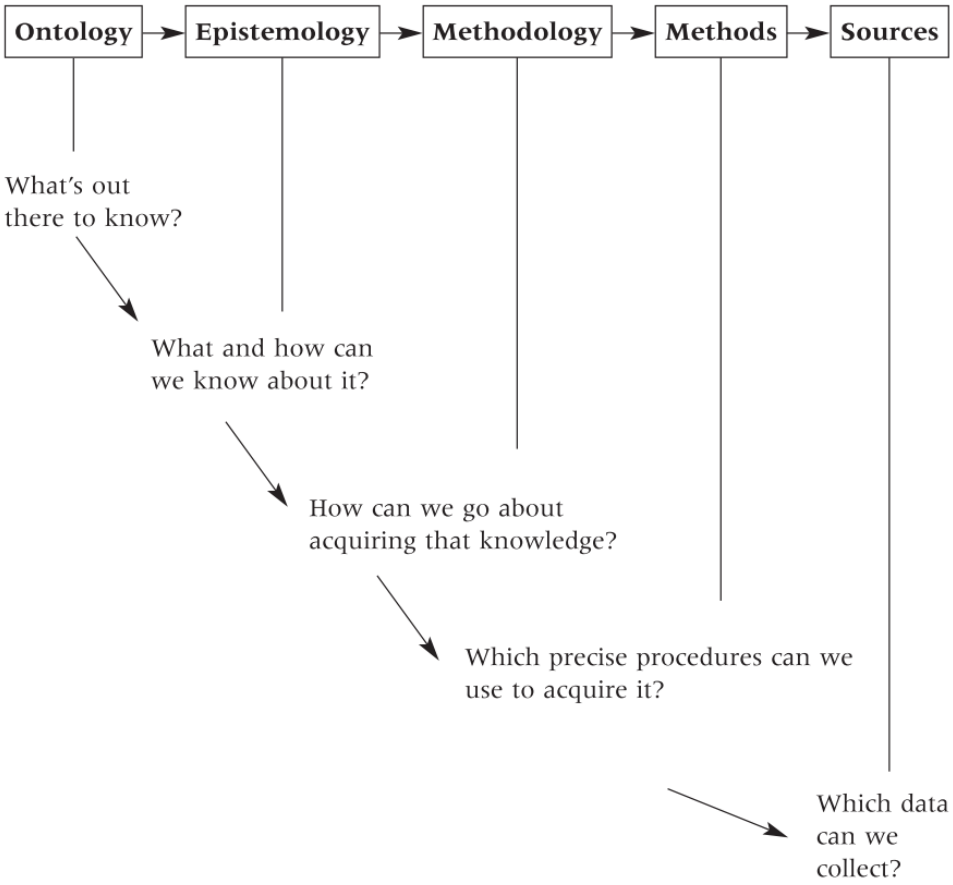



Table 4-1 outlines the ontological, epistemological and methodological stance of five alternative research paradigms.

**Table 4-1: Basic beliefs of alternative enquiry paradigms adapted from Guba (1994, p.109) * column based on Heron & Reason (1997)**

| Belief | Positivism | Post-positivism | Critical theory | Constructivism (interpretivism) | Participatory * |
|---|---|---|---|---|---|
| Ontology | Naïve realism – "real" reality but apprehendable | Critical realism – "real" reality but only imperfectly and probabilistically apprehendible | Historical realism – virtual reality shaped by social, political, cultural, economic, ethics and gender values; crystallized over time | Relativism – local and specific constructed and co-constructed realities | Participative reality – subjective reality, co-created by mind and given cosmos |
| Epistemology | Dualist/objectivist; findings true | Modified dualist/ objectivist; critical tradition/community; findings probably true | Transactional/subjectivist; value-mediated findings | Transactional/subjectivist; created findings | Critical subjectivity in participatory transaction with cosmos; extended epistemology of experimental, propositional and practical knowing |
| Methodology | Experimental/ manipulative; verification of hypotheses; chiefly quantitative methods | Modified experimental/manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods | Dialogic/dialectical | Hermeneutical/dialectical | Political participation in collaborative action inquiry; primacy of the practical; use of language grounded in shared experimental context |

Amongst the listed paradigms in the Table 4-1, post-positivism is the closest to the researcher's belief of reality. However, as positivism and interpretivism have attracted the most attention amongst the IS researchers and also to provide a clear definition of post-positivism paradigm in contrast with the former two, these three research paradigms have been defined in the next sections.

### 4.3.2 Positivist paradigm

Positivist researchers ontologically embrace the "belief that external world consists of pre-existing hard tangible structures which exist independently of an individual's cognition" (B. Fitzgerald & Howcroft, 1998, p. 323). This indicates that there is only one true reality. Therefore, to capture this one true reality and represent it accurately, it is argued that the researcher must remain objective and impartial to the phenomenon. To achieve this, positivists employ general theories to build propositions operationalised and tested in the field as hypotheses (Crotty, 1998; Guba & Lincoln, 1994; Hammersley, 2000). Positivism is focused on the validity and control of research procedures (Orlikowski & Baroudi, 1991). Therefore, each statement should either be empirically testable or logically true (Landry & Banville, 1992).

Traditionally, positivism was the dominant research paradigm in the physical sciences and, at its early days, in the IS field (Nissen, 1985). Positivism approach in IS research focuses on quantitative data, testing theories and hypotheses, and quantifying propositions (Orlikowski & Baroudi, 1991). While IS research has been dominated by positivist approach, evidence suggests that it is not suitable for all studies (Nissen, 1985). Social scientists criticise exclusive focus on statistical hypotheses testing for two reasons: 1) the necessity of building the theories through inductive qualitative research, and 2) the scientific control applied for generalisation may eliminate the context (Glaser & Strauss, 1967; B. Kaplan & Duchon, 1988). Whilst this has no consequence for the physical science where the paradigm initially arose, it can lead to a potentially significant problem in the domains of inquiry where the subjects are human beings or the societies where they live. Considering the limitations of the positivism when it comes to studying human subjects and their endeavours, the next section defines the interpretivism as an alternative paradigm.

### 4.3.3 **Interpretivist paradigm**

Interpretivism adopt a relativist ontology that includes the "belief that multiple realities exist as subjective constructions of the mind [whereby] socially-transmitted terms direct how reality is perceived and this will vary across different languages and cultures" (B. Fitzgerald & Howcroft, 1998, p. 325). This indicates that reality is relative. Therefore, the interpretivist approach tries to understand the phenomena through the meaning that individuals assign to it (Boland, 1985; Orlikowski & Baroudi, 1991). In other words, interpretivism encourages the subjective descriptions over the prediction and definition of goals associated with positivism (Nissen, 1985).

Methodologically, the interpretivist paradigm employs a hermeneutical dialectic methodology. This approach defines and refines the constructions through the interaction amongst and between respondents and researchers which is interpreted through the conventional hermeneutical techniques (Guba & Lincoln, 1994). In comparison to positivism, Interpretivism values the context of IS research study by showing more flexibility and providing greater depth which suits studying the events involving human activities (Greene, 1994; B. Kaplan & Duchon, 1988). However, interpretivism has been criticised as it "focuses on particularities and neglects the general" (Hackley, 2007, p. 104).

The last alternative inquiry paradigm defined in this study, is post-positivism as explained in the next section.

### 4.3.4 **Post-positivist paradigm**

Bhattacherjee, (2012) explains that in post-positivism paradigm, combination of empirical observations with logical reasoning directs researchers into a "*reasonable inferences about a phenomenon"*.

> *Post-positivists view science as not certain but probabilistic (i.e., based on many contingencies), and often seek to explore these contingencies to understand social reality better. The post-positivist camp has further fragmented into subjectivists, who view the world as a subjective construction of our subjective minds rather than as an objective reality, and critical realists, who believe that there is an external reality that is independent of a person's thinking but we can never know such reality with any degree of certainty* (p. 18).

Scholars define critical realism as the ontological stance of the post-positivism (Bhattacherjee, 2012; Guba & Lincoln, 1994). Few others also consider critical realism as a philosophy (Carlsson, 2007, 2011; Mingers, 2000, 2002). Either way, similar descriptions have been provided for critical realism and post-positivist paradigms which are explained in this section.

Critical realism definitions implies that researchers observations and/or findings are influenced by their perceptions and therefore does not reflect a precise view of reality, but the researcher's perception of it (Teddlie & Tashakkori, 2009). Critical realism indicates that social phenomena exist in the objective world, and some "lawful reasonably stable relationships" exist among them (Miles & Huberman, 1994, p. 429) yet this reality can be understood only "imperfectly and probabilistically" (Guba & Lincoln, 1994, p. 109).

Critical realism hold advantages to be used in IS research because (1) critical realism enables researchers to take a "realist stance while accepting the major critiques of naïve realism; (2) it addresses both natural and social science and thus encompasses both hard and soft (and critical) approaches; and (3) it does potentially

fit well with the reality of IS as an applied discipline" (Mingers, 2002, p. 300). Critical realism is either qualitative or quantitative and is concerned with why things are as they are and concerns with the mechanisms that shape the observable events. Critical realism "emphasizes the holistic interaction" of different objects (e.g. material, social) and therefore indicates that understanding of a particular situation requires a variety of methods. Also, it "requires the researcher to be particularly aware of the assumptions and limitation of their research" (Mingers, 2002, p. 302).

Methodologically, the post-positivist paradigm encourages pluralism believing that there is no one correct method of science instead, there are many (Wildemuth, 1993). In other words pluralism within the post-positivism paradigm emphasises the importance of applying multiple measures and observations that while each might not be accurate but can provide an improved understanding of the reality. Pluralism allows alternative research approaches. In fact, it is pluralism which reinforces the use of post-positivism paradigm in IS research (W. Chen & Hirschheim, 2004).

Traditionally in the addressed research paradigms in the IS literature, qualitative data is associated with interpretive, and post-positivism paradigms and quantitative data to positivisms, but in fact, qualitative versus quantitative approaches is a beyond paradigm debate which has been explained in the following section.

### 4.3.5 The qualitative versus quantitative debate

The debate between qualitative and quantitative approaches is not new. Table 4-1 assigns quantitative approach to positivism paradigm and qualitative to post-positivism and interpretivism paradigms, but yet many researchers utilise quantitative approaches for interpretive studies (Denzin & Lincoln, 1998).

Quantitative approach is focused on studying predefined variables (Denzin & Lincoln, 1998). In social sciences, it has been criticised for several reasons. The majority of these reasons include: 1) inability to understand human behaviour and focus only on a few preselected controlled variables, while in social systems there are many uncontrolled variables, and 2) the focus on preselected number of variables prevents researchers from studying the effect of context effectively (Guba & Lincoln, 1994). Therefore, quantitative approaches are not considered as suitable options for

studying social systems in which "so many uncontrolled and unidentified variables" are involved (B. Kaplan & Duchon, 1988, p. 572).

In contrary to quantitative approaches, the qualitative approach allows the researcher to get closer to the subject's perspective and to provide deeper understanding of social phenomena and hence avoids the critiques mentioned for quantitative approach in social science (Guba & Lincoln, 1994; Marshall & Rossman, 1989). Qualitative approach is more appropriate for the studies where an in-depth understanding of the complexity of the studied phenomenon is required, or for exploratory studies when there is not enough theory to explain the reality (Marshall & Rossman, 1989).

Following the explanation of available research paradigms and the qualitative versus quantitative debate, the subsequent section explains the available research options and sampling strategies.

## 4.4 Available research options

The IS field is very diverse and consequently there is no single research approach suiting all studies (Jenkins, 1985). McGrath (1984) suggests three factors that researchers should consider and optimise in their research design: 1) the generalisability of the findings, 2) accuracy of the measurement and, 3) realism of the context in which data has been collected. Each research strategy has various strengths and weaknesses (e.g. surveys maximise the generalisability but fail the realism). The research strategy chosen by scholars is in fact a trade-off between the strength and weakness of the available methods. Therefore, the key point to consider when choosing a research method is the alignment of its capabilities with the requirements of the research objective (Jenkins, 1985). A number of taxonomies are available in the literature to help researchers in selecting the appropriate research method based on the nature of their research including the research framework introduced by Marshall & Rossman (1989).

The purpose of research and type of research questions are two factors that can help researchers in selecting a research method. Marshall & Rossman, (1989)

framework outlined in Table 4-2 is a useful tool for identifying the research methods based on the purpose of research and nature of research questions.

Descriptive research describes the phenomenon through the frame of what, when and where questions. Exploratory research is looking for explanations for the observed phenomena, behaviour or problem. On the other hand, by answering how and why types of questions, explanatory research seeks to identify the outcomes and causal factors of studied phenomenon (Bhattacherjee, 2012).

**Table 4-2: Marshall and Rossman's research framework (1989) adopted from Daly (2014, p.141)**

| Purpose of research | Research question | Research method | Example of data collection techniques |
|---|---|---|---|
| **Exploratory**<br>To investigate little understood phenomena.<br>To identify/discover important variables to generate hypotheses | What is happening in the social program?<br>What are the salient themes, patterns, categories in participant's meaning structures?<br>How are these patterns linked? | Case study, Field study | Participant observation, In-depth interviewing; Elite interviewing |
| **Explanatory**<br>To explain the forces causing the phenomenon in question.<br>To identify plausible causal networks shaping the phenomenon. | What events, beliefs, attitudes and policies are shaping this phenomenon?<br>How do these forces interact? | Multi-site case study, History, Field study, Ethnography | Participant observation; In-depth interviewing; Survey questionnaire; Document Analysis. |
| **Descriptive**<br>To document the phenomenon of interest | What are the salient, behaviours, events, beliefs, attitudes and processes occurring? | Field study, Case study, Ethnography | Participant observation, In-depth interviewing, Document analysis, Unobtrusive measures, Survey questionnaire |
| **Predictive**<br>To predict the outcomes of the phenomenon.<br>To forecast the events and behaviours resulting from the phenomenon. | What will occur as a result of this phenomenon?<br>Who will be affected and how? | Experiment, Quasi-experiment | Survey questionnaire (large sample), Kinesics / Proxemics, Content Analysis. |

To meet the research objective, regardless of the type of research questions, there are two dominant research methods, namely, case study and field study. These two research methods are suitable for most of studies, and so are outlined in the next two sections.

### 4.4.1 Case study approach

Case study is defined as "an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 1994). The case study method does not control or manipulate the variables and studies the phenomenon

within its contexts. Case study may include one or multiple sites and allows the use of qualitative approaches for data collection and analysis (Cavaye, 1996). The case study method is useful particularly for research in new topic areas and to answer "how" or "why" type of questions (Eisenhardt, 1989). Case studies could be used in both theory building and theory testing studies (Yin, 1994). The use of case study methods includes a few advantages and disadvantages which are listed as follows:

Advantages of case study methods:

- Allows studying the information system in its natural setting and thus provides the ability to generate theories (Yin, 1994).
- Enables researchers to study the complexity of the process under study (Benbasat, Goldstein, & Mead, 1987; Gable, 1994).
- It is suitable for domains where previous studies have been conducted. It supports the use of a variety of sources of evidence (e.g. documents and interviews) (Benbasat et al., 1987; Yin, 1994).

Disadvantages of case study methods:

- Inability for generalisation (Gable, 1994).
- Risk of information overload which may prevent researchers from providing compact and organised documents (Siggelkow, 2007).
- Lack of control over independent variables limits the internal validity of the conclusions (Miles & Huberman, 1994).

Another dominant method used in the IS domain, field study, is explained in the next section.

### 4.4.2 Field study approach

Field study is conducted in a natural setting with human subjects (Jenkins, 1985). In comparison to case study, in field study there is more prior knowledge available about the variables of interest and how to measure them (Gable, 1994). Field studies require the researchers to have prior definition of the constructs in the field and the relationship amongst them (Benbasat et al., 1987). Field studies attempt to relate dependent variables to a number of explanatory independent variables through a

cross sectional analysis (R. S. Kaplan, 1986). The use of field study methods involves advantages and disadvantages as listed below:

Advantages of field study:

- Conduct research in the natural setting (Jenkins, 1985) providing a rich understanding of the phenomenon under investigation.
- By taking advantage of background knowledge, results may be reported in short timeframe and also obtain information that may never been achieved otherwise (Jenkins, 1985).

Disadvantages of field study:

- The applicability of the results of a field study to the different populations and contexts is difficult (i.e. low external validity),
- Inability to control the independent variables may cause unexpected variables to have unnoticed impacts on the findings (Jenkins, 1985).

To ensure ethical considerations have been taken into account in the presented research, prior to starting data collection the researcher applied for ethical approval from University College Cork's Social Research Ethics Committee. The ethics committee brought a number of considerations into researcher's attention that are explained in the next section.

## 4.5 Ethical considerations

Since this study does not collect any private or clinical data, no ethical impediments were expected. However because in this study the researcher interviewed parents of children with autism, even though he queried them only about their information source preference behaviour, he applied for an Ethical approval. To submit the application, the research proposal, consent form and interview guides were provided to University College Cork's Social Research Ethics Committee[18] (SREC). On the 16th of September 2014 the ethical approval was granted. A copy of the ethical approval is presented in Appendix section 7. As a part of the process of

[18] https://www.ucc.ie/en/research/ethics/

obtaining the ethical approval, the following points were brought to attention of the researcher:

- The objective of the study should be explained to the interviewees clearly and completely.
- Data must be stored securely.
- Since the recruitments took place through the recommendation of an autism school principal and senior IS practitioners, the maximum care must be paid to assure the voluntarily participation of informants.

To answer the research questions, this study includes two phases. The following section explains the research protocol, data collection and data analysis approaches being employed to conduct each of these phases.

## 4.6 Designing the suitable research approach

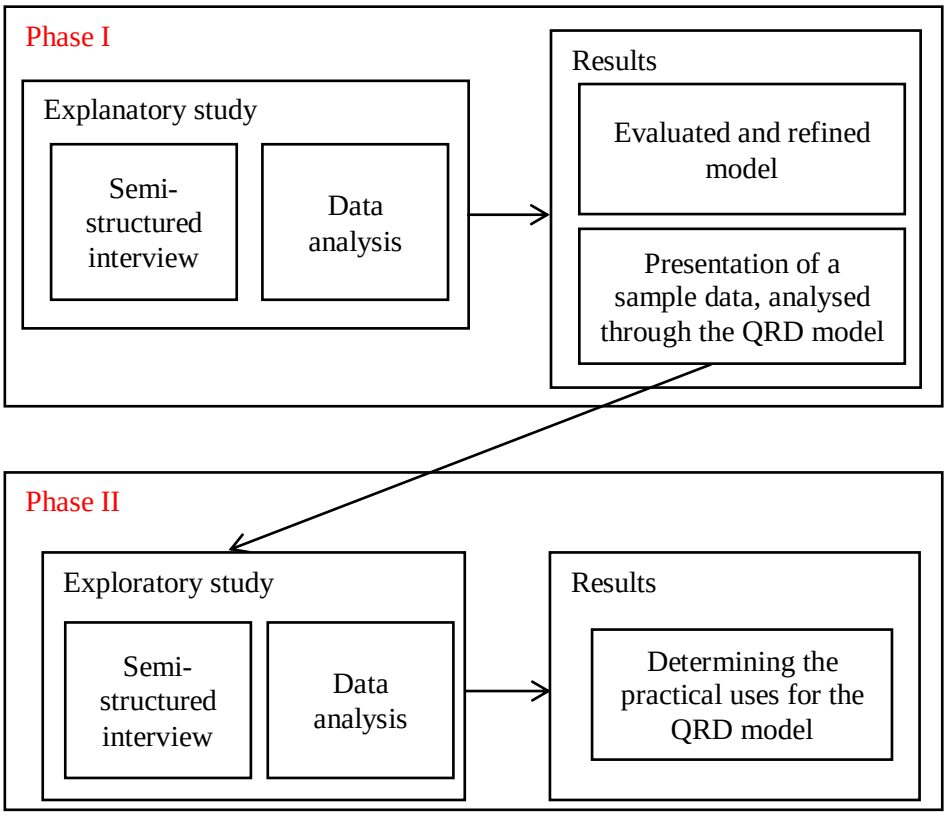
The research objective has an undeniable impact on the choice of research strategy. "What one wants to learn determines how one should go about learning it" (Trauth, 2001, p. 4). Research does not follow styles, instead it seeks to answer the research questions through the most appropriate ways which may include the use of a combination of methods (Dainty, 1983). Therefore, to achieve the objective of this study and answer the research questions, a combination of methods and approaches are required to be used.

Ontological and epistemological beliefs of the researcher and the requirements of the context are the factors which led the researcher to design the research approach (Grix, 2002; Remenyi & Williams, 1995). ***Ontologically***, the researcher believes that there is an external reality which is independent of the researcher's thinking. ***Epistemologically***, he believes that "we can never know such reality with any degree of certainty" and so this reality can be understood only "imperfectly and probabilistically" (Bhattacherjee, 2012, p. 18; Guba & Lincoln, 1994, p. 109). Therefore, ***methodologically*** the researcher needs to apply multiple measures and observations that although each individual measure might not be accurate, they can provide a better understanding of reality altogether (W. Chen & Hirschheim, 2004). Methodologically, through another perspective researchers argues that since reality is

shaped from different objects, it requires a variety of methods to measure it (Mingers, 2002). Furthermore, in this study, the researcher is interested in the theories and mechanisms behind the observable events and in learning those mechanisms. He is carefully considering his assumptions and limitations which make him a ***critical realist***.

The data required for this study has been collected in two phases and from two different populations (i.e. parents of children with autism and IS practitioners). During the initial phase, the data collected from parents were used to answer the first two research questions. The second phase involved interviews with IS practitioners and was used to answer the third research question. Different hybrid of methods and techniques were employed to collect and analyse data at each phase. Results drawn from the first phase of the study inform the second phase as shown in Figure 4.3 where the research process in this study is outlined.

**Figure 4.3: Research process in this study**




The explanatory stage of this study (phase one) is focused on a specific phenomenon (parenting of a child with autism) in its natural context. It does not

manipulate the context and seeks to answer how-type questions. The informants in this phase are selected theoretically and all informants share the characteristic of being a parent of a child with autism. These criteria best match the characteristics of ***case study***. Phase two of this study involves the same case (parenting of a child with autism), only different informants were selected. The informants for phase two also were selected theoretically and all were IS practitioners who could potentially be involved in the development of an information system to be used by parents of children with autism.

The ***research strategy*** in this study is explanatory for RQ1 and RQ2, and exploratory for RQ3. Because all three research questions involve investigating human behaviour in its natural context and numerous uncontrolled variables contribute to the context, ***qualitative*** data collection approaches have been pursued. To assess the applicability of the developed conceptual model in the context and also to determine its practical uses, semi-structured interviews were conducted. Semi-structured questions suites both explanatory and exploratory studies as it enables the researcher to adhere to the theory and conceptual model. Furthermore, by taking advantage of open ended questions the exploratory purposes of the research objective and research questions were met (Bhattacherjee, 2012; Hair et al., 2007).

**Table 4-3: Research methodological process**

| Paradigm | Strategy | Methodology | Method | Data collection techniques |
|---|---|---|---|---|
| Post-positivism<br>Critical realism | Explanatory (RQ1 & RQ2)<br>Exploratory (RQ3) | Pluralism[19] | Case study | Semi-structured interviews underpinned by an instrument |

Due to feasibility and cost constraints, researchers cannot study entire populations and must select a "representative sample[20] from the population of interest for observation and analysis" (Bhattacherjee, 2012, p. 65). Since this study employs a qualitative approach with a small sample size, it uses a ***purposive sampling strategy*** (Huberman & Miles, 2002) in which researcher purposefully selects the samples

[19] Methodologically, the post-positivist paradigm encourages pluralism believing that there is no one correct method of science instead, there are many (Wildemuth, 1993). In other words pluralism within the post-positivism paradigm emphasizes the importance of applying multiple measures and observations that while each might not be accurate but can provide a better understanding of the reality (W. Chen & Hirschheim, 2004).

[20] "Sampling is the statistical process of selecting a subset (called a "sample") of a population of interest for purposes of making observations and statistical inferences about that population" (Bhattacherjee, 2012, p. 65).

based on certain criteria. Therefore, some samples have zero chance to be included in the study (Bhattacherjee, 2012). Table 4-4 outlines the typology of sampling in qualitative inquiry adapted from Patton (1990, p. 183), Huberman and Miles (2002, p.28) and Bhattacherjee (2012, p. 69).

**Table 4-4: Typology of sampling in qualitative inquiry adapted from Patton (1990, p. 183), Huberman and Miles (2002, p.28) and Bhattacherjee (2012, p.69)**

| Type of sampling | Purpose |
|---|---|
| Maximum variation | Documents diverse variations and identifies important common pattern |
| Homogeneous | Focuses, reduces, simplifies, and facilitates group interviewing |
| Critical case | Permits logical generalisation and maximum application of information to other cases |
| Theory based | Finding examples of a theoretical construct and thereby elaborate and examine it |
| Confirming and disconfirming cases | Elaborating initial analysis, seeking exceptions, looking for variation |
| Snowball or chain | Identifies cases of interest from people who know what cases are information rich |
| Extreme or deviant case | Learning from highly unusual manifestations of the phenomenon of interest |
| Typical case | Highlights what is normal or average |
| Intensity | Information-rich cases that manifest the phenomenon intensely, but not extremely |
| Politically important cases | Attracts desired attention or avoids undesired attraction |
| Random purposeful | Adds credibility to sample when potential purposeful sample is too large |
| Stratified purposeful | Illustrates subgroups; facilitates comparisons |
| Criterion | All cases that meet some criterion; useful for quality assurance |
| Opportunistic | Following new leads; taking advantage of the unexpected |
| Combination or mixed | Triangulation, flexibility, meets multiple interests and needs |
| Convenience | Saves time, money, and effort but at the expense of information and credibility |
| Quota sampling | The population is segmented into mutually-exclusive subgroups (just as in stratified sampling), and then a non-random set of observations is chosen from each subgroup to meet a predefined quota. |
| Expert sampling | Respondents are chosen in a non-random manner based on their expertise on the phenomenon being studied. |

For this study, data is collected from two identified populations: 1) parents of children with autism, and 2) IS practitioners with experience in system development projects. Due to the differentiations in the goals of the studies conducted on each population, this study adapts different research strategies for each data collection stage of each phase. The sections 4.6.1 and 4.6.2 explain case selection approach, research protocol, data collection and data analysis techniques employed in phase one and two of this study.

### 4.6.1 **Phase I**

RQ1 and RQ2 are designed to evaluate the relationships between the QRD model constructs, and its ability to analyse the context and determine users' information requirements and its characteristics. To empirically evaluate the applicability of the QRD model in the context of IDMES, it should be tested in a case that meets all the characteristics of such context.

#### 4.6.1.1 **Case selection**

In the explanatory phase of this study, the case study plays the supporting role to facilitate the understanding of the applicability of the QRD model for determining and presenting users' information requirements and as a result is called an ***instrumental case study*** (Stake, 2005). To select a suitable case similar to the majority of qualitative research studies, the sampling strategy employed in this study is ***purposive*** (Huberman & Miles, 2002). In purposive sampling, samples are selected because of the theoretical reasons not statistical ones (Patton, 1990). This section explains why the case of parenting children with autism is a suitable instrumental case study to evaluate the QRD model.

Parents of children with autism are examples of individuals who should make decisions in equivocal situations. Autism spectrum disorder is a group of disorders marked by significant qualitative limitations in social interactions, verbal and nonverbal communication, and restricted repetitive and stereotyped patterns of behaviour, interests, and activities (Kogan et al., 2008). As the cause and cure of autism is unknown, "a number of interventions have been developed, to address different behaviours and characteristics that emerge and indeed re-emerge" (Crawford, 2013, p. 41).

> *This array of interventions is a nightmare for desperate parents to deal with. ... Parents have the stress of coping with the many characteristics of autism, coupled with the expense of accessing interventions ... [taking into account that] the most effective approaches for individuals with autism incorporate a variety of interventions* (Crawford, 2013, pp. 53–54).

As a result of the complexity involved with autism, decision on an intervention for the child with autism is associated with high level of uncertainty for parents (Crawford, 2013; Kogan et al., 2008; Mackintosh et al., 2005). To obtain the information they need, parents frequently and actively seek information. Their ISB is associated with several problems including: being time consuming, stressful and often causing information overloading (D. B. Bailey et al., 1999; Crawford, 2013; Fleischmann, 2005; Kogan et al., 2008; Liptak et al., 2006; Mackintosh et al., 2005). Table 4-5 lists a number of problems and uncertainties reported by scholars in the case of caring a child with autism.

**Table 4-5: Problems and uncertainties parents face in the case of caring a child with autism**

| Problems and uncertainties | Author |
|---|---|
| - Enormous number of care/treatments<br>- Expectations not being met<br>- Vague hope for new treatments<br>- Strategy of action<br>- Formulating the action | (Fleischmann, 2005) |
| - Uncertainty and doubt about child's disability<br>- Service delivery structure<br>- Complementary and alternative medicines and therapies<br>- Investigating for all options instead of relying on doctors<br>- Complete and unbiased information about various treatment options | (Liptak et al., 2006) |
| - How to obtain services for the child | (D. B. Bailey et al., 1999) |
| - Ambiguity<br>- Information Overload | (Mackintosh et al., 2005) |

Parents of children with autism have been selected to analyse their information needs through the QRD model because of the following reasons:

- Parents should ***actively seek for information*** for many tasks including the interventions to be performed (Mackintosh et al., 2005).
- Their decisions regarding the interventions to be performed are equivocal because of the high number of available options and unknown reason of the problem (Crawford, 2013; Kogan et al., 2008; Mackintosh et al., 2005).
- Parents deal with high level of uncertainty and stress as they are unsure about the accuracy of the available services (Crawford, 2013; Holroyd, J., & McArthur, 1976).
- Parents' information seeking task is time consuming, stressful and often lead to information overloading (D. B. Bailey et al., 1999; Crawford,

2013; Fleischmann, 2005; Kogan et al., 2008; Liptak et al., 2006; Mackintosh et al., 2005).

The ultimate purpose of the QRD model is to determine users' information requirements and its characteristics. This information is used for identifying the users' information needs and characteristics of information sources to be developed. Information analysts are the potential users of this model. Therefore the interviewer had interviewed parents through the perspective of an information analyst who is responsible for the analysis of information requirements for developing an information system to assist parents in their decision making activity. The following section explains the strategy employed to recruit the informants for phase one of the study.

#### 4.6.1.2 **Research protocol**

To select the participants, it should be considered that besides the constructs which are displayed in the QRD model, there are other variables which may impact the model's constructs. To neutralise their impact, a high number of participants is required if a random selection is employed.

A large number of intervening factors are noticed in the literature that impact parents' information source preference behaviour e.g. task complexity, expectations, beliefs, experience, demographics, salience, time, income, literacy level, time since child being diagnosed with autism, type of need (affective, cognitive and physical), socio-cultural environment, politico-economic environment, role related barriers, emotional variables, and information characteristics (Abram & Dowling, 1979; Byström & Järvelin, 1995; Dervin, 1998; Johnson & Meischke, 1993; Jr & Durio, 1983; Kogan et al., 2008; Mackintosh et al., 2005; Rogith et al., 2016; Savolainen, 2008; Wilson, 2006b, 1997). Feasibility and cost constraints prevent researchers from investigating the impact of all these factors on information behaviour of parents of children with autism or neutralise all. Therefore, as the ultimate objective of this study is to analyse the users' information requirements and its characteristics, amongst all intervening variables the researcher focuses on *perceived information needs, IQ* and *users' preferred sources* in the QRD model as representatives of ***users' information needs*** and its ***characteristics***.

Studying the impact of only two variables (i.e. information needs and its characteristics) selected from many other known intervening variables impacting users' source preference and information behaviour could be a tricky task. The reason is that any observed relationship between constructs of the model could be caused by variables other than information needs and its characteristics, meaning the uncontrolled variables. So, to minimise such possibilities an appropriate strategy should be employed to select participants. Table 4-6 lists the intervening factors and suggests how their impact can be neutralised/minimised.

**Table 4-6: Inclusion criteria**

| Intervening factor | Strategy to address it |
|---|---|
| Task complexity | Select parents who have handled the same task (might have different complexity for different individuals). |
| Salience | Select the same task for all interviewees. |
| Expectations | Impact of this factor has been included (same across all information categories[21]). |
| Beliefs | Impact of this factor has been included (same across all information categories[21]). |
| Experience | Interviewees with similar amount of experience in caring children with autism have been selected. |
| Demographics | Impact of this factor has been included (same across all information categories[21]). |
| Income | All informants have been selected from the same private school so parents' income should be above average. |
| Time | Impact of this factor has been included (same across all information categories[21]). |
| Role related barriers | Impact of this factor has been included (same across all information categories[21]). |
| Literacy level | Impact of this factor has been included (same across all information categories[21]). |
| Socio cultural environment | Data has been collected from people living in the same city. |
| Politico-economic environment | Data has been collected from people living in the same city. |
| Emotional variables | Impact of this factor has been included (same across all information categories[21]). |
| Source characteristics | Impact of this factor has been included (under investigation). |
| Information characteristics | Impact of this factor has been included (under investigation). |
| Gender | Impact of this factor has been included (same across all information categories[21]). |

[21] In parallel with types of information needs (domain, problem and problem solving), this criterion also may impact parents source preference behaviour. But since same group of informants are interviewed for all three categories, impact of this criterion on all three types of behaviour pursued for each type of information needs is the same. As a result this criterion does not interfere with the comparison between source preference behaviours conducted for different categories of information needs.

It should be noted that to evaluate the relationship between type of information needs and seekers' information behaviour, RQ1 compares the information behaviour pursued by the same group of individuals when they sought different types of information. Therefore, the impacts of all included factors are constant across different categories of behaviour (i.e. domain, problem and problem solving ISB). Table 4-6 guided the researcher in identifying the criteria that each parent should meet to be included in the sample, and led the researcher to the criteria that participants should meet. The following three criteria are considered to be met by the interviewees, two of which derived from Table 4-6:

1. **Parents with above the average income and in similar socio-cultural and politico-economic environments**

Individual's income is a very personal piece of information, but to minimise its impact on the data, all the participants were selected from a private primary school[22] for children with autism where parents can afford the relatively high tuition fee. So, only families with above the average income were included in this study. Also, parents' occupations were queried during the interview which proved all enjoy high income jobs. Moreover, collecting the data from the parents who lived in the same city could control the socio-cultural and politico-economic factors and keep them consistent amongst interviewees.

2. **The child being diagnosed with autism at least five years ago**

To keep the impact of experience with autism consistent, only parents were interviewed that their children have been diagnosed with autism at least five years ago and they could all be considered as experienced parents who have passed the coping period.

3. **Be the main decision maker (planner)**

As the context of this study is the individual decision making, it is critical to interview the main decision maker in the family regarding childcare. In the case of

[22] Aeine Mehrvarzi specialised private primary school for children with autism in Tehran, Iran, has been chosen as the study site. This school has about 60 students, mostly low functioning children with autism with low communication abilities, and 26 staff.

the care given to children with autism, it is assumed that one member in each family is the main decision maker and other family members are considered as sources of information assisting the decision maker. The school's principal confirmation of the researcher's assumption about the decision making environment in the families proved it to be right. As the school and families must work very closely, the main planner in each family was known to the school's principal. To identify the main decision makers in each family a request was made to the school's principal to identify the active parents to the researcher, i.e. those who are often in contact with school for planning. Initial identification of main decision makers was validated during the interviews by asking parents to identify the main decision makers in their family regarding their child's care planning.

Seventeen individuals (11 female and 6 male), all parents of children with autism and all meeting the inclusion criteria described earlier were interviewed for this study. All interviewees lived in Tehran, Iran, were Persian speakers and their children were pupils of Aeine Mehrvarzi special school. Interviewees had been contacted by the school principal one or two days prior to the interview to explain the purpose of study. 18 parents had been contacted and 17 accepted to participate in the study. One of the parents expressed her willingness to participate but due to her busy schedule she could not make time. To save parents' time and for their convenience, the school principal very kindly offered the speech therapy room to conduct the interviews, and if unavailable her own office. Parents were given the option of being interviewed at their home or at school. All preferred to be interviewed at school when they dropped or collected their child in the morning or afternoon. Two parents would usually wait at school for their children to take therapies and were available at that time for interviews. Table 4-7 outlines parents' demographics and duration of each interview. Due to ethical considerations, no personal information about the interviewees is reported.

**Table 4-7: Parents of children with autism participating in phase one of this study**

| ID | Gender | Age | Literacy level | Duration of interview |
|---|---|---|---|---|
| 01 | M | 35-45 | High school diploma | 1:10 |
| 02 | F | 35-45 | Masters | 1:50 |
| 03 | M | 35-45 | Bachelor's degree | 1:10 |
| 04 | F | 35-45 | Bachelor's degree | 1:30 |
| 05 | F | 35-45 | High school diploma | 1:15 |
| 06 | F | Above 45 | Bachelor's degree | 2:15 |
| 07 | F | 35-45 | Bachelor's degree | 2:00 |
| 08 | F | 35-45 | Bachelor's degree | 2:20 |
| 09 | F | 25-35 | Bachelor's degree | 1:15 |
| 10 | M | 35-45 | Masters | 2:40 |
| 11 | F | 25-35 | Bachelor's degree | 2:00 |
| 12 | F | 35-45 | Bachelor's degree | 1:45 |
| 13 | F | Above 45 | High school diploma | 1:20 |
| 14 | M | Above 45 | MD | 2:10 |
| 15 | M | Above 45 | PhD | 1:00 |
| 16 | F | 35-45 | High school diploma | 1:50 |
| 17 | M | 35-45 | Bachelor's degree | 2:15 |

The following section explains the data collection techniques employed for this phase of the study.

#### 4.6.1.3 Data collection techniques

Information analysts' communication activities are the key to determining users' information requirements. The methods applied by information analysts facilitate the process of acquiring information from users (Shuraida & Barki, 2013). Therefore, it is very important that special attention is paid to the design of the data collection methods and techniques that facilitate analyst-user communication.

For IRD methods and techniques, the data collection and analysis methods must take account of the limitations of the context. To apply the QRD model for determining information requirements of parents of children with autism, suitable data collection methods and techniques should be used. The following subsections define the techniques and methods employed for data collection in this phase.

##### 4.6.1.3.1 Critical incident technique

To conduct interviews, a technique named "critical incident technique" was used. This technique is basically designed for collecting data about an incident that has happened in the past (Flanagan, 1954). Following on this technique, interviewees were asked to remember an incident in which they needed to decide whether to pursue a particular intervention for their child with autism. Critical incident

technique provides several advantages to address the IRD limitations mentioned in section 2.2.2.1. These advantages include:

- Informants recall a memory rather than speak of their perceptions or assumptions, which increases the accuracy.
- Enables researchers to analyse the change in informants' behaviour longitudinally over time by asking them to remember more than one incident of information seeking at different time points.
- Enables researchers to collect more than one set of data from each interviewee to test the applicability of the model.
- Assisting interviewees in recalling a memory could help with the accuracy (e.g. by helping them remembering the context to recall their behaviour)

To use critical incident technique a number of important points are derived from Flanagan (1954) which are as follows:

- Data is necessary to be collected while the facts are still fresh in the mind of informants.
- Data could be partially analysed during the data collection as the findings could be validated with the informant.
- Memory is improved if the detail and focus of the interview are explained to informants in advance.
- When interviewees are motivated to make detailed observations, critical incident technique could be used for slightly older incidents as well.

Asking individuals about what they have already experienced and build questions based on their answers is to address a problem that Johnson et al., (2006) indicate in their study of seekers' information behaviour:

> *Our relatively simple approach here asked people what they thought they would do, evoking scripted behaviour, but these intentions often change dramatically in any one actual pathway emblematic of a particular search* (p. 579).

Experience is one of the factors impacting the ISB. To study the impact of experience on ISB two methodological options were considered. The first option was a longitudinal study on parents that their child is recently diagnosed with autism and continue the study for a few years till they cope with the problem (autism). This option was not feasible in this study due to time and financial constraints. The second option was using the critical incident technique. One of the challenges of using this technique in this study was that one of the two incidents that parents were asked to recall has happened at least five years ago. However, for two reasons it was inferred that parents should be able to recall the old incident. 1) Early stages after diagnosis is a challenging and important stage of parents' lives. Memories of such important and unique incident are better remembered. 2) Parents, actively seek information, analyse and implement them and they are not just given all the information they need. This active (not passive) seeking behaviour increase the chance of behaviour to be recalled. Therefore critical incident method was used[23].

To collect parents' ISB, the concepts of information horizon and pathways were leverages. These concepts and their accompanied data collection instruments used in this study are explained in the next section.

#### 4.6.1.3.2 Information horizon and pathways data collection strategy

The theoretical background for the data collection techniques employed in this study is coming from information horizon concept introduced by Sonnenwald (1999) for ISB. The qualitative data collection techniques are designed based on the method created and tested by Sonnenwald et al. (2001) and applied in Savolainen & Kari (2004) and Savolainen (2007, 2008). These data collection techniques are found specifically beneficial to study the concepts of "information horizon" and "information pathways". There are slight modification made to Sonnenwald et al. (2001) and Savolainen & Kari (2004) and Savolainen (2007, 2008) data collection techniques to suit the requirements of this study. The main three modifications are: 1) interviewees have been asked to identify the queries they sought information for, 2) their queries were categorised into three groups of domain, problem and problem

[23] During the data collection all interviewed parents indicated that they clearly recall the old incident

solving queries, and 3) they have been asked to fill one information horizon and pathways diagram for each category of their own queries.

The information source horizon has been explained previously in chapter two. It is presumed that information users have a perceived information horizon in which they can act at the time of information seeking. This horizon includes a list of sources that seekers are aware of and use (Savolainen, 2008; Sonnenwald et al., 2001). To study the sources seekers include and exclude in their horizons and why they do it, ***a semi structured interview*** and a ***graphical instrument*** have been designed based on the structure of Sonnenwald et al. (2001) and Savolainen & Kari (2004) studies. These studies use an instrument to graphically display the information sources used by information seekers.

Sonnenwald et al. (2001) empirically tested their technique by conducting a study on eleven undergraduate students about their ISB for a specific incident. The questions asked were focused on "type of information needed; why that information was needed; which information resources (including individuals) they accessed, why and in what order; whether they were satisfied with the outcomes; how the information was used; what they would do similarly the next time; and what they would do differently the next time" (Sonnenwald et al., 2001, p. 5). Considering the objective of this study, only the questions which presumed to be relevant for information system design and development were asked from interviewees.

In this study, an instrument has been used through that interviewees draw their used information sources (information horizon), their importance (importance zones) and the sequence through which they have used the sources (information pathways) (see section 4.6.1.3.4).

The following section explain the semi-structured interviews designed to collect the data about parents' ISB.

##### 4.6.1.3.3 Semi-structured interviews: Instrument #1

The QRD model has been designed for use in equivocal decision making contexts. Therefore, the data collection context for phase one, as explained, is a complex one. The QRD model as the conceptual model underpinning the data collection steps,

helps designing the interview guide and reduces the chance of data overloading (Huberman & Miles, 2002). To obtain the complexity of the study, the researcher used a combination of data collection methods and techniques, one of which is a semi-structured interview with open ended questions. This method enabled the researcher to pursue his explanatory objective in this phase of the study.

Taking advantage of semi-structured interviews with open ended questions enables the interviewer to dynamically interact with participants and collect their perspectives. On the down side, data collection and analysis in this type of study is generally very time consuming and gaining access to participants could be very difficult (Sonnenwald et al., 2001, p. 3). For this study, semi-structured interviews were deemed suitable since the study should follow the structure of a conceptual model, yet it requires interviewees to describe their ISB. Semi-structured interviewees are flexible interviewing approach and allow informants to expand their answers. At the same time, it enables the researcher to follow a structure to address the areas of interest (Creswell, 2008; Guillaume & Bath, 2004).

As discussed in section 4.6.1.2 the effect of intervening factors impacting parents' source preference behaviour could be minimised by employing suitable informant selection strategies. There are other factors which could not be controlled by the informant selection strategies. One of these factors is the ***task complexity***. To keep its impact constant, all parents were asked about an instance in which they needed to make a decision for interventions necessary for a specific problem. This ensures that the collected data is focused on parent's information behaviour pursued for similar type of tasks and so task complexity remained relatively constant.

To find quality dimensions in different contexts scholars have used different methods, from testing available dimensions through questionnaires in the targeted context (Doll & Torkzadeh, 1988; O'Reilly, 1982; Seddon & Kiew, 1996) to asking interviewees to name the dimensions which have impacted their decisions (Savolainen, 2007, 2008). Both ways have advantages and disadvantages. Not presenting a list of IQ dimensions helps interviewees to think and name what they have in their minds but at the same time it does not include the findings of previous studies. In this study, the researcher asked the interviewees to name the IQ

dimensions impacting their preference. This approach allowed interviewees to describe the IQ dependent problems that interviewees have. It also reduces the chance of overlooking important context specific IQ dimensions that are not very well highlighted in the literature.

To evaluate the QRD model relationships and its ability to be used for IRD in the context of caring a child with autism, seventeen individuals (11 female and 6 male) were interviewed. The reason for stopping at this number was reaching the point of theoretical saturation as the researcher was observing the same phenomena which has been already observed in the study (Eisenhardt, 1989).

One of the qualitative research challenges which became evident in this study was that the richness of the collected data in the interviews is dependent on the experience of the researcher (Huberman & Miles, 2002). To conduct interviews professionally, the researcher found a number of important points to be considered during the interview:

- Respecting the pace of interviewee.
- Not asking leading questions.
- Not judging the respondent answers.
- Not asking closed question as it slows down the interview pace.
- Making sure that the informants fully understand the questions.
- Listening carefully and asking more questions seeking for further information (Laforest & Bouchard, 2009).
- At long interviews availability of refreshments (e.g. tea, coffee and chocolate) is helpful.
- Using appropriate probes when informants get close to mention what the researcher is looking for.
- Researcher should keep an open mind and let the data lead him/her, otherwise he/she will find what he/she wants rather than what interviewees really think.
- Interviewer should respectfully get the interview back in track if interviewees go off track.

- Phone interviews might be very beneficial as researcher can manage the time more efficiently.
- Interviewee's opinion could be affected if they are known by the researcher or his/her relatives. In such cases, interviewer must stress out the confidentiality of the study.
- Explaining the researcher's personal interest to the subject helps interviewees to open up to him/her further.

During semi-structured interviews, the researcher asked informants a series of structured and open-ended questions. The interview guide is available in Appendix section 7.4. The sequence of activities conducted during the interview in this study is outlined as below:

1. The researcher introduced himself and explained the purpose of the interview, the reasons informants were being interviewed and upon clarifying that the collected information remain confidential, asked for permission to audio record the interview (Laforest & Bouchard, 2009). The researcher then asked the interviewee to describe their basic demographics.
2. The interviewee was asked to recall the last incident in which he/she sought information to make a decision for an intervention option for his/her child with autism.
3. The interviewer made enquiries about the queries the interviewee sought during that information seeking incident. The interviewer with the assistant of the interviewee categorised these queries into domain, problem and problem solving during the interview.
4. The interviewee was asked to fill in one information horizon diagram by their used information sources for each category of their queries (filling instrument #2 in, which is explained in section 4.6.1.3.4).
5. The interviewee was asked to number the sequence through which he/she has used information sources for each category of queries (added to the instrument #2).

6. The interviewee was asked to recall a similar incident that occurred close to diagnosis, five years ago. Hereafter, this incident is called “early after receiving the diagnosis” incident.
7. The interviewee was asked the questions in steps 3, 4 and 5 for the “early after receiving the diagnosis” information seeking incident.
8. The interviewer made enquiries about the reasons for using all information sources indicated by the interviewee during the interview (IQ dimensions).
9. The interviewee was asked to define the factors by which he/she have assessed each indicated IQ dimension.

As it is already described, the data collection includes a second instrument within the semi-structured interviews. This instrument is named information horizon and pathways diagram and is explained in the following section.

##### 4.6.1.3.4 Information horizon and pathways diagram: Instrument #2

As indicated in section 2.2.2.1, there are several limitations that should be considered when collecting information from users, amongst which are communication challenges. To minimise this problem when collecting data from parents, this study takes advantage of the data collection method designed by Sonnenwald et al. (2001) and has been used by Savolainen & Kari (2004) and Savolainen (2007, 2008). Sonnenwald et al. (2001) study leverages the concepts of information horizon and information pathways to collect data through a graphical instrument. This instrument is improved by Savolainen & Kari (2004) to include the importance of used information sources as well.

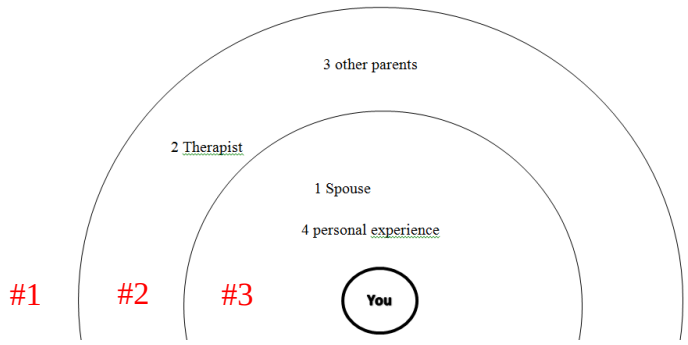
The information horizon and pathways instrument is in fact a diagram drawn by interviewees describing their information behaviour. In this diagram, a symbol representing the interviewee is located at the centre of the diagram. Interviewee is asked to draw the information sources he/she has accessed around himself/herself (Sonnenwald et al., 2001) when he/she was seeking information to decide between available interventions. For this study, the interviewer guided the informants on how to fill the instrument, kept notes and audio recorded the interviews as interviewees were asked to think aloud when filling the instruments.

Think aloud protocol enables data collection about participants' cognitive reasoning while performing the task (Sonnenwald et al., 2001). In this study, think aloud protocol has been used to collect interviewees' reasoning for placing information sources near or far from themselves and their reasons for the sequence through which they have used the information sources. To validate the accuracy of collected data, any time the researcher was not clear about what the interviewee means, he asked the interviewee to confirm the accuracy of the notes he has taken and correct him if the notes were not accurate.

Savolainen & Kari (2004) and Savolainen (2007) suggest including the importance zones into the information horizon diagrams as a measure for the importance of information sources to users. Therefore, interviewees were asked to locate the most important sources closest (zone #3), sources with partially importance in the middle (zone #2) and the peripherally important sources in the farthest area (zone #1). "Put simply: The more preferred a source, the closer to the participant on the map" (Savolainen, 2007, p. 1714).

Following the indication of used information sources, parents were asked to number the information sources based on the sequence through which they are being used. Figure 4.4 provides a filled example of an information horizon instrument developed for this study.

**Figure 4.4: An example of information horizon and pathway diagram: data collection instrument**




The QRD model developed in chapter three (Figure 3.2), categorises the information needs into three categories: domain, problem and problem solving. The first question after the opening discussions and demographics was about the queries parents were pursuing in the incident for which ISB had taken place. The

interviewees were asked to assist the interviewer in categorising their queries across the three categories of information needs. Then, they were asked to draw the information sources they have used to seek each category of their own queries. Each interviewee was asked to fill in one diagram for each category of information needs per incident i.e. one diagram for domain queries, one for problem queries and another one for problem solving queries for 1) the latest ISB incident, and 2) the "early after receiving the diagnosis" information seeking incident (potentially six diagrams per interviewee in total).

A decision that a researcher should make prior or during the data analysis is selecting the unit of analysis. The "*key issue of selecting and making decisions about the appropriate unit of analysis is to decide what is you want to be able to say something about at the end of the study*" (Patton, 1990, p. 168). Phase one of this study focuses on parents' information seeking behaviour pursued for making a decision. Therefore, the unit of analysis in this phase is supporting parents' decision making.

The subsequent subsection explains the data analysis techniques adapted in this phase of study.

#### 4.6.1.4 **Data analysis methods**

Data analysis is the means through that researchers draw rigorous conclusions in research studies. Qualitative data analysis refers to the "various methods for coding, categorising and assigning meaning to data" (Gliner & Morgan, 2000, p. 9). Eisenhardt (1989) indicates that data analysis is at the heart of a theory building research study and at the same time it is the least codified part.

Miles & Huberman (1994) identified a number of important points to be considered in the data analysis phase including: data displays, threats of analytic validity and transparency and distribution of data analysis and management procedures. To address these points, four interrelated tasks are identified to be conducted, three of which within the data analysis:

- Data collection
- Data reduction
- Data display
- Data verification

The following three sections explain data reduction, data display and data verification steps.

##### 4.6.1.4.1 Data reduction – coding

At this step codes are defined. Codes are simply the labels assigned to a chunk of data (Miles & Huberman, 1994) which facilitates retrieval, organisation and interpretation of data in shaping conclusions. In the field of IS research, the following steps are involved in the coding process:

1. Identifying seed categories based on research assumptions (Miles & Huberman, 1994) by deductive approaches and conduct open coding through inductive approaches and assign a code to each chunk of data.
2. Refining data into categories based on their identified similarities and differences through comparative analysis (Strauss & Corbin, 1990). All the data and emerging codes should be constantly compared to assign similar data to the same code category and reduce the number of individual codes. This process is called constant comparison (Creswell, 2008).
3. Creating the higher level categories by merging the lower level code categories and their properties (closed coding) (Heavin, 2010).

Strauss & Corbin (1990) suggest the use of a "coding paradigm" which includes the use of open, axial and selective coding techniques. These coding techniques are described as follows:

**Open coding** is associated with the microanalysis and assigning a code to each or group of words. In other words, "the analytic process through which concepts are identified and their properties and dimensions are discovered in the data" is labelled as open coding (Strauss & Corbin, 1990, p. 101). All the data and emerging codes should be constantly compared to assign similar data to the same codes in order to

reduce the number of individual codes and shape abstract themes. This process is called constant comparison (Creswell, 2008).

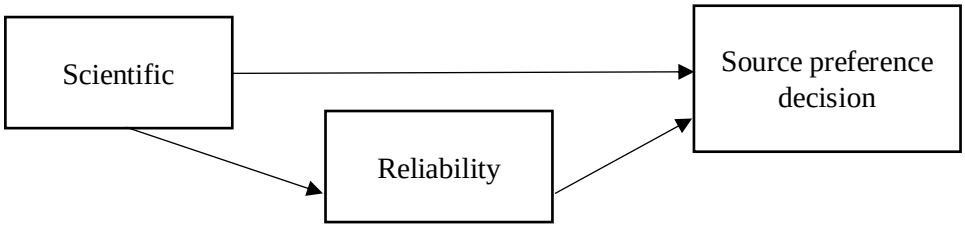
For the presented research, to begin the open coding, data has been anonymised and interviewee names was replaced with an ID. Table 4-8 provides examples explaining the open coding process in this study.

**Table 4-8: Sample of open coding showing parents' quality requirements**

| # | Transcription | Open code |
|---|---|---|
| 08 | "You could implement his advices, he prescribed good medicines and gave us good advices" | Reliability |
| 16 | "I can believe what she says because she acts based on her knowledge and does not decide emotionally" | |
| 08 | "[The text] includes academic references and presents statistics" | Scientific |
| 13 | "Children [with autism] are different, only a few of them have the same problem as mine" | Diversity |

**Axial coding** is about 1) identifying the relationships between the themes (code categories) and 2) validating it by data. After open coding stage, the researcher should look for the relationships between categories and subcategories emerged during the open coding (Strauss & Corbin, 1990). Figure 4.5 provides an example of axial coding in this study.

**Figure 4.5: A sample of axial coding displaying the relationships between parents' quality requirements and source preference decision**

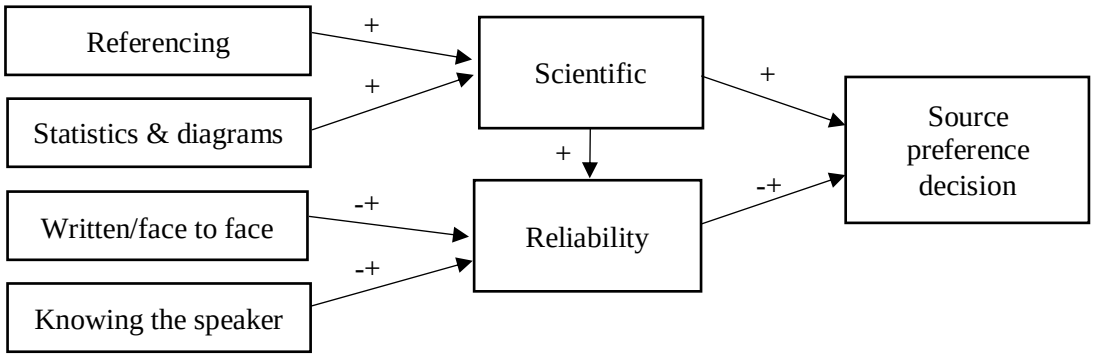



Validation of relationships is the second step of axial coding. Researchers must "validate his or her interpretations through constantly comparing one piece of data to another" (Strauss & Corbin, 1990, p. 137). To that purpose, researchers should constantly return to data to validate the identified relationships.

The next subsection outlines the selective coding as the last step in Strauss & Corbin's (1990) coding paradigm.

**Selective coding** means developing theories fitting the collected data. To do so, a story needs to be built, the core categories should be identified and relationships between them and other categories to be evaluated (Strauss & Corbin, 1990). Figure 4.6 provides an example of selective coding in this study.

**Figure 4.6: A sample of selective coding illustrating the positive/negative impact of quality requirement dimensions on parents' source preference decision**




By using the selective coding approach, the researcher could further probe the identified relationships towards a "process of integrating and refining the theory" (Strauss & Corbin, 1990, p. 143). The following section defines the next task of the data analysis which is data display.

#### 4.6.1.4.2 Data display

Data displays are defined as systematic ways to present the data in a visual format (Miles & Huberman, 1994). Visual presentation of the analysed data represents an important part of this study as present-ability and the understand-ability of determined information requirements are amongst the most important points to be considered during the IRD process. Graphical means increase the understand-ability of presented information requirement and so shapes an important part of this study to specifically answer RQ3. To facilitate the data display, the QRD presentation matrix has been designed in this study in section 3.2.5 and has been evaluated in RQ3.

The following section defines data verification in research studies.

#### 4.6.1.4.3 Data verification

"Drawing conclusions and verifications refers to deriving meaning from the data" (Daly, 2014, p. 169). "The emphasis on verification started the separation of modern

science from philosophy and metaphysics and further development of the "scientific method" as the primary means of validating scientific claims" (Bhattacherjee, 2012, p. 8). Data verification is focused on the logic through which conclusions can be derived from the data.

Unlike data collection techniques which is similar for both RQ1 and RQ2, different analysis techniques are employed to answer each of these questions. Therefore, the analysis techniques employed for answering each research question is explained under a different heading in this section.

#### 4.6.1.5 **Analysis techniques: RQ1**

The ultimate expectation of a response to this question is twofold:

1. Explain the relationship between information needs and source preference behaviour.
2. Build the foundation to explain the relationship between type of information needs and quality requirements (answer to RQ2).

Following the ontological stance of this study (i.e. critical realism), for responding to RQ1, a hybrid analysis method has been applied to the data collected through interviews and information horizon and pathways diagrams. This hybrid method includes using two analysis tools consisting of information pathways analysis techniques and database (Microsoft Access 2010).

##### 4.6.1.5.1 Interviews

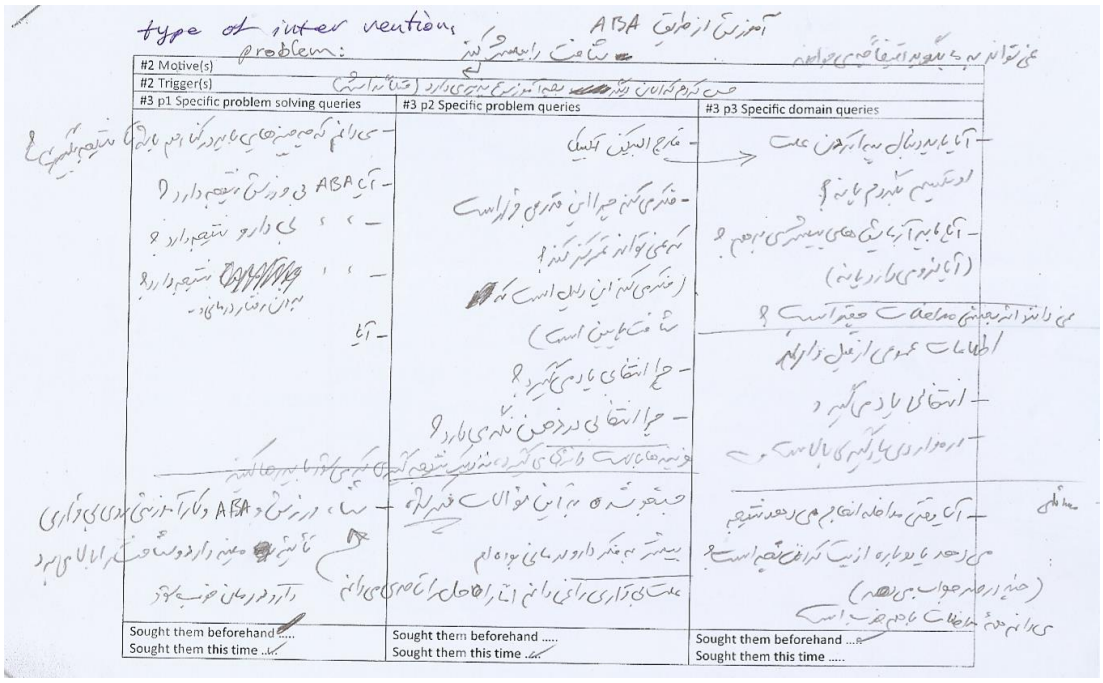
In this study, information has been categorised into "domain information (e.g., known scientific facts), problem information (i.e., problem characteristics), and problem-solving information (i.e., expertise in problem treatment)" (Byström & Järvelin, 1995). Categorising interviewees' queries took place during the interview. The definitions of categories of information were explained to parents. Then, they were asked to evaluate how the researcher has categorised their queries and correct him if he has made any mistakes. By considering context's characteristics and parents' evaluations of researcher's categorisation, the following characteristics were

identified during the first few interviews helping the researcher in categorising queries during subsequent interviews.

1. If a query at some point focuses on learning about specific problems related to a specific child or searches for specialists for diagnosis, it was categorised as a problem query.
2. If a query is focused on a specific problem solving solution, attempts to solve a problem related to a specific child or searches for specialists, organisations or facilities for problem solving, it was categorised as a problem solving query.
3. If a query is not specific to a child and seeks general information and/or facts which is valid for all or a group of children with autism it was categorised as a domain query.

The researcher predesigned a table to be filled with interviewees' categorised queries. Table 4-9 displays a sample of note tables used for categorising parents' queries. One table was filled by the researcher for each incident i.e. one for the latest ISB incident and one for the "early after receiving the diagnosis" seeking incident. It was identified during the first few interviews that parents may mix up the dates and name a few queries they have sought previously for their recent seeking behaviour. Asking them about when they have sought those queries could help them refresh their memories.

**Table 4-9: A sample note table used for categorising queries**




To analyse the collected data, the researcher used a Microsoft Access 2010 database he developed for this study. Therefore, all transcribed notes tables have been transferred into database tables with similar structures. For instance, Table 4-9 (list of queries) was analysed, transcribed and entered into the database query table (see Table 4-10). The data has been collected and analysed in Persian. The results of the initial analysis (open coding) then was translated to English and entered into the database. All the interviews, coding and translations were carried out by the same researcher who is fluent in both languages. To validate the accuracy of translations, one of the researcher's colleagues who is fluent in both Persian and English languages was consulted in challenging instances.

**Table 4-10: A screen shot of the query table in Access database**

| User_ID | Query | Type_of_query |
|---|---|---|
| 01 | what should be done to with his overweight/behaviour/energy problems? | Problem solving info |
| 01 | Find more about medicines and their side effects | Domain info |
| 02 | Can these children go to school? Do they have the ability to get educated? | Domain info |
| 02 | Learn about importance of education for these children | Domain info |
| 02 | Learn about importance of not letting these children fall behind others | Domain info |
| 02 | Can she hold a pen because of sensing problems? | Problem info |
| 02 | looking for similar people's experiences in ordinary and special schools (with e | Problem info |
| 02 | What type of school is better for my child?ordinary or special, social or private? | Problem solving info |
| 02 | Benefits and side effects of medicines | Domain info |
| 02 | Complete medicines' information | Domain info |
| 02 | List of neurologist doctors familiar with Autism, with their address and CV | Problem info |
| 02 | Which doctor is good? | Problem solving info |
| 03 | Why with all the difference Autistic children show some similarities? | Domain info |
| 03 | What are repetitive behaviours? | Domain info |
| 03 | What is the cause of Autism? | Domain info |
| 03 | What is Autism physiological cause? | Domain info |
| 03 | In what range of Autism my child falls? | Problem info |
| 03 | What kind of interventions can help child to be independent? | Problem solving info |
| 04 | Which education style is better? | Domain info |
| 04 | Can ABA be used for home education? | Domain info |
| 04 | How to strengthen the deep understanding in my child? | Problem solving info |

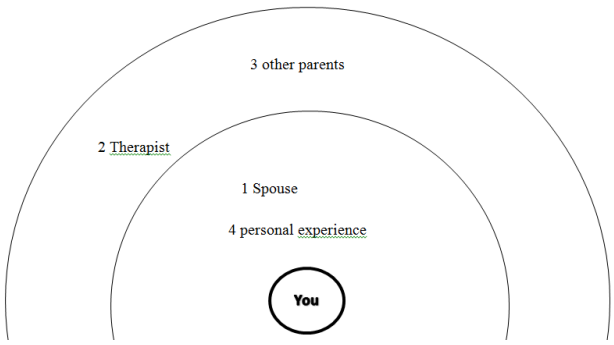
In addition to taking notes, interviews also were audio recorded with permission. However, since parents' queries have been transcribed and coded already in the taken notes, recorded interviews were not transcribed. The recordings were only listened to in order to identify and note the main themes that emerged (Laforest & Bouchard, 2009), and also to check the accuracy of the notes, codes and categorising the queries. Although not transcribing the recordings saves time, it has challenges too. For instance, if a relationship was missed in the codes and memos, reviewing open coding step and looking for a specific comment in recordings can be very time consuming. The researcher took notes and did the open coding during the interview because then he had the opportunity to communicate with interviewees about his interpretations and codes and so could identify the relationships and meanings more accurately.

After categorising the queries, parents were asked to fill in one information horizon diagram for each category of their own queries and think aloud while filling in the diagrams. The following subsection explains how the data collected by information horizon and pathways diagrams are analysed to answer RQ1.

#### 4.6.1.5.2 Information horizon and pathways diagrams

As explained in section 4.6.1.3.4, this study takes advantage of a graphical data collection tool to collect users' ISB named information horizon and pathways diagrams.

**Figure 4.7: An example of a filled information horizon and pathway data collection instrument**




Each interviewee was asked to fill in one information horizon and pathways diagram for each category of their information needs per incident. That is, one diagram for domain queries, one for problem queries and another one for problem solving queries for the latest ISB and the same three diagrams for an "early after receiving the diagnosis" seeking incident (potentially six diagrams per interviewee in total).

The data collected from the diagrams have been analysed by taking advantage of two tools:

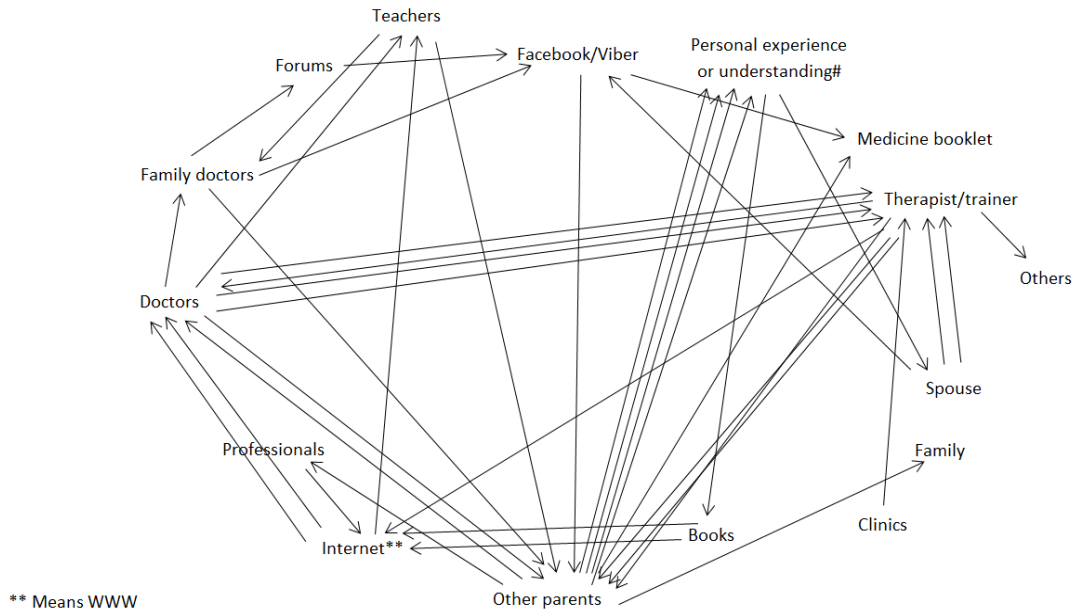
1. Information pathways graphical analysis to 1) identify the role each source plays in parents' ISB, and 2) to graphically present and compare the ISB pursued for each type of information needs.
2. Microsoft Access 2010 database to identify 1) the most popular information sources, 2) the average number of sources used at each seeking behaviour, 3) the sources' average importance, and 4) the sources' average usage.

Graphical data analysis technique used in this study is adapted from Sonnenwald et al. (2001). To analyse the data, information pathways are drawn based on the sequences through which interviewees have used information sources. To analyse

Figure 4.7 as an example, the interviewee has indicated that she has sought information from her spouse first, then therapist, then other parents and finally personal experience for problem solving queries. This behaviour has been analysed by drawing an arrow from spouse to therapist, one from therapist to other parents and another one from other parents to personal experience in Figure 4.8. The rest of the arrows demonstrated in Figure 4.8 are derived from the rest of information horizon diagrams collected during the rest of the interviews.

To draw information pathway diagrams there have been cases in which the seeker had used only one source in one ISB. At the analysis stage in the pathways diagrams it is counted as one incoming arrow and is marked by # sign. In two cases informants could not recall the sequence in which they had used the information sources. In these cases the researcher still considered the diagram useable, not for information pathways but for information horizon and zones. There are also some sources that parents have not drawn in their information seeking diagrams, but they were mentioned during the interview. These sources have been included in the list of sources being used by each parent but not included in the sources used for each type of need.

**Figure 4.8: Information pathways analysis map, drawn for problem solving ISB (latest ISB)**




By counting the number of incoming and outgoing arrows to each information source, its role within the information horizon can be identified (Sonnenwald et al.,

2001) as shown in Table 4-11 for the first seven most popular sources. If the number of outgoing arrows is higher than the number of incoming arrows with more than 1, source is labelled "recommending". It means *"they are a starting point* and *either recommend other resources directly and/or do not provide the complete information the individual is seeking* because in either case, the individual continues to access additional resources*"* (Sonnenwald et al., 2001, p. 12). Recommending sources can be used for reduction of the equivocality because they are the first sources being used by seekers and because they direct seekers to other sources of information. For example, in case of the care of children with autism, doctors are the most popular first source. Information wise, their responsibility could be resolving the equivocality and directing parents to other information sources to answer their queries (Daft & Lengel, 1986). If the number of incoming arrows are higher than the number of outgoings with more than 1, these sources are called "focusing". It means seekers tend to end their seeking actions here. *"In this sense they narrow the information seeking process"* (Sonnenwald et al., 2001, p. 12). It has inferred that seekers stop information seeking when they find the required information, therefore this type of information source provides seeker with information they are looking for and help them make their decisions. Finally, if the incoming and the outgoing arrows are equal or different by 1, it is a balanced source, suggesting that these sources assist both resolving equivocality and finalising decisions but specialised in none.

**Table 4-11: Incoming and outgoing requests to sources sought for problem solving information (latest ISB)**

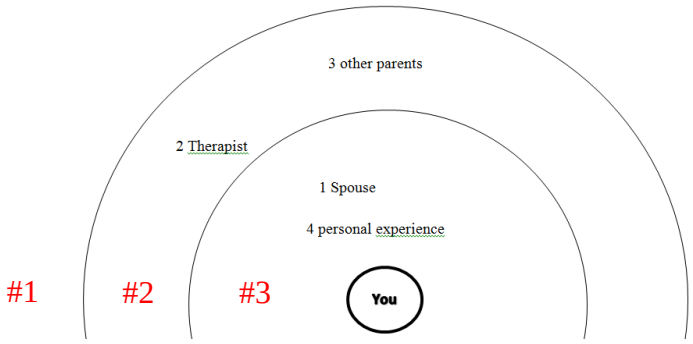
| Source | Incoming | Outgoing | Total | Type |
|---|---|---|---|---|
| Other parents | 7 | 8 | 15 | Balanced |
| Therapist/trainer | 6 | 6 | 12 | Balanced |
| Doctors | 4 | 6 | 10 | Recommending |
| WWW | 4 | 3 | 7 | Balanced |
| Personal experience | 5 | 2 | 7 | Focusing |
| Social network | 3 | 2 | 5 | Balanced |
| Books | 1 | 2 | 3 | Balanced |

For coding the information sources or channels[24], a number of keywords were selected to name the sources mentioned by parents (open coding). Similar codes then were categorised into a number of code pools (e.g. specific blogs, forums and websites all were categorised under WWW). In fact to report the accumulative

[24] Information channel or media (e.g. WWW) includes variety of information sources (e.g. Wikipedia) which include messages or information (e.g. definition of autism) (Johnson et al., 2006).

results the researcher had to use the media's names instead of sources' names. This is the reason for addressing an information channel or media in this study as information sources.

**Figure 4.9: An example of information horizon and pathway diagram: data collection instrument**




In this study within the information horizon, sources were categorised in three ***zones***. These zones consist of the most important sources (zone #3), partially important sources (zone #2) and peripherally important sources (zone #1) (Savolainen & Kari, 2004; Savolainen, 2007). To identify the importance of each source for users, each zone in information horizons had been given a mark. 3 to the most important sources, 2 to the partially important sources and 1 to the peripherally important sources. The average of the importance marks[25] given to each source by the users determines the importance of an information source to users (see Table 4-12 for parents' problem solving ISB).

In addition to average importance in this study, the average use of each source has been leveraged for determining the importance of information sources to users. Average use of an information source is calculated by dividing the number of times each source has been appeared in users information horizon diagrams compared to the total number of diagrams collected (see Table 4-12 for parents' problem solving ISB).

[25] Source importance mark has been calculated by dividing sum of all the marks given to a source to the total number of times that information source has been drawn in the pathways

**Table 4-12: Parents' problem solving information horizon (latest ISB)**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Other parents | 10 | 2.4 | 71 |
| Doctors | 7 | 2.71 | 50 |
| Therapist/trainer | 6 | 2.5 | 43 |
| WWW | 6 | 2.17 | 43 |
| Personal experience | 5 | 3 | 36 |
| Spouse | 3 | 2.67 | 21 |
| Books | 3 | 2.67 | 21 |

Databases are widely used for quantitative data analysis in business. As mentioned earlier, a Microsoft Access 2010 database is used for the quantitative analysis in this study. Information horizon data collection technique was applied in this study to enable *"both quantitative and qualitative analysis"*. Quantitative analysis is used to analyse the popularity of information sources (Savolainen & Kari, 2004, p. 422), calculating the average number of sources being used in each seeking behaviour, sources' average importance and average usage. The researcher's expertise in SQL[26] and databases enabled him to design a relational database to enter the coded data and run sophisticated queries on them.

The researcher developed 44 unique SQL statements to query the data and constantly evaluated their understand-ability and usefulness with supervisors and colleagues (see Appendix section 7.2). The following section explains the data reduction, display and verification techniques used to answer RQ2.

#### 4.6.1.6 **Analysis techniques: RQ2**

RQ2 is focused on identifying the IQ dimensions considered by parents to evaluate the quality of information sources and the factors that parents have used to measure each IQ dimension. Following that, this question takes advantage of the results of RQ1 to explain the relationship between information needs and IQ requirements.

As explained in section 2.3, IQ is a well-defined subject and there are several methods available to measure it. However, due to the subjective and context sensitive nature of it, there is no general agreement between scholars on IQ dimensions' definitions and on their priority for IQ measurement in different contexts (Batini et

[26] Structured Query Language

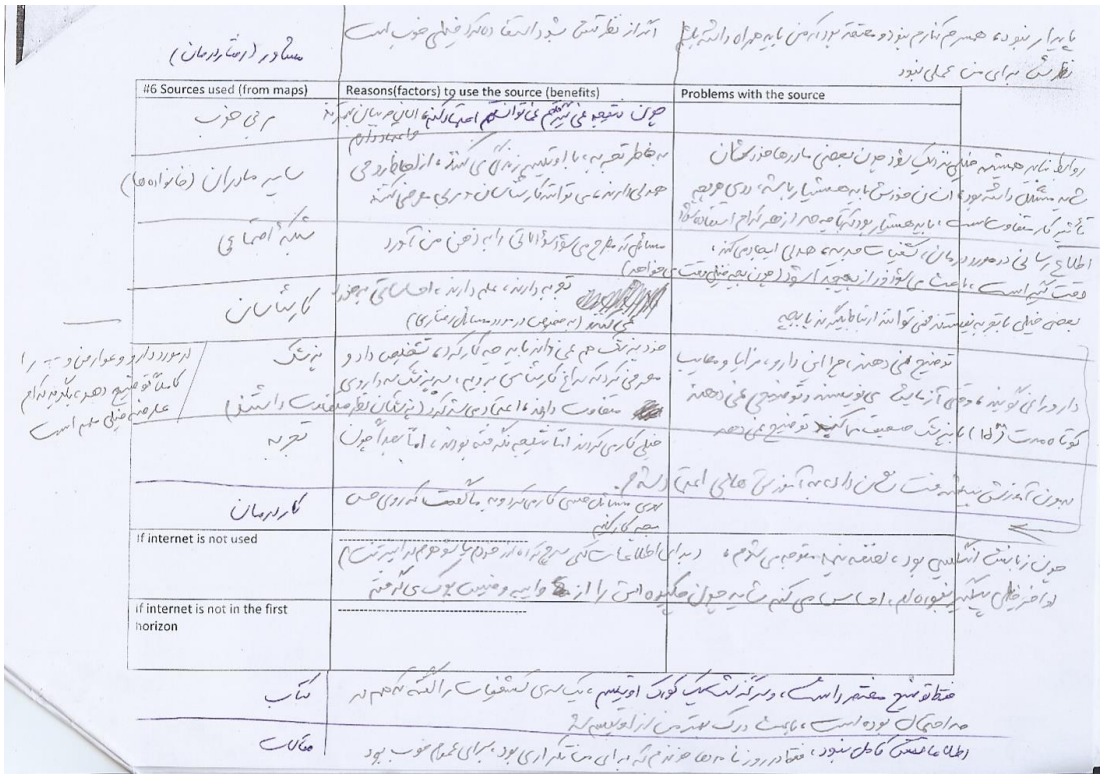
al., 2009). Therefore, to identify the most important IQ dimensions and define them in the field (focus of RQ2) this study follows an ***integrated approach*** for developing codes structure. It means that this study employs an inductive approach in developing codes (open coding) but it deducts code types (e.g. IQ dimensions) from available theories (Bradley, Curry, & Devers, 2007).

The collected data to answer this question have been gathered by the semi-structured interviews and underpinned by the graphical instrument. The collected data had been partially coded (open coding) during the interviews. The main reason for coding during interviews was the sequential nature of interview questions in a way that answers given to the earlier questions should be used to shape subsequent questions. That is:

- question one was about the categorised queries (RQ1),
- question two was about sources being used for each category of indicated queries (RQ1),
- question three was about the IQ dimensions considered for using each of the mentioned sources (RQ2), and
- question four was about the measurement factors for each considered IQ dimension (RQ2).

To use the answers given to the earlier questions in subsequent questions, the researcher prepared a series of interconnected tables. For instance during the interview the researcher filled in a table with the information sources indicated by the informant (answer to RQ1) so in the next question he can collect the reasons that informants have considered for using each source. Table 4-13 displays a sample of note tables used to capture parents' reasons for using each information source. As it can be noted from this table, if parents were not using the internet to seek their required information, they were specifically asked about their reasons. This was included in the tables because the initial research design was focused only on IRD for developing internet-based information sources which later changed to encompass other sources.

**Table 4-13: A sample note table used for identified IQ dimensions**



| #6 Sources used (from maps) | Reasons(factors) to use the source (benefits) | Problems with the source |
|---|---|---|
| مربی خوب | | |
| سایر مادران (خانواده‌ها) | | |
| شبکه اجتماعی | | |
| کارشناسان | | |
| پزشک | | |
| تجربه | | |
| کار درمان | | |
| If internet is not used | | |
| if internet is not in the first horizon | | |
| کتاب | | |
| مقالات | | |

The researcher also generated a list of IQ dimensions identified by parents during the interviews. This list was used to query parents about the measurement factors they considered for evaluating each IQ dimension. It should be noted that it was not possible to identify all IQ dimensions during the interview due to the coding time requirements. However, the interviewer made a list of all IQ dimensions indicated directly by interviewees during the interview. Table 4-14 illustrates an example of note tables used for IQ dimensions measurement factors. The first column from left was filled in by the interviewer when the informant was discussing his/her source preference reasons.

**Table 4-14: A sample note table used for IQ dimensions definitions and measurement factors**

| Mentioned preference/problematic factors (from #6) | Definition #7 | Indicators [redacted] #8 | |
|---|---|---|---|
| اعتماد [redacted] | | | |
| اعتماد به مری | | | |
| اعتماد به اطلاعات | | | |
| عدم دارند (سی است) | | | |
| تجربی | | | |
| گفتگو جدید | | | |
| احساسی هم خودمونی کنه | | | |
| بازتاب خوش می دانند | | | |
| [redacted] | | | |
| اطلاعات [redacted] | | | |

To analyse the IQ dimensions, all notes about parents' reasons for using each information source were entered into the Microsoft Access 2010 database and coded manually. The reasons for selecting database and manual coding over Nvivo include:

- For IQ dimensions, coding were relatively straight forward since the literature has recommended most of IQ dimensions to be expected. That is, most of the codes has been recommended by the literature.
- To report the IQ dimensions considered for each source and identify the priority of IQ dimensions to users, quantitative analysis is required. This could be done efficiently by using a database and SQL queries.

It should be noted that IQ is a well-defined concept in the literature and so the process of constant comparison for coding IQ dimensions should include the terminologies supported by the literature. Since the data has been collected in Persian, it was a challenge to link some of the Persian words to their equivalent English IQ dimensions. To overcome this challenge, the used terminologies were very carefully selected to convey the same meaning in both languages. For instance translating Persian terminologies representing trust and believability was very

challenging. Selecting reliability as the IQ dimension representing both dimensions could solve this problem. To validate the accuracy of translations, one of the researcher's colleagues who is fluent in both Persian and English languages was consulted in challenging instances.

As indicated, coding IQ dimensions were relatively straight forward as the researcher has adapted an integrated approach for coding and was using the available code categories for IQ dimensions. For coding purposes, the researcher has entered the reasons parents have mentioned for using a source into a database table (see Table 4-15[27]) and then manually coded them into another table designed for the analysis of IQ dimensions (see Table 4-16).

**Table 4-15: A screenshot of the database table designed for the raw data**

| User_ | Source | Type_of_q | Import | Seque | Current_sc | Old_source | Reason_to_use |
|---|---|---|---|---|---|---|---|
| 09 | Personal experience | Problem info | Primary | 1 | ☑ | ☐ | |
| 09 | Social networks | Problem info | Secondar | 3 | ☑ | ☐ | |
| 09 | Teachers | Problem info | Primary | 1 | ☐ | ☑ | Spends a lot of time with child, trust, credible, knows ch |
| 09 | Doctors | Problem info | Primary | 2 | ☐ | ☑ | Trust, specialty, knows about the problem and how to d |
| 09 | Personal experience | Problem info | Secondar | 3 | ☐ | ☑ | Direct observation |
| 09 | Disabled sport committ | Domain info | Primary | 1 | ☑ | ☐ | No other source to find child's strength, |
| 09 | Social Networks | Domain info | Secondar | 2 | ☑ | ☐ | Connects me to more mothers |
| 09 | Personal experience | Domain info | Secondar | 2 | ☐ | ☑ | |
| 09 | Social Networks | Domain info | Primary | 1 | ☐ | ☑ | |
| 09 | Spouse | Problem solv | Primary | 1 | ☑ | ☐ | He knows the child very well, we should discuss the fina |
| 09 | Therapist/trainer | Problem solv | Primary | 2 | ☑ | ☐ | |
| 09 | Other parents | Problem solv | Primary | 1 | ☐ | ☑ | Experience, felt the same problems, |
| 09 | Personal experience | Problem solv | Primary | 2 | ☐ | ☑ | |
| 08 | Personal experience | Domain info | Primary | 1 | ☑ | ☐ | I understand the problems well, I know what is wrong, I |
| 08 | Spouse | Domain info | Primary | 2,7 | ☑ | ☐ | Can find the problems together when discuss it, recomm |
| 08 | Books | Domain info | Primary | 3 | ☑ | ☐ | trustable author, a researcher author with high experier |
| 08 | Internet | Domain info | Primary | 4 | ☑ | ☐ | Quick to find information, many sites exist |
| 08 | Workshops | Domain info | Primary | 5 | ☑ | ☐ | Opened my view, learned few things, helped me in my |
| 08 | Other parents | Domain info | Secondar | 6 | ☑ | ☐ | Knew the parent recommending very well, I knew she s |
| 08 | Personal experience | Problem solv | Primary | | ☐ | ☑ | |
| 08 | Books | Problem solv | Primary | | ☐ | ☑ | |
| 08 | Doctors | Problem solv | Primary | | ☐ | ☑ | Trust, could implement his/her opinions, prescribed goo |

| Reason_to_use | Problems_to_use |
|---|---|
| | |
| | |
| Spends a lot of time with child, trust, credible, knows child well | |
| Trust, specialty, knows about the problem and how to deal with it | Spend a little time with my child |
| Direct observation | May decide quickly, may decide based on my preference |
| No other source to find child's strength, | Might not have specialists for Autistic children |
| Connects me to more mothers | can not generalise parents opinion, their opinions might be biased, ma |
| | |
| | |
| He knows the child very well, we should discuss the financials together | |
| | |
| Experience, felt the same problems, | can not generalise parents opinion, children are different, one mother |
| | |
| I understand the problems well, I know what is wrong, I know my child well, I can offer | Get used to his behaviour and may not see them any more |
| Can find the problems together when discuss it, recommend the solutions | |
| trustable author, a researcher author with high experience, realistic, practical informati | Scared me at the start, should evaluate its information personally, pler |
| Quick to find information, many sites exist | Should know the author, untrustable, should be evaluated personally |
| Opened my view, learned few things, helped me in my decision making, face to face co | Expensive, specific timing, it is too long for a day, may not meet its exa |
| Knew the parent recommending very well, I knew she seek information precisely | Knew a few numbers at the start, children age, children may not have t |
| | |
| | |
| Trust, could implement his/her opinions, prescribed good medicines, gave us good adv | Expensive, does not spend much time, do not know the child, hard to a |
| | |
| | |
| High experience, high academic information, trustable, accissible, convenient, brief inf | Human error, his/her personal interpretation of source information, m |

[27] Reasons_to_use and problem_to_use fields in Table 4-15 are notes only and have not been designed to run SQL queries on.

**Table 4-16: Screenshot of database table designed for IQ dimension analysis**

| User_ID | Source | Factor |
|---|---|---|
| 04 | Teachers | Experience |
| 04 | Teachers | Reliability |
| 04 | Teachers | Reputation |
| 04 | Therapist/trainer | Reliability |
| 04 | Therapist/trainer | financiallybiased |
| 04 | Workshops | Scientific |
| 04 | Workshops | Timeliness |
| 04 | Massmedia | Timeliness |
| 04 | Massmedia | Timeliness |
| 04 | Massmedia | Amountofrelevantinforn |
| 04 | Doctors | Amountofrelevantinforn |
| 04 | Doctors | Amountofrelevantinforn |
| 04 | Doctors | Caring |
| 04 | Doctors | Empathy |
| 04 | Doctors | Timeliness |
| 04 | Doctors | Financiallybiased |
| 04 | Other parents | Experience |
| 04 | Other parents | Reliability |
| 04 | Other parents | Amountofrelevantinforn |
| 04 | Trusted doctors | Consulting |
| 04 | Trusted doctors | Reliability |
| 04 | Trusted doctors | Scientific |
| 04 | Autism communitie: | Scientific |
| 04 | Autism communitie: | Distance |
| 04 | Social networks | Networking |
| 04 | Social networks | Technicalissues |
| 05 | Clinics | Personalreasons |

Using these tables enabled the researcher to run a number of queries on the data. A well-designed database supports the analysis of a subject through several perspectives and so meets the requirements of critical realism. The following screenshots illustrate how the researcher evaluated the employment of different units of analysis for calculating the popularity of information sources. Table 4-17 and Table 4-18 represent the number of times each source has been used for each category of information needs and the source popularity. To calculate the popularity, two units of analysis have been leverages. In Table 4-17, to calculate source popularity, the number of times each source has been drawn in diagrams has been divided by the potential number of diagrams that could be collected for each category of information needs i.e. 31. In Table 4-18, on the other hand, the number of times each source has been drawn in diagrams has been divided by the number of diagrams filled for each category of information needs. The SQL statements to generate these tables are displayed below each table.

**Table 4-17: Accumulative (both incidents) source popularity for each type of needs (number of potential diagrams as unit of analysis)**

| Source | Type_of_query | Total number of appre | Importance Average | Total number of maps inc blanks | Popularity % |
|---|---|---|---|---|---|
| Other parents | Domain info | 15 | 2.27 | 31 | 48 |
| Doctors | Domain info | 10 | 2.4 | 31 | 32 |
| Books | Domain info | 9 | 2.33 | 31 | 29 |
| Internet | Domain info | 8 | 2 | 31 | 26 |
| Personal experience | Domain info | 7 | 2.57 | 31 | 23 |
| Therapist/trainer | Domain info | 6 | 2.5 | 31 | 19 |
| Spouse | Domain info | 4 | 2.75 | 31 | 13 |
| Social Networks | Domain info | 4 | 2.5 | 31 | 13 |
| Massmedia | Domain info | 3 | 2.67 | 31 | 10 |
| Teachers | Domain info | 3 | 2.67 | 31 | 10 |
| Doctors | Problem info | 11 | 2.36 | 31 | 35 |
| Personal experience | Problem info | 10 | 2.8 | 31 | 32 |
| Therapist/trainer | Problem info | 9 | 2.33 | 31 | 29 |
| Other parents | Problem info | 8 | 2.75 | 31 | 26 |
| Internet | Problem info | 7 | 2.57 | 31 | 23 |
| Books | Problem info | 6 | 2.67 | 31 | 19 |
| Other parents | Problem solving info | 16 | 2.56 | 31 | 52 |
| Doctors | Problem solving info | 13 | 2.69 | 31 | 42 |
| Personal experience | Problem solving info | 10 | 2.9 | 31 | 32 |
| Therapist/trainer | Problem solving info | 9 | 2.67 | 31 | 29 |
| Internet | Problem solving info | 9 | 2 | 31 | 29 |
| Books | Problem solving info | 4 | 2.75 | 31 | 13 |
| Spouse | Problem solving info | 4 | 2.75 | 31 | 13 |
| Teachers | Problem solving info | 3 | 3 | 31 | 10 |
| Professionals | Problem solving info | 3 | 2.67 | 31 | 10 |
| Social networks | Problem solving info | 3 | 2.33 | 31 | 10 |

```
SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of apprearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], 31 AS [Total number
of maps inc blanks], Round(((Count(Sources.Source)/31)*100),0) AS [Popularity %]
FROM Sources
WHERE Sources.Type_of_query Is Not Null
GROUP BY Sources.Source, Sources.Type_of_query
HAVING (((Count(Sources.Source))>2))
ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC;
```

**Table 4-18: Accumulative (both incidents) source popularity for each type of needs (number of filled diagrams as unit of analysis)**

| Source | Type_of_query | Total number of apprear | Importance Average | Number of filled maps | Popularity % |
|---|---|---|---|---|---|
| Other parents | Domain info | 15 | 2.27 | 19 | 79 |
| Doctors | Domain info | 10 | 2.4 | 19 | 53 |
| Books | Domain info | 9 | 2.33 | 19 | 47 |
| Internet | Domain info | 8 | 2 | 19 | 42 |
| Personal experience | Domain info | 7 | 2.57 | 19 | 37 |
| Therapist/trainer | Domain info | 6 | 2.5 | 19 | 32 |
| Spouse | Domain info | 4 | 2.75 | 19 | 21 |
| Social Networks | Domain info | 4 | 2.5 | 19 | 21 |
| Massmedia | Domain info | 3 | 2.67 | 19 | 16 |
| Teachers | Domain info | 3 | 2.67 | 19 | 16 |
| Doctors | Problem info | 11 | 2.36 | 18 | 61 |
| Personal experience | Problem info | 10 | 2.8 | 18 | 56 |
| Therapist/trainer | Problem info | 9 | 2.33 | 18 | 50 |
| Other parents | Problem info | 8 | 2.75 | 18 | 44 |
| Internet | Problem info | 7 | 2.57 | 18 | 39 |
| Books | Problem info | 6 | 2.67 | 18 | 33 |
| Other parents | Problem solving info | 16 | 2.56 | 27 | 59 |
| Doctors | Problem solving info | 13 | 2.69 | 27 | 48 |
| Personal experience | Problem solving info | 10 | 2.9 | 27 | 37 |
| Therapist/trainer | Problem solving info | 9 | 2.67 | 27 | 33 |
| Internet | Problem solving info | 9 | 2 | 27 | 33 |
| Books | Problem solving info | 4 | 2.75 | 27 | 15 |
| Spouse | Problem solving info | 4 | 2.75 | 27 | 15 |
| Teachers | Problem solving info | 3 | 3 | 27 | 11 |
| Professionals | Problem solving info | 3 | 2.67 | 27 | 11 |
| Social networks | Problem solving info | 3 | 2.33 | 27 | 11 |

```
SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of apprearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], [**S-AS/U].[Number
of filled maps], Round(((Count(Sources.Source)/[**S-AS/U].[Number of filled maps])*100),0) AS [Popularity %]
FROM Sources, [**S-AS/U]
WHERE (((Sources.Type_of_query) Is Not Null)) AND [**S-AS/U].Type_of_query=Sources.Type_of_query AND [**S-AS/U].Type_of_query=Sources.Type_of_query
GROUP BY Sources.Source, Sources.Type_of_query, [**S-AS/U].[Number of filled maps]
HAVING (((Count(Sources.Source))>2))
ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC;
```

Following the identification of IQ dimensions that parents consider to select information sources, measurement factors for evaluating each IQ dimension have

been derived from the definitions that parents provided for each dimension. Coding IQ dimensions' measurement factors is a challenging task as it is an inductive coding with no code categories to be derived from literature. Furthermore, because IQ dimensions may be interrelated analysis of their measurement factors become even more complicated (e.g. if an information is scientific it is more likely to be reliable but not necessary each reliable information is scientific).

To define IQ dimensions' measurement factors the researcher used the following sources of data in interviews: 1) direct questions asked from parents on definition of IQ dimensions, 2) parents' think aloud, 3) the definitions that parents provided for IQ dimensions during the source preference behaviour discussion. Because the required data to define IQ dimensions' measurement factors were scattered in between multiple tables in the database, the researcher did not find the database as an efficient analysis tool. As a result the researcher employed Nvivo 10 for coding and analysis of the measurement factors. To start the analysis, the raw notes already entered to the database (Microsoft Access 2010) were exported to Microsoft Excel spreadsheets and from there were imported to the Nvivo 10. As mentioned earlier, the interviews were audio recorded. All the recordings were also entered to Nvivo 10 and fully listened to. This was done to check the accuracy of the notes. Any emerging trends also were transcribed, coded and analysed to find possible emerging patterns.

Nvivo facilitates the coding especially when the code categories are not known from the literature (inductive coding (Bradley et al., 2007)). Like other types of coding, inductive coding requires constant comparison (Creswell, 2008). To define IQ dimensions and identify their subjective measurement factors, Nvivo 10 enabled the researcher to go back and forth through several pages of notes. At this stage, data analysis was qualitative and complex queries were not required. Instead, the coding was complex and manual coding would not be as accurate. That is the reason for using Nvivo 10 instead of database to identify the IQ dimensions' measurement factors.

The data collected from parents were analysed through the QRD model and the results were presented to IS practitioners involved in information system development for usability evaluation. The following section explains the research

protocol, data collection and data analysis techniques employed for phase two of the study.

### 4.6.2 Phase II

The second phase of this study which is the focus of RQ3 is about identifying the practical uses for the analysed data through the QRD model. To achieve this goal, the results of the instrumental case study of the parents of children with autism were presented to a group of IS practitioners. IS practitioners' feedback on the usability of the analysed data was employed for evaluating the proposed uses and identifying the emergent applications of the QRD model and its presentation matrix. This phase of the study is exploratory and therefore makes case study an ideal candidate for pursuing it.

#### 4.6.2.1 Case selection

Similar to phase one, the case study in phase two is an instrumental case study because gaining an understanding of the practical usefulness of the developed method is the main contribution of this case study as opposed to the case itself (Stake, 2005). To evaluate the results of the explanatory study by IS practitioners, the researcher employed the purposive sampling. In purposive sampling, the selected samples are chosen due to theoretical reasons not statistical ones (Patton, 1990).

The case for this phase of the study is the same as phase one i.e. "parenting of a child with autism". The difference between these two phases is that in phase one the participants were potential information users but in phase two, the participants are the potential developers of the system that is to provide the information. In the subsequent section, the strategies for recruiting informants in this phase of study are explained.

#### 4.6.2.2 Research protocol

In this study, an IS practitioner refers to an IS expert individual who plays a role in the process of developing an information system (see section 2.2.2.3). IS practitioners include, but are not limited to, ***information analysts, system analysts, system developers, designers and IS managers***. It should be noted that a number of

none-IS practitioners such as ***content developers*** and ***managers*** may also benefit from the results of the QRD method. However, since in IS development projects these parties should be briefed by the information analysts, their requirements is determined through the opinion of IS practitioners who have worked as information analysts.

The employed typology to select the participants could be named either as expert sampling or criterion sampling. This typology was selected to maximise the chance of interviewing the participants who have the required experience to provide professional feedback on the data analysed by the QRD model. As a result, the IS practitioners who were ***involved in the process of developing an information system*** (selection criterion) have been included in this study.

To reflect the maximum variety of feedback, the IS practitioners for the exploratory study were selected from experts with different types of experience in developing information systems (i.e. managers, system developers, system analysts, information analysts, user interface designers). Selected IS practitioners, in their jobs were either directly involved with requirement determination process or had/have dependencies on its results. To identify the potential participants to be interviewed for this study, a list of the IS practitioners with practical experience in information system development projects were generated by discussing the subject with two senior researchers in the Business Information System (BIS) department, University College Cork (UCC). Following that, the researcher contacted all IS practitioners in the list to arrange a date and time for an interview. Nine IS practitioners expressed interest as the potential interviewees. Face-to-face or Skype interviews were arranged with eight of the potential candidates. Table 4-19 lists the IS practitioners who participated in phase two of this study and their experience in system development projects.

**Table 4-19: IS practitioners selected for interview**

| ID | Experience in IS development | Project Size |
|---|---|---|
| 01 | System designer, system analyst | Small |
| 02 | System/information analyst, system developer, technical manager | Small/large |
| 03 | System developer | Small |
| 04 | System developer | Large |
| 05 | Designer, information analyst, system analyst, system developer | Small |
| 06 | Websites design and development, requirement gathering for app development, UI analyst | Medium-Large |
| 07 | Development for web, project manager | Small-Large |
| 08 | Requirement gathering, design, development | Small-Large |

The following section explains the data collection techniques employed to collect data from IS practitioners.

#### 4.6.2.3 Data collection techniques

Phase two of this study focuses on identifying the practical uses for applying the QRD model to determine users' information requirements in the context of IDMES. As indicated in section 2.2.2.3, a number of stakeholders are involved in the process of information system development such as information analysts, system analysts, managers, system developers, content providers and testers. Therefore, in this phase, eight IS practitioners with a variety of expertise were interviewed. During the interview, they were presented with the QRD presentation matrix reflecting parents' information requirements and how the presented data has been collected and analysed. IS practitioners' feedback on the practical usability of the sample analysed data has been leveraged in this phase to ***validate the proposed uses for the QRD model and its analysed data*** and also to identify its emergent applications. Table 4-20 provides a list of IS practitioners who were interviewed in this study. Due to ethical considerations no personal identifiable information is provided.

**Table 4-20: IS practitioners interviewed to evaluate the QRD presentation matrix**

| ID | Experience in IS development | Project Size | Date | Duration of interview | Face-to-face/Skype |
|---|---|---|---|---|---|
| 01 | System designer, system analyst | Small | 15/05/2015 | 01:30 | Face-to-face |
| 02 | System/information analyst, system developer, technical manager | Small/large | 03/07/2015 | 01:30 | Face-to-face |
| 03 | System developer | Small | 14/07/2015 | 00:45 | Skype/phone |
| 04 | System developer | Large | 14/07/2015 | 00:45 | Skype/phone |
| 05 | Designer, information analyst, system analyst, system developer | Small | 14/07/2015 | 01:15 | Skype/phone |
| 06 | Websites design and development, requirement gathering for app development, UI analyst | Medium-Large | 31/07/2015 | 00:45 | Face-to-face |
| 07 | Development for web projects, project manager for mobile projects | Small-Large | 31/07/2015 | 01:00 | Face-to-face |
| 08 | Requirement gathering, design, development, project manager | Small-Large | 05/08/2015 | 00:45 | Face-to-face |

It should be noted that as an IS practitioner may have the ability to handle several roles in the information system development, most of the interviewees were experienced in more than one role. Also, IS practitioners with experience in small projects, may have handled more than one responsibility in one project (e.g. the same individual may determine information requirements, analyse the required systems and develop it).

This part of the study is exploratory in nature. Thus, the interviewer only asked open-ended questions and allowed the interviewee to lead the discussion on the subject. To answer RQ3 in this phase of the study, the researcher was looking for evaluating a group of defined hypotheses proposed for the practical uses expected from applying the QRD model for IRD in equivocal situations. Additionally, the researcher was interested in discovering any other emergent practical uses that IS practitioners may identify for the results of IRD conducted on the instrumental case study by leveraging the QRD model.

For phase two, the data collection was conducted through a semi-structured interviews involving 1) the explanation of the QRD presentation matrix (described in section 3.2.4), 2) describing the data collection and analysis techniques employed at phase one to interviewees, and 3) asking interviewees about how this kind of data and analysis technique could be useful for them in their experience. It should be noted that while all of the questions in this phase are open-ended, the interviewees' answers never left the usability boundary. This could be due to the fact that all the

interviewees were experts in the field and they had understood the subject of the question very well. The interview guide used in this phase is available in Appendix section 7.5.

The interviews were conducted face-to-face or through Skype/telephone. For Skype/telephone interviews, the interview guide had been emailed to the interviewees prior to the interview and they were asked to have it printed or have it open on their computers' screen during the interview.

The following section explains how the collected data was analysed in this phase of study.

#### 4.6.2.4 Analysis techniques

In phase two of this study, the usability of determined information requirements in phase one is evaluated. Therefore, in this phase the unit of analysis is individuals. These individuals are the IS practitioners who provide the systems assisting parents of children with autism in their decision making process. To answer RQ3, during phase two of this study, six hypotheses proposed in section 3.2.4 have been evaluated. In addition to these six hypotheses derived from the literature, one additional hypothesis also is added for evaluation during the data analysis conducted for RQ1 and RQ2 (explained in section 5.5.1). Apart from evaluating these hypotheses, the researcher was also interested in discovering any emergent uses for the QRD model and its presentation matrix.

**Table 4-21: List of hypotheses evaluated in second phase of this study**

| ID | Hypothesis |
|---|---|
| H1 | Users' categorised queries represent seekers' information needs and are useful for content development. |
| H2 | Categorised information sources and IQ dimensions are useful for context analysis and defining the problem space. |
| H3 | Identifying potential users' IQ requirements is useful to develop quality information systems. |
| H4 | Identifying IQ dimensions measurement factors is useful for implementing IQ dimensions. |
| H5 | Identifying equivocality and uncertainty resolution sources assist designers and developers in developing the information flow in their systems. |
| H6 | The QRD method is applicable in other contexts. |
| H7 | Analysis of users' information behaviour change over time/experience is useful to identify the gaps in the information horizon (problem definition) |

H1, H2, H3, H4, H5 and H7 are focused on evaluating the usefulness of different parts of the QRD presentation matrix. On the other hand, H6 is testing the applicability of the QRD method in similar contexts. The interview with IS practitioners was consist of only one question which was regarding the uses they could identify for applying the requirements determined by the QRD model in their experience. So, any use indicated by them could be interpreted as the generalisability of IRD technique developed in this study to the other contexts.

Following the recommendations of critical incident technique, the collected data were analysed during the interviews. So, during the interview the feedback received from the IS practitioners were categorised in a table like Table 4-22. At the end of each interview the filled table was validated by the interviewee.

**Table 4-22: A sample of note table used for analysing IS practitioners' feedback**

| Used for | How | Matrix's useful part | Relevant hypothesis |
|---|---|---|---|
| Context analysis | This technique gives a good understanding of the context and how things work prior to development. Can provide a good starting point to develop any type of information source | Source categorisations /pathways-whole matrix | H2 |
| | | | |

Upon asking interviewee's permission, the interview session was audio recorded. Similar to the first two research questions, the interviews for this phase were not fully transcribed, although all of the recorded interviews were fully listened, relevant themes were transcribed (Laforest & Bouchard, 2009) and the accuracy of the notes taken during the interviews was also confirmed. While Skype interviews proved to be useful and time efficient, the technical difficulties caused the researcher to lose two interview audio records. For these two incidents, upon the realisation of the technical difficulty, the researcher validated his notes by asking interviewees to repeat the answers to ensure full capture of the data.

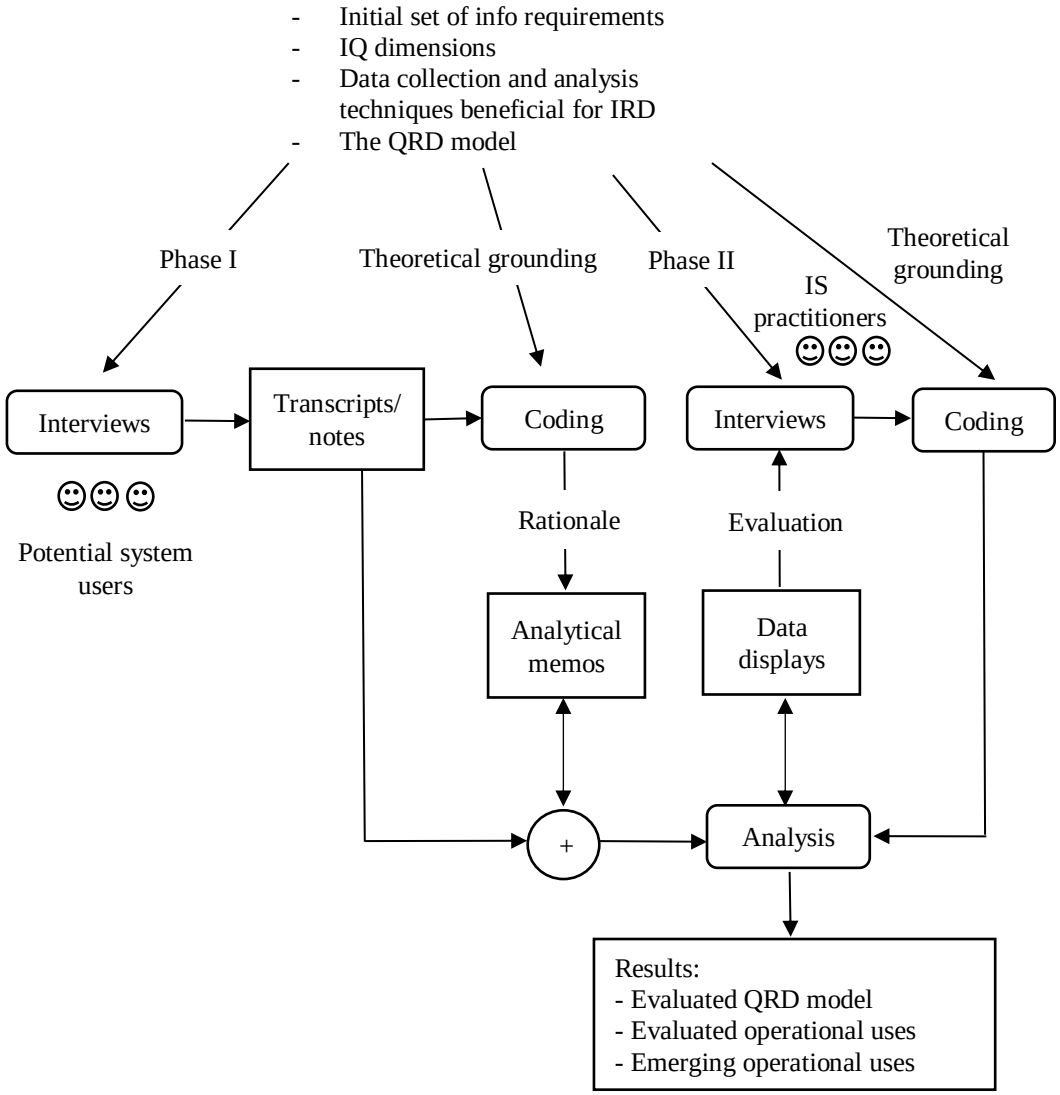
The next section synthesises how data has been analysed in this study.

### 4.6.3 Synthesis of data analysis process

This chapter explained how the research was designed, the data were collected and analysed in two phases of this study. The following diagram (Figure 4.10)

displays an overview of the data collection and analysis process pursued in this study.

**Figure 4.10: Schematic overview of data analysis process employed in this study. Adapted from (Agerfalk & Fitzgerald, 2008, p. 407)**




The final section in this chapter provides a summary of the research approach employed to achieve the research objective.

## 4.7 Summary of research approach: The QRD method

To achieve the objective of this study, the researcher followed the post-positivism paradigm and accepted the methodological process indicated in Table 4-23.

**Table 4-23: Research methodological process**

| Paradigm | Strategy | Methodology | Method | Data collection techniques |
|---|---|---|---|---|
| Post-positivism Critical realism | Explanatory (RQ1 & RQ2/ Exploratory (RQ3) | Pluralism[28] | Case study | Semi-structured interviews underpinned by an instrument |

This study consists of two phases. Phase one was to evaluate the constructs of the QRD model and the relationships between them in the context of IDMES. Phase two was to evaluate the usefulness of the determined information requirements for information system development and consequently the usefulness of the QRD model.

For the data analysis in phase one, data reduction was focused on the explanatory evidence collected from the case of parenting a child with autism to explain parents' information needs, quality requirements and source preference behaviour, through the lens of the QRD model. This study followed an integrated approach for developing codes structure at this stage. That is, it employed an inductive approach in developing codes (open coding) but it deduced code types (e.g. IQ dimensions) from available theories (Bradley et al., 2007). The looser inductive approach employed at this stage enabled the researcher's "creative work" (Huberman & Miles, 2002) to grasp the complexity of the research through the researcher's perceptions, experience and observations. At the same time, the deductive approach helped the researcher to remain within the focus of the study.

During phase two, the researcher was looking specifically for evidence to support the proposed and emergent practical uses for the sample information requirements determined by the QRD method. Practicality of the determined information in this phase has been evaluated through the eyes of IS practitioners.

Practically the ambition of this study is to develop a specifically designed IRD method from the combination of the QRD model and its associated data collection, analysis and presentation techniques, for the context of IDMES. Figure 4.11 provides a flowchart highlighting all the steps and tools to be used for data collection, analysis

[28] Methodologically, the post-positivist paradigm encourages pluralism believing that there is no one correct method of science instead, there are many (Wildemuth, 1993). In other words pluralism within the post-positivism paradigm emphasizes the importance of applying multiple measures and observations that while each might not be accurate but can provide a better understanding of the reality (W. Chen & Hirschheim, 2004).

and presentation of the results of the QRD method. Following these steps will enable the information analysts to determine users' information requirements and present it with the QRD presentation matrix illustrated in Figure 4.12.

**Figure 4.11: Steps of the quality requirement determination method**

1 Identify the criteria to categorise users' queries.
2 Interview users about the queries they have sought in two incidents when they made a specific decision (one recent, one earlier).
3 Categorise their queries using the identified criteria (see section 5.3.1) and update the criteria.

S1: Collect and categorise queries

1 Users fill one information horizon diagram for each category of their own queries for each incident (see section 4.6.1.3.4).
2 Users indicate the quality dimensions of each source.
3 Users define IQ dimensions and their measurements factors.

S2: Collect information horizons, pathways and quality dimensions

1 Identify popular information sources (information horizon).
2 Identify the information sources roles in the environment (information pathways).

S3: Identify users' information horizon and source roles

1 Calculate the average number of sources sought in each diagram
2 Calculate the quality requirements for each source (see section 5.4).
3 Calculate the quality requirements of each category of information sources (based on provided type of information).
4 Calculate system's quality requirements, sorted by source and information specific dimensions.

S4: Identify quality requirements per source/information needs/role/entire system

1 Compare source average use in the two incidents.
2 Compare source average importance in the two incidents.
3 Colour code the success of subsystem/applications (see section 5.5.1).

S5: Compare average use and importance change over time and rate sources

1 Suggest solutions for each subsystem/application based on its specific requirements (leveraging users' recommendations could be beneficial at this stage).

S6: Suggest information and system specifications

The data collected and analysed by the QRD method should be presented by the QRD presentation matrix displayed in Figure 4.12.

**Figure 4.12: The process of filling in the QRD presentation matrix**[29]

| Type of information | **Recommending** | **Balanced** | **Focusing** | |
|---|---|---|---|---|
| **e.g. Domain** | Sources X,Y,Z | Sources X,Y,Z | Sources X,Y,Z | |
| **e.g. Problem** | Sources X,Y,Z | Sources X,Y,Z | Sources X,Y,Z | |
| **e.g Problem solving** | Sources X,Y,Z | Sources X,Y,Z | Sources X,Y,Z | |
| | | | | |
| | | | | |

S1


S2, S3

| **Type of information** | **Equivocality resolution **** | **Confirming** | **Uncertainty resolution** | **Positive** | **Negative** |
|---|---|---|---|---|---|
| Domain | Therapist/trainer (-1-1)=-2 … | Books (-1-1)=-2 … | Other parents (0+1)=1 … | Empathy … | Reliability … |
| Problem | Doctors (-1-1)=-2 … | Books (1+1)=2 … | Therapist/trainer (-1+0)=-1 … | Accessibility … | Reliability … |
| Problem solving | Doctors (1-1)=0 … | Books (1+1)=2 … | Personal experience (1-1)=0 … | Experience … | Reliability … |
| Role specific quality dimensions | Reliability … | Experience … | Experience … | | |
| | Reliability … | Reliability … | Reliability … | | |
| The entire information horizon | | | | | |
| Source specific factors (Must have):<br>- Empathy, Experience<br>* Use parents provided information<br>… | | | Information specific factors (Must have):<br>- Reliability, 2-Scientific, 3-Speciality<br>… | | |

S5

S4

S4

S4

| | Equivocality resolution | Confirming | Uncertainty resolution |
|---|---|---|---|
| Domain information | System's settings for application 1 | System's settings for application 2 | System's settings for application 3 |
| Problem information | System's settings for application 4 | System's settings for application 5 | System's settings for application 6 |
| Problem solving information | System's settings for application 7 | System's settings for application 8 | System's settings for application 9 |

S6

[29] Presentation matrix has been updated during the data analysis phase (see section 5.5.3)

The following chapter presents the data collected and analysed through the explained research approaches.

# CHAPTER FIVE: ANALYSIS AND DISCUSSION

## 5.1 Introduction

In this chapter, the data collected in both phases of this study has been analysed and discussed to answer to the three research questions posed in this thesis. To meet the requirements of pluralism as the methodology selected for this study, for answering each research question a number of analysis techniques are pursued.

The goal of RQ1 was to investigate the proposed relationship between perceived information needs and source preference behaviour in the QRD model. To analyse this relationship, parents' information needs is categorised into three groups of domain, problem and problem solving queries. Following that, parents' source preference behaviour, to obtain each category of their information needs, is analysed. This analysis is conducted by leveraging information horizons and pathways as data analysis methods and the data collected from a study of parenting children with autism. The answer to RQ1 is discussed in section 5.3.

RQ2 explains the QRD model's quality requirement construct in detail by capturing information seekers' source preference rationale through an IQ lens. The response to RQ2 is anticipated to: 1) identify the *high priority IQ dimensions* impacting users' source preference behaviour, 2) provide users' *subjective definitions and measures* for evaluating IQ dimensions, and 3) *evaluate the relationship between IQ requirements and information needs* in the sample context. To evaluate this relationship, RQ2 leverages the findings of RQ1 to explain the relationship between information needs and IQ requirements. Similar to RQ1, the data collected from parents of children with autism has been used to answer RQ2 in section 5.4.

The aggregation of the data analysed for responding to RQ1 and RQ2 is proposed that will assist information analysts in determining system's information requirements. To evaluate the applicability of the QRD model to analyse users' information needs and its characteristics (and answer RQ3), two steps have been taken. First, the results of parents' source preference behaviour analysis were presented in the QRD presentation matrix described in section 3.2.4. Then, the QRD presentation matrix was explained to eight IS practitioners in order to evaluate seven

hypothesis proposed for the usability of the analysed data (see section 3.2.4). The response to RQ3 is discussed in section 5.5.

To analyse the collected data and answer the research questions, this chapter starts with outlining the informants' demographics in section 5.2. Following that, section 5.3, 5.4 and 5.5 answer the three research questions consequently. At the end of this chapter, section 5.6 summarised the answers to the three research questions.

## 5.2 Informants' demographics (phase one and phase two)

Data collection in this study was conducted in the case of parenting children with autism from two groups of informants: 1) parents of children with autism were selected as potential system users, and 2) IS practitioners were selected as potential system developers. In the phase one, the researcher collected and analysed system users' (parents) information requirements through the eyes of an information analysts. In phase two on the other hand, the researcher evaluated the usability of the determined information requirements by the IS practitioners as potential system developers.

To collect the data from parents of children with autism, a specialised private primary school for children with autism in Tehran[30], Iran, was selected. This school has about 60 students (mostly low functioning children with autism with low communication abilities) and 26 staff. One of the benefits of selecting a private school to recruit the informants was to reduce the impact of "income"[31] on ISB of parents as all the families could at least afford the tuition fee of the school. This ensured that the population of informants was homogenous across a broad range of attributes.

Seventeen individual parents (11 female and 6 male) were interviewed. Their ***literacy level*** varied from high school diploma to PhD with the majority (53%)

[30] Aeine Mehrvarzi special primary school

[31] There are multiple factors impacting seekers' information source preference behaviour which are beyond the scope of this study such as task complexity, expectations, believes, experience, demographics, salience, time, income, literacy level, time since the child was diagnosed with autism, type of need (affective, cognitive and physical), socio-cultural environment, politico-economic environment, role related barriers, emotional variables, information characteristics (Abram & Dowling, 1979; Byström & Järvelin, 1995; Dervin, 1998; Johnson & Meischke, 1993; Jr & Durio, 1983; Kogan et al., 2008; Mackintosh et al., 2005; Rogith et al., 2016; Savolainen, 2008; Wilson, 2006b, 1997).

carrying a bachelor's degree. 12/17 (71%) of interviewees identified the ***mother as the main decision maker*** for planning child care, 4/17 (23%) mentioned both parents, and one individual (6%) did not answer this question. ***Children's age*** ranged from 8 to 19 years. In this study only parents with over five years of experience in caring for children with autism were interviewed. Therefore since low functioning children with autism are often diagnosed at age of 2-4, the youngest child that the researcher interviewed his parent was 8 years old. Among the 17 interviewed parents, only two (12%) individuals indicated that they were ***familiar with autism*** before their child's diagnosis and two (12%) only had basic knowledge about this condition prior to their child's diagnosis. However, 13/17 (76%) interviewees did not know anything about autism prior to their child's diagnosis. In terms of the ***number of children*** in the family, 9/17 (53%) parents have only one, 7/17 (41%) have two and 1/17 (6%) has four children. In families with more than one child (8 cases), in 4 cases (23% of total 17 cases) the child with autism is the last child. This indicates that 13/17 (76%) interviewees did not give birth to any more children after having a child with autism. Table 5-1 provides a list of interviewed parents.

Parents were interviewed about two incidents in which they have sought information. One was their latest ISB in which they were seeking information to make a decision for an intervention needed for their child. The other was about a similar ISB that has taken place "early after receiving the diagnosis". From the 17 interviewed parents, *14* were interviewed about their *"early after receiving the diagnosis" ISB*. This is because the idea for collecting parents' early after diagnosis ISB emerged during the first four interviews and follow up interview could be conducted only for one of the four interviewees. The 14 parents whom are interviewed about both latest and "early after receiving the diagnosis" ISB incidents are highlighted in yellow in Table 5-1.

**Table 5-1: Parents of children with autism participating in phase one of this study**

| ID | Gender | Age | Literacy level | Duration of interview |
|---|---|---|---|---|
| 01 | M | 35-45 | High school diploma | 1:10 |
| 02 | F | 35-45 | Masters | 1:50 |
| 03 | M | 35-45 | Bachelor's degree | 1:10 |
| 04 | F | 35-45 | Bachelor's degree | 1:30 |
| 05 | F | 35-45 | High school diploma | 1:15 |
| 06 | F | Above 45 | Bachelor's degree | 2:15 |
| 07 | F | 35-45 | Bachelor's degree | 2:00 |
| 08 | F | 35-45 | Bachelor's degree | 2:20 |
| 09 | F | 25-35 | Bachelor's degree | 1:15 |
| 10 | M | 35-45 | Masters | 2:40 |
| 11 | F | 25-35 | Bachelor's degree | 2:00 |
| 12 | F | 35-45 | Bachelor's degree | 1:45 |
| 13 | F | Above 45 | High school diploma | 1:20 |
| 14 | M | Above 45 | MD | 2:10 |
| 15 | M | Above 45 | PhD | 1:00 |
| 16 | F | 35-45 | High school diploma | 1:50 |
| 17 | M | 35-45 | Bachelor's degree | 2:15 |

Each interviewee was asked to fill in one information horizon and pathway diagram for each category of information needs per incident. This includes one diagram for domain queries, one for problem queries and another one for problem solving queries for 1) the latest ISB incident, and 2) the "early after receiving the diagnosis" information seeking incident (potentially six diagrams per interviewee in total). For the *latest ISB, 17 parents* were interviewed. Thus, potentially 51 information horizon and pathway diagrams could be collected from interviewees for their recent information seeking incident. However, empirically 33 information horizon and pathway diagrams were collected due to the fact that few interviewees did not seek all three categories of information in both incidents (e.g. three cases had only problem solving queries). For the *"early after receiving the diagnosis" ISB, 14 parents*[32] were interviewed and in total, 30 diagrams were collected for the "early after receiving the diagnosis" ISBs. The total number of information horizon diagrams collected for the latest and "early after receiving the diagnosis" incidents is 63. Table 5-2 shows the number of diagrams collected for each category of information needs per incident.

[32] Interviewees ID02 and ID05-ID17

**Table 5-2: Number of collected information horizon and pathway diagrams**

| Incident | Number of interviewees | Proportion of interviewees who filled domain ISB diagram | Proportion of interviewees who filled problem ISB diagram | Proportion of interviewees who filled problem solving ISB diagram | Proportion of total ISB diagrams filled by interviewees |
|---|---|---|---|---|---|
| Latest ISB | 17 | 8/17 | 11/17 | 14/17 | 33/51 |
| "Early after receiving the diagnosis" ISB | 14 | 11/14 | 7/14 | 12/14 | 30/42 |
| **Total** | 31 | 19/31 | 18/31 | 26/31 | **63/93** |

In the second phase of data collection, eight IS practitioners experienced in the management, design and development of information systems were interviewed and presented with parents' determined information requirements. The group of individuals interviewed reside in Cork and Dublin in Ireland. Table 5-3 provides the list of interviewees in this phase of the study.

**Table 5-3: IS practitioners interviewed to evaluate the QRD presentation matrix**

| ID | Experience in IS development | Project size | Date | Duration of interview | Face-to-face /Skype |
|---|---|---|---|---|---|
| 01 | System designer, system analyst | Small | 15/05/2015 | 01:30 | Face-to-face |
| 02 | System/information analyst, system developer, technical manager | Small-large | 03/07/2015 | 01:30 | Face-to-face |
| 03 | System developer | Small | 14/07/2015 | 00:45 | Skype/phone |
| 04 | System developer | Large | 14/07/2015 | 00:45 | Skype/phone |
| 05 | Designer, information analyst, system analyst, system developer | Small | 14/07/2015 | 01:15 | Skype/phone |
| 06 | Websites design and development, requirement gathering for app development, UI analyst | Small-Large | 31/07/2015 | 00:45 | Face-to-face |
| 07 | Development for web projects, project manager for mobile projects | Small-Large | 31/07/2015 | 01:00 | Face-to-face |
| 08 | Requirement gathering, design, development, project manager | Small-Large | 05/08/2015 | 00:45 | Face-to-face |

The following section provides the analysis of the data collected from parents of children with autism to answer the RQ1.

## 5.3 RQ1: How do perceived information needs impact users' source/media preference behaviour in the QRD model?

Information systems must address their users' information needs. However identifying user's information needs in equivocal situations cannot be done simply by asking users (Davis, 1982). To determine users' information needs the QRD model proposes that for different perceived information needs, users show different

behaviours. Analysing ISBs that users pursue for varied types of their information needs then can help analysts and designers in meeting users' needs in their designs.

The relationship between perceived information needs and users source preference behaviour has received a limited support from the literature (see section 3.2.2). Therefore, in this study this relationship is empirically evaluated through a sample context analysis conducted in the case of parenting children with autism. This section evaluates this relationship and explains how perceived information needs in the QRD model impact source preference behaviour. The QRD model proposes information horizons and information pathways as measurement tools for measuring users' source preference behaviour. As a result, to answer RQ1 these two measurement tools have been leveraged to display the impact of the different categories of parents' information needs as an independent variable (section 5.3.1) on their source preference behaviour as a dependent variable (section 5.3.2).

The following section explains parents' perceived information needs.

### 5.3.1 Perceived information needs

Section 3.2.3 defines the measurement for perceived information needs as "queries in the mind of information seekers". In this study, perceived information needs are categorised based on the types of information needs (i.e. domain, problem, and problem solving information). Perceived information needs are the result of the problem at hand[33] or motive. To narrow the scope, this study focused only on ISBs in which parents' motive was to make a decision about interventions needed for their child.

In phase one of this study, parents were asked to recall two incidents in which they sought information. To identify their information needs in each incident, the researcher asked parents to indicate the queries they searched for in each ISB incident. By leveraging the definitions of the three types of information needs,

[33] Interviewees are asked about the last time they sought information to make a decision for an intervention. The list of interventions they mentioned are out of the scope of RQ1 and are presented in Appendix section 7.3.1.

parents' assistance and the following three criteria[34], the researcher categorised the parents' queries:

1. If a query at some point focuses on learning about specific problems related to a specific child or searches for specialists for diagnosis, it was categorised as a problem query.
2. If a query is focused on a specific problem solving solution, attempts to solve a problem related to a specific child or searches for specialists, organisations or facilities for problem solving, it was categorised as a problem solving query.
3. If a query is not specific to a child and seeks general information and/or facts which is valid for all or a group of children with autism it was categorised as a domain query.

The queries sought in "early after receiving the diagnosis" ISB by parents (42 domain, 7 problem, 3 problem solving) indicates that, as anticipated, unexperienced parents' concentration was more on domain information. Although 12/14 (86%) of the interviewees sought queries to solve their problems (which clarifies their interest in problem solving) but their queries still were very vague and general which in many cases were falling under domain information category. In contrast, the queries experienced parents have sought in their latest ISB incident (21 domain, 35 problem, 40 problem solving) reveals that experienced parents' concentration were more on problem and problem solving information rather than domain information.

To display a sample of parents' queries and their categories, Table 5-4 and Table 5-5 are provided for the latest and "early after receiving the diagnosis" ISB incidents, respectively. As an example each table represents five queries pursued by parents for each category of their information needs. The complete lists of parents' queries in both ISBs are represented in Appendix section 7.3.1. It must be noted that while a number of questions indicated by parents seem to be yes/no type of questions but the answer to these question usually are not yes/no and mostly depends on specifications and severity of the child's condition.

[34] These three categorising criteria formed during the interviews.

**Table 5-4: Example of parents' queries sought in the latest ISB incident, categorised by type of information needs**

| Query | Type of query |
|---|---|
| Can children with autism learn how to read and write? | Domain info |
| How much does education cost? | Domain info |
| Benefits and side effects of medicines | Domain info |
| Complete medicines' information | Domain info |
| Is there a medicine to help a child with autism? | Domain info |
| Do school's benefits outweigh the problems associated with attending school? | Problem info |
| How to teach him not to take off his cloths before getting in bathroom? | Problem info |
| How to teach him to avoid improper acts? | Problem info |
| How to teach him to wash himself properly at shower? | Problem info |
| looking for similar people's experiences in ordinary and special schools (with exact problem) | Problem info |
| Looking for clips to show how similar problems are treated | Problem solving info |
| Does ABA helps without sport/behaviour therapy/medicine? | Problem solving info |
| Seeking for consultancy on how to impact the problems her son has? | Problem solving info |
| What should be done for his overweight/behaviour/energy problems? | Problem solving info |
| Which doctor to go to? | Problem solving info |

**Table 5-5: Example of parents' queries sought in an "early after receiving the diagnosis" ISB incident, categorised by type of information needs**

| Query | Type of query |
|---|---|
| Can children with autism communicate through writing if cannot speak? | Domain info |
| Can these children go to school? Do they have the ability to get educated? | Domain info |
| Learn about importance of education for these children | Domain info |
| Is it right to prescribe medicine for these children? | Domain info |
| Does autism have a medicine? | Domain info |
| Is it right that I push him to do something? I usually don't | Problem info |
| Can she hold a pen because of sensing problems? | Problem info |
| Looking for other parents in internet experiencing exact same problem | Problem info |
| In what range of autism my child falls? | Problem info |
| How did my child become Autistic? (examine the hypothesis) | Problem info |
| How to help him quit his irregular love to specific objects? | Problem solving info |
| Is the therapist I have chosen is the best? | Problem solving info |
| What kind of interventions can help my child to be independent? | Problem solving info |

Following the identification of parents' perceived information needs, the subsequent section explains the impact of parents' perceived information needs on their source preference behaviour by leveraging the concepts of information horizons and pathways.

### 5.3.2 The impact of information needs on source preference behaviour

The QRD model suggests that the source preference actions are measured by information horizons and information pathways. Similar to perceived information needs, parents' source preference behaviour also was measured for two information

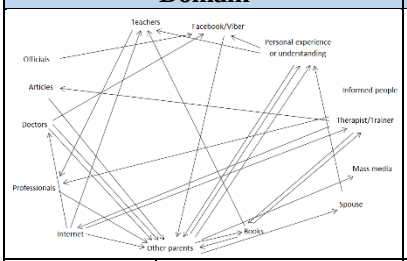
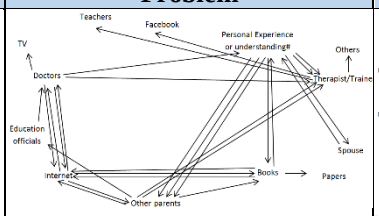
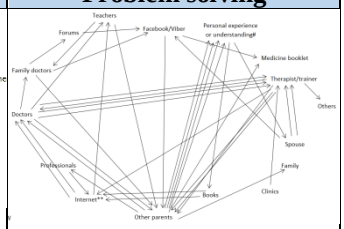
seeking incidents. As described in section 5.2, for each incident, parents were asked to draw three information horizon and pathway diagrams. This separately collected data for categories of information needs has allowed the researcher to analyse the impact of users' perceived information needs on their source preference behaviour.

#### 5.3.2.1 Information pathways

The QRD model proposed that perceived information needs impact seekers' source preference behaviour. One of the tools used for measuring the source preference behaviour is the "information pathways" tool. Information pathways define the sequence through which parents have used the information sources in their information horizon. As described in section 4.6.1.5.2, the data collected from information horizon and pathway diagrams were analysed by leveraging a graphical analysis method. This analysis method identifies the role that each information source plays in the information horizon by comparing the number of incoming and outgoing queries for each source. The information pathways also graphically display the popular sources in the information horizons. Table 5-6 presents the information pathways[35] pursued by parents in the latest ISB for all three categories of information needs together to simplify the comparison and discussion (in all pathways information sources are positioned similarly).

[35] Full screen pathways are presented in Appendix section 7.3.3.2.

**Table 5-6: Summary of parents' information pathways pursued in their latest ISBs**

| | Domain | Problem | Problem solving |
|---|---|---|---|
| |  |  |  |
| Being 1st source in X% of ISBs | Doctors, 25% | Personal experience, 45% | Doctors, Other parents, Spouse, 21% |
| Avg number of source used/ISB | 3.38 | 3.82 | 3.86 |
| Avg no of relationships/ ISB | 3.5 | 2.77 | 2.89 |
| Number of relationships | 28 | 30.5* | 40.5* |
| Number of queries | 21 | 35 | 40 |
| Number of collected diagrams | 8 | 11 | 14 |

*When parents have used only one information source in their ISB, the number of relationships for this behaviour has been counted as 0.5 as using one source has been considered as one incoming query but no outgoing.

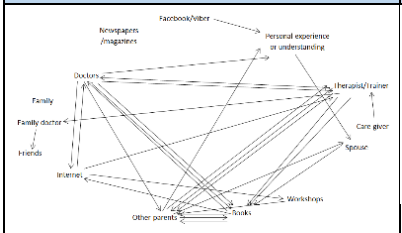
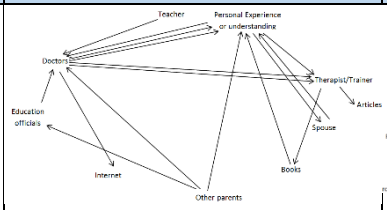
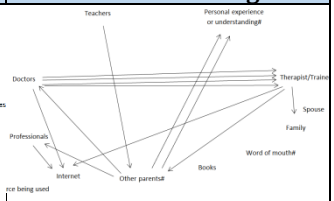
In Table 5-6 the comparison between the first sources sought by parents for each category of information needs indicates that parents started their ISB from different sources when seeking different types of information. It has been argued that in equivocal situations, equivocality should be resolved first (Daft & Lengel, 1986). Therefore assuming that the first sources sought by parents are used for equivocality resolution, suggests that for different information needs parents have preferred different sources for resolving equivocality.

Data derived from information pathways presented in Table 5-6 are used to describe the pathways parents have followed for each category of their information needs. From the 17 interviewees who filled the information horizon and pathway diagrams for their latest ISB, 14/17 (82%) have performed problem solving specific ISB, 11/17 (65%) have performed problem specific ISB and 8/17 (47%) have performed domain specific ISB. This differentiation indicates that parents show different interests in seeking different types of information.

To obtain their required information, parents have used more than one information source regardless of the type of information they were seeking. However the average number of sources they have sought in their latest ISB for domain information (3.3) is different from the number of sources they have used for problem and problem solving information (both 3.8). On the other hand the higher average relationship per ISB in domain ISBs, indicates that while parents tend to use fewer sources in their domain ISBs but they have used one source more than once in a single ISB. In total, Table 5-6 indicates that in parents' latest ISB, their problem and problem solving ISB are very similar but both are different from parents' domain ISB.

Critical incident technique in this study enabled the researcher to study another information seeking incident in which children had been recently diagnosed with autism and their parents were unexperienced in caring a child with autism. Table 5-7 provides a summary[36] of parents' ISBs pursued in this incident.

**Table 5-7: Summary of parents' information pathways pursued in "early after receiving the diagnosis" ISBs**

| | Domain | Problem | Problem solving |
|---|---|---|---|
| |  |  |  |
| Being 1st source in X% of ISBs | Doctors, 27% | Other parents, 42% | Doctors, Other parents, 33% |
| Avg number of source used/ISB | 4.64 | 3 | 2.5 |
| Avg no of relationships/ ISB | 2.64 | 2.43 | 1.33 |
| Number of relationships | 29 | 17 | 16* |
| Number of queries | 43 | 7 | 3 |
| Number of collected diagrams | 11 | 7 | 12 |
| *When parents have used only one information source in their ISB, the number of relationships for this behaviour has been counted as 0.5 as using one source has been considered as one incoming query but no outgoing. | | | |

[36] Full screen pathways are represented in Appendix section 7.3.4.2

In Table 5-7 the comparison between the first sources being sought by parents for each category of information needs also indicates that parents started their ISB by different sources when seeking different types of information. Yet in comparison to experienced parents' behaviour, they used fewer sources and the average popularity of first sources were higher. Furthermore, Table 5-7 indicates that from the 14 interviewees who filled in the information horizon and pathway diagrams for their "early after receiving the diagnosis" ISB, 12 (86%) have performed problem solving specific ISB, 7 (50%) have performed problem specific ISB and 11 (79%) have performed domain specific ISB. This differentiation indicates that parents show different interest in seeking different types of information.

The average numbers of sources that parents seek for problem solving and problem information are 2.5 and 3, respectively. However, for domain information they have accessed 4.6 number of sources in each ISB which is considerably higher. The comparison between the average number of relationships and the average number of sources used in each ISB indicates that parents tend to use domain and problem information sources more than once in one ISB. In total, Table 5-7 confirms that unexperienced parents also follow different pathways for distinct categories of information needs.

An interesting observation made from Table 5-7 indicates that unexperienced parents had only three problem solving specific queries but 12/14 (86%) sought problem solving information. The reason for this contradiction is that at "early after receiving the diagnosis", many parents were looking for information to solve the problems, however their queries were usually very general that could not be categorised as problem solving. So, they were referring to doctors or other parents seeking information to solve their problems (e.g. parenting a child with autism) with very general queries (e.g. "does autism have a medicine?") that in this study are categorised as domain information queries.

In addition to the information reported in Table 5-6 and Table 5-7, Sonnenwald et al. (2001) suggests that information pathways can be used to identify the role of information sources in seekers' information horizon based on the differentiation between the number of incoming and outgoing information requests for each source

(see the analysis method in section 4.6.1.5.2). As described by Sonnenwald et al. (2001), if in information pathways the number of outgoing arrows are higher than the number of incoming arrows by more than 1, the source was labelled as "recommending". It means that these sources recommend other sources of information to the seekers. This definition suggests that the recommending sources may have the ability to resolve seekers' large queries into smaller ones and recommend other sources for resolving the more manageable queries. As a result, the recommending sources are very similar to equivocality resolution sources as in equivocal situations they also should be able to resolve the equivocality and break large queries into smaller ones and recommend other sources to answer them. For example, a doctor, as a recommending source, is expected to be able to break down parents' general queries into smaller ones, answers them and/or recommend other sources to answer them. If the incoming arrows to a source are higher than outgoing ones by more than 1, these sources are called "focusing". It means that the seekers tend to end their seeking behaviours at this source. The information in these sources may have helped the parents in making their decisions. The focusing sources are very similar to sources which reduce the uncertainty since they are the ones providing the final answers. Finally, if the numbers of incomings and outgoings arrows are equal or different by 1, it is a "balanced" source, suggesting that they are not the main sources for resolving equivocality or for answering the specific queries but do a bit of both.

Table 5-8 provides an example of information pathways analysis conducted for determining the roles of information sources that parents have used in their latest domain ISBs. Two tables similar to Table 5-8 provide an analysis of the role of information sources in parents' problem and problem solving ISBs. These tables are presented in detail in Appendix section 7.3.3.2.

**Table 5-8: The role of information sources used in the latest ISB for domain information**

| Source | Incoming | Outgoing | Total links | Type of source |
|---|---|---|---|---|
| Other parents | 8 | 5 | 13 | Focusing |
| Personal experience | 3 | 3 | 6 | Balanced |
| Therapist/Trainer | 2 | 4 | 6 | Recommending |
| WWW | 1 | 4 | 5 | Recommending |
| Books | 2 | 3 | 5 | Balanced |
| Doctors | 1 | 3 | 4 | Recommending |
| Social Networks | 3 | 1 | 4 | Focusing |

Information sources may perform different roles in the information horizon depending on the type of information that they provide. Table 5-9 illustrates information sources average use and their roles when providing different types of information. Data suggests that except for two sources (i.e. books and doctors) the role of information sources varies based on the type of information it provides. For example, parents are more likely to use other parents' information to meet their domain information needs than their problem and problem solving information needs. The different roles that the same information source performs for providing diverse types of information needs also can be used to illustrate the impact of the type of perceived information needs on parents' information seeking actions.

**Table 5-9: The role of information sources in parents' information horizon in the latest ISB**

| Source | Avg. use | Domain | Problem | Problem solving |
|---|---|---|---|---|
| **Other parents** | 67% | Focusing | Balanced | Balanced |
| **Doctors** | 45% | Recommending | Recommending | Recommending |
| **WWW (internet)** | 45% | Recommending | Balanced | Balanced |
| **Personal experience** | 45% | Balanced | Recommending | Focusing |
| **Therapist/trainer** | 39% | Recommending | Focusing | Balanced |
| **Books** | 30% | Balanced | Balanced | Balanced |
| **Social networks** | 21% | Focusing | ------- | Balanced |

Similar data also has been collected from parents' ISB pursued in an "early after receiving the diagnosis" information seeking incident. Table 5-10 illustrates the roles performed by the information sources when providing information to unexperienced parents. This table outlines[37] how information sources performed different roles based on the type of information they were providing. In the "early after receiving the diagnosis" information seeking incident, parents used "personal experience" constantly as a focusing source for all categories of their information needs. This means that parents have made the final decisions mostly based on their personal experience. Nevertheless, for unexperienced parents, the rest of the information sources have performed varied roles when used for different categories of information needs.

[37] Detailed analysis tables are represented in Appendix section 7.3.4.2.

**Table 5-10: The role of information sources in parents' information horizons in an "early after receiving the diagnosis" ISB**

| Source | Avg. use | Domain | Problem | Problem solving |
|---|---|---|---|---|
| **Doctors** | 63% | Recommending | Balanced | Recommending |
| **Other parents** | 57% | Focusing | Recommending | Balanced |
| **Personal experience** | 40% | Focusing | Focusing | Focusing |
| **Therapist/trainer** | 37% | Recommending | Balanced | Balanced |
| **WWW (internet)** | 30% | Balanced | --- | Focusing |
| **Books** | 30% | Focusing | Balanced | --- |
| **Spouse** | 20% | Balanced | Balanced | --- |

Following subsection defines the impact of information needs on parents' information horizons.

#### 5.3.2.2 Information horizon

Information horizons are formed by the information sources that users are aware of and use. Information horizons are also derived from information horizon and pathway diagrams drawn by parents. To define parents' information horizons, the information sources that they had drawn were entered into the Microsoft Access 2010 database. Following the data entry, querying data identified the most popular sources and their popularity amongst parents.

Within the information horizon, sources were categorised into three ***zones***. These zones consist of the most important sources (zone #3), partially important sources (zone #2) and peripherally important sources (zone #1) (Savolainen & Kari, 2004; Savolainen, 2007). To identify the importance of each source for users, each zone in information horizons had been given a mark. 3 to the most important sources, 2 to the partially important sources and 1 to the peripherally important sources. The average of the importance marks[38] given to each source by the users determines the importance of an information source to them.

From the 17 parents who were interviewed about their latest ISB, eight domain information seeking diagrams, 11 problem information seeking diagrams and 14 for problem solving information seeking diagrams (33 in total) were collected. The information sources they used for each category of information needs and the importance mark given to each information source has been entered to the Microsoft

[38] Source importance mark has been calculated by dividing sum of all the marks given to a source to the total number of times that information source has been drawn in the pathways

Access 2010 database. Following the data entry, querying[39] the database returned the information sources used by parents for different categories of information needs, accompanied with their average importance and popularity. The category specific tables that are created for the information sources that parents have used for each category of their information needs are presented in Appendix section 7.3.3.1. Table 5-11 displays parents' information horizon for all three categories of information needs in their latest ISB. The information presented in this table includes four pieces of data which are presented in each cell. They are: 1) each source' average use as a percentage, 2) each source' average use in order, 3) sources' role[40] in information horizon and 4) their importance to users categorised based on type of information that information source provides.

**Table 5-11: Parents' top seven popular sources sought for three categories of information needs in the latest ISB**

| Source | Domain* | Problem* | Problem solving* | Overall* |
|---|---|---|---|---|
| **Other parents** | 88% / 1st<br>Focusing/2.29 | 45% / 4th<br>Balanced/2.6 | 71% / 1st<br>Balanced/2.4 | 67%/1st |
| **Doctors** | 38% / 2nd<br>Recommending/2.33 | 45% / 4th<br>Recommending/2 | 50% / 2nd<br>Recommending/2.71 | 45% /2nd |
| **WWW (internet)** | 38% / 2nd<br>Recommending/1.67 | 55% / 2nd<br>Balanced/2.5 | 43% / 3th<br>Balanced/2.17 | 45% /2nd |
| **Personal experience** | 38% / 2nd<br>Balanced/3 | 64% / 1st<br>Recommending/3 | 36% / 5th<br>Focusing/3 | 45% /2nd |
| **Therapist/trainer** | 12% / 7th<br>Recommending/1 | 55% / 2nd<br>Focusing/2 | 43% / 3th<br>Balanced/2.5 | 39% / 5th |
| **Books** | 25% / 6th<br>Balanced/1.5 | 45% / 4th<br>Balanced/2.6 | 21% / 6th<br>Balanced/2.67 | 30% / 6th |
| **Social media** | 38% / 2nd<br>Focusing/2.33 | 9%/7th<br>----/2 | 21%/6th<br>Balanced/2.23 | 21%/7th |

*Provided data in each cell are, source usage average in %/source usage in order/role of source/importance average (1-3), respectively. The unit of analysis is the number of filled diagrams (e.g. 17 interviewees have filled 8 domain info. seeking diagrams 7 including other parents as a source so other parents average use for domain information seeking is 7/8=88%).

[39] The SQL query is: SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], [**S-AS/U+CT].[Number of filled maps], Round(((Count(Sources.Source)/[**S-AS/U+CT].[Number of filled maps])*100),0) AS [Popularity %] FROM Sources, [**S-AS/U+CT] WHERE (((Sources.Current_source)=Yes) AND ((Sources.Type_of_query) Is Not Null) AND [**S-AS/U+CT].Type_of_query=Sources.Type_of_query) GROUP BY Sources.Source, Sources.Type_of_query, [**S-AS/U+CT].[Number of filled maps] ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC;

[40] Derived from information pathways but included in this table to simplify the presentation.

Four similar queries were run on the database to generate Table 5-11: three queries for categories of information needs and one for the overall popularity[41] of information sources, regardless of the type of information that each source has provided. Table 5-11 illustrates the top seven most commonly used information sources by parents. These seven information sources have been used by at least 20% of parents and are considered as parents' information horizon. As anticipated, at this level, the same sources were used for all types of information needs only with different priorities.

Taking advantage of the critical incident technique enabled the researcher to collect two sets of data from parents about two incidents of their ISB. As described in section 5.2, 14 parents were queried about their "early after receiving the diagnosis" ISB. From that 14 parents, 11 domain information seeking diagrams, seven problem information seeking diagrams and 12 problem solving information seeking diagrams (30 in total) were collected. The category specific tables generated for the information sources that parents have used for each category of their information needs are displayed in Appendix section 7.3.4.1. Table 5-12 displays parents' information horizon for all three categories of information needs in an "early after receiving the diagnosis" ISB. The information presented in this table includes four pieces of data which are presented in each cell. They are: 1) each source' average use in percentage, 2) each source' average use in order, 3) sources' role[42] in information horizon and 4) their importance to users categorised based on type of information that information source provides.

[41] The SQL query is: SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round(((Count(Sources.Source)/33)*100),0) AS [Popularity %] FROM Sources WHERE Sources.Current_source=Yes AND Sources.Type_of_query IS NOT NULL GROUP BY Sources.Source ORDER BY Count(Sources.Source) DESC;

[42] Derived from information pathways but included in this table to simplify the presentation.

**Table 5-12: Top seven popular sources sought for three categories of information needs in an "early after receiving the diagnosis" ISB**

| Source | Domain* | Problem* | Problem solving* | Overall* |
|---|---|---|---|---|
| **Doctors** | 64% / 2nd<br>Recommending/2.43 | 86% / 1st<br>Balanced/2.67 | 50% / 1st<br>Recommending/2.67 | 63% / 1st |
| **Other parents** | 73% / 1st<br>Focusing/2.25 | 43% / 2nd<br>Recommending/3 | 50% / 1st<br>Balanced/2.83 | 57%/ 2nd |
| **Personal experience** | 36% / 6th<br>Focusing/2.25 | 43% / 2nd<br>Focusing/2.33 | 42% / 3rd<br>Focusing/2.8 | 40% / 3rd |
| **Therapist/trainer** | 45% / 4th<br>Recommending/2.8 | 43% / 2nd<br>Balanced/3 | 25% / 4th<br>Balanced/3 | 37% / 4th |
| **WWW (internet)** | 45% / 4th<br>Balanced/2.2 | 14% / 5th<br>---/3 | 25% / 4th<br>Focusing/1.67 | 30% / 5th |
| **Books** | 64% / 2nd<br>Focusing/2.57 | 14% / 5th<br>Balanced/3 | 8% / 7th<br>---/3 | 30% / 5th |
| **Spouse** | 27% / 7th<br>Balanced/3 | 14% / 5th<br>Balanced/3 | 17% / 6th<br>---/2.5 | 20% / 7th |

*Provided data are, source usage average in %/source usage in order/role of source/importance average (1-3), respectively. The unit of analysis is the number of filled diagrams (e.g. 14 interviewees have filled 11 domain info. seeking diagrams 8 including other parents as a source so other parents average use for domain information seeking is 8/11=73%).

As discussed by Johnson et al. (2006), seekers may prefer certain sources within their environment over the others. Savolainen and Kari (2004) and Savolainen (2007) and Savolainen (2008) use the idea of information zone to categorise the information sources inside information horizons. Savolainen and Kari (2004) and Savolainen (2007) method[43] to categorise the importance of information sources has been leveraged to determine each source average importance. However, as can be seen in Table 5-11 and Table 5-12, the average importance of the majority of information sources for different categories of information needs are indicated to be very similar in both ISB incidents. This is due to parents having difficulties in differentiating the importance of information sources. To most of them, all the information sources are equally important. Therefore, the researcher derived a second technique to identify information sources' importance to users and to study the reality from a second perspective. Employing multiple methods to analyse the same subject is also in line with the researcher's choice of following critical realism and pluralism.

To identify the most important sources in parents' information horizon, the researcher used the average number of sources used by parents for each category of information needs. The average number of sources used by parents in their latest ISBs is between 3 and 4 (see Table 5-6). Therefore the first four information sources

[43] They use information zones to collect the importance but do not use average importance.

in parents' information horizons are assumed as the most important information sources (see Table 5-13 and Table 5-14).

Table 5-13 must show the top four information sources with the highest usage average for all three categories of information needs. However for domain information four sources become the second and therefore five information sources are displayed for this category of information. For problem information three sources become the 4th source and so covering one more source would push the list up to the 6th source which would spoil the analysis. Similar story is valid for Table 5-14.

**Table 5-13: The most important information zone[44] (latest ISB)**

| Domain | Problem | Problem solving |
|---|---|---|
| Other parents<br>88% / 1st | Personal experience<br>64% / 1st | Other parents<br>71% / 1st |
| Doctors<br>38% / 2nd | Therapist/trainer<br>55% / 2nd | Doctors<br>50% / 2nd |
| WWW (internet)<br>38% / 2nd | WWW (internet)<br>55% / 2nd | WWW (internet)<br>43% / 3th |
| Personal experience<br>38% / 2nd | | Therapist/trainer<br>43% / 3th |
| Social media<br>38% / 2nd | | |
| Provided data are, source usage average in %/source usage in order | | |

Table 5-13 suggests that despite the similarity of the top seven sources used for all types of perceived information needs, the top four popular sources used by parents in their latest ISBs were different. Scanning these information sources indicates that except "WWW", no other source/media constantly remains at the most important information zone. *This finding justifies that the most important information zones considered by parents is affected by the type of information that parents seek even though parents' information horizon for all types of information needs are the same.*

Similar to Table 5-13, Table 5-14 identifies the most important information sources for parents in an "early after receiving the diagnosis" ISB. In Table 5-14 the top three information sources are displayed since the average number of information sources being used by parents in this ISB is about three. Interestingly, despite the

[44] Most important information zone includes the top frequently used information sources e.g. if average number of sources used for domain information seeking is 3.5, the four most commonly used sources are in the most important information zone.

clear differentiation between the first four sources used by parents in their latest ISB, at "early after receiving the diagnosis" stage parents were relying on very similar sources for all categories of their information needs. Therefore, "Doctors", "Other parents" and "Personal experience" are the top three sources for problem and problem solving information seeking and only for domain information "Books" replace "Personal experience".

**Table 5-14: The most important information zone (early after receiving the diagnosis ISB)**

| Domain | Problem | Problem solving |
|---|---|---|
| Other parents<br>73% / 1st | Doctors<br>86% / 1st | Doctors<br>50% / 1st |
| Doctors<br>64% / 2nd | Other parents<br>43% / 2nd | Other parents<br>50% / 1st |
| Books<br>64% / 2nd | Personal experience<br>43% / 2nd | Personal experience<br>42% / 3rd |
| | Therapist/trainer<br>43% / 2nd | |
| Provided data are, source usage average in %/source usage in order | | |

The next section concludes the answers to RQ1.

### 5.3.3 Conclusion to RQ1

It is proposed that analysing ISBs that users pursue for varied types of their information needs can help analysts and designers in meeting users' needs in their designs. For instance identifying other parents as the most popular source of information that parents use for domain information can highlight the role of social networks for providing this type of information. As a result the objective of this question was to investigate the relationship between users' perceived information needs and source preference behaviour. The data collected from parents of children with autism have been used to study this relationship. In the QRD model, users' source preference behaviour is measured by information horizons and pathways. By leveraging these two tools to analyse parents' source preference behaviour, it was concluded that for distinct types of information needs parents show different source preference behaviour.

During the process of data collection and analysis, the QRD model proves its ability to categorise users' source preference behaviour based on the categories of

information needs. Taking advantage of information pathways also enables the researcher to categorise information sources based on their role in equivocality and uncertainty resolution as the QRD model suggests. Table 5-15 and Table 5-16 categorised parents' information horizon based on the type of information they provide and the role they play in users' information horizon as it was recommended in section 2.4. The only differentiation between the presentation structure in Table 5-15 and Table 5-16 and the one suggested in section 2.4 is that these two tables include an extra column named confirming sources. The reason for this modification is that the result of instrumental case study identifies many sources in parents' information horizon as balanced sources. By comparing Sonnenwald et al. (2001) methods for identifying balanced sources with researcher's observations of their role in parents' information horizons, he has categorised them as the confirming information sources.

**Table 5-15: Parents' categorised information horizon in the latest ISB**

| | **Equivocality resolution (Recommending)** | **Confirming (Balanced)** | **Uncertainty resolution (Focusing)** |
|---|---|---|---|
| **Domain** | Doctors<br>WWW<br>Therapist/trainer | Personal experience<br>Books | Other parents<br>Social media |
| **Problem** | Doctors<br>Personal experience | Other parents<br>WWW<br>Books | Therapist/trainer |
| **Problem solving** | Doctors | WWW<br>Other parents<br>Therapist/trainer<br>Social media<br>Books | Personal experience |

**Table 5-16: Parents' categorised information horizon in an "early after receiving the diagnosis" ISB**

| | **Equivocality resolution (Recommending)** | **Confirming (Balanced)** | **Uncertainty resolution (Focusing)** |
|---|---|---|---|
| **Domain** | Doctors<br>Therapist/trainer | WWW<br>Spouse | Other parents<br>Personal experience<br>Books |
| **Problem** | Other parents | Spouse<br>Books<br>Therapist/trainer<br>Doctors | Personal experience |
| **Problem solving** | Doctors | Therapist/trainer<br>Other parents | WWW<br>Personal experience |

The recommending sources have been used to reduce the equivocality because they are the first sources used by seekers and lead them to other sources. For example, doctors, as a recommending and the most popular first source, lead parents to other information sources to answer the queries which are raised from resolving equivocality (Daft & Lengel, 1986). On the other hand, the focusing sources narrow the information seeking process. It is assumed that finding some information in the focusing sources, reduces the uncertainty and helps the decision makers in making their decisions and stop seeking information. Another reason to use focusing sources could be to confirm the information sought from the recommending sources. For instance, when a doctor recommends a therapy, confirming the effectiveness of this therapy by other parents or therapists may lead parents to making the final decision. Finally, the definition of balanced sources suggests that they assist both resolving equivocality and finalising decisions but specialised in none.

Equivocality resolving sources are proposed to need the richest media (Daft & Lengel, 1986; Sonnenwald et al., 2001). The findings of this study is in line with this proposition since the data shows that 70% (7/10) of recommending sources and 100% of popular starting nodes have been selected from the human/face-to-face sources. In the age of social media, it is important to realise that in critical equivocal contexts, a premium is still attached to face to face communication. On the other hand, this study also indicates the rising importance of social media enabled interaction. One could argue that the average use of social media will increase further in future years following its rapid popularity increase. Middle age Iranian society for instance has shown an incredible interest in the mobile social networks in the past few years (e.g. Viber, Telegram, Whatsapp). The data collected in this study also highlights social networks as the media showing the highest increase of average use in comparison to the other information sources in parents' information horizon by 18% increase in usage. This popularity increase indeed makes social media a strong platform candidate for development of information systems to be used by parents of children with autism in Iran. However it must be noted that only 47% of parents have used social media for seeking information which makes it the 7$^{th}$ popular source in their information horizon.

If recommending sources cannot resolve the equivocality, seekers' confusion remains and their queries would not be resolved into more specific ones. Unfortunately, the researcher's observations indicate that at least in 23% (4/17) of cases, parents were still struggling with equivocality (learnt from their high level queries as parents were just describing the problem. These parents also were expressing their confusion). In these cases, none of the sources used by parents could resolve the equivocality.

The findings of this study is not in line with one part of the findings of the Savolainen (2008) study. Savolainen (2008) indicates that information seekers use information sources in the same order as their importance to users. That is, an information seeker uses the most important source first, then the partially important sources and subsequently the peripherally important sources. However the findings of this study suggest that the sequence through which users seek information in most cases is not related to importance of sources to users probably due to the complexity of the decision they should make. For example, people may use peripherally important sources first, then the most important sources and then partially important ones. As a result, in this study it has been suggested that in equivocal decision making situations the sequence through which users access information sources is due to sources' equivocality and uncertainty resolution abilities not their importance to users.

In this study, the researcher categorised information needs into domain, problem and problem solving queries and seekers' ISBs showed that they behave differently when seeking varied types of information. The researcher suggests that seekers' ISBs would differ when they seek different types of information regardless of how their information needs have been categorised. Studying the impact of other methods of categorisation of information needs on seekers' source preference behaviour might be more practical to study other contexts.

The following section discussed the response drawn from the collected data to RQ2.

## 5.4 RQ2: How does the QRD model unpack users' information quality requirements and its relationship with information needs in equivocal situations?

As described in chapter two, in equivocal decision making situations extra attention should be paid to determining the characteristics of users' required information i.e. *perceived information needs, quality* and *source*. Identifying these characteristics will assist analysts and designers in creating quality information systems. As a result, the focus of RQ2 is twofold:

- Unpacking users' IQ requirement to address its measurement and applicability challenges i.e. identifying the context specific IQ dimensions, their priority for users, and the definitions of IQ dimensions.
- Explaining the relationship between users' IQ requirements and information needs.

IQ dimensions in this study is proposed to have the ability to quantify the characteristics of information requirements. Therefore it can assist information analysts in identifying the problems in the context and measure them during the IRD phase. This study is unique in this regard for the following three main reasons:

1. IQ dimensions have not been used as a tool to quantify the information requirement characteristics at IRD stage of system development projects before.
2. The QRD method identifies the IQ requirement that users expect from every information sources that are available in their information horizon. Determining the IQ requirements users expect from the entire information horizon rather than an isolated source results in identification of task/decision specific IQ requirements not the source specific ones.
3. Users define IQ dimensions and their priority based on their experience and do not rate or define presented IQ dimensions based on their knowledge, best judgment or ideals.

RQ2 identifies two categories for IQ. One category represents quality dimensions which are ***information specific*** and are measured by the information content alone.

This category includes *intrinsic and contextual IQ*. The second category of IQ dimensions are ***source specific*** and includes *representational* and *accessibility* IQ dimensions. The same type of categorisation may apply to measurement factors employed by users for evaluating IQ dimensions.

To meet the requirements of pluralism, for determining parents' IQ requirements, the researcher has used multiple analysis techniques. The following section discusses and compares the results of leveraged analysis techniques to discover the IQ dimensions necessary to be met by the proposed information system and its different subsystems or applications. Additionally, the following section defines identified IQ dimensions and explains the factors through which parents have measured them.

### 5.4.1 Quality requirements: dimensions, priority, definition and measurement factors

As proposed by the QRD model, the quality requirements of potential system users have been defined as a combination of the following characteristics:

1. The required IQ dimensions to be met by the proposed system
2. Priority of the required IQ dimensions for the users
3. Definition and measurement factors for evaluation and implementation of each IQ dimension

These three components of IQ are defined through the users' perspective in next three subsections.

#### 5.4.1.1 Quality requirement dimensions

Quality requirements construct is proposed by the QRD model as the reasons for system users' source preference behaviour. During the interviews, 20 information sources[45] were identified in parents' information pathways diagrams which were mentioned by parents more than once. Parents' positive and negative evaluation of the quality of these sources or the information conveyed by them were coded and listed in Table 5-17 and Table 5-18, respectively. The numbers in each cell indicates

[45] Only sources that at least two individuals indicated same quality dimension for, are listed in this section.

the number of individuals indicating a quality dimension as a positive or negative criteria of an information source. Next to the name of each source in these tables, the number of individuals who were queried about source's quality dimensions is represented in brackets. At the bottom of the tables, the total number of individuals indicating a dimension and the total number of sources each dimension has been considered for, are presented. It should be noted that if one individual has considered the same dimension for two sources, the number of individuals indicating that dimension has been counted as 2. All the dimensions indicated for more than two sources or more than four times for a single source are highlighted in green for dimensions with positive impact on parents' decisions and in red if indicated for having a negative impact.

**Table 5-17: IQ dimensions having positive impact on parents' source preference**

| | **Other parents (17)** | **Doctors (16)** | **Personal experience (14)** | **Therapist/Trainer (14)** | **WWW (10)** | **Books (9)** | **Social Networks (8)** | **Teachers (6)** | **Professionals (6)** | **Spouse (5)** | **Mass media (5)** | **Trusted doctors (3)** | **Multimedia (2)** | **Sum** | **T.N. of sources** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Completeness | | | | | | | | | | | | | 2 | 2 | 1 |
| Consulting | | | | | | | | | | 2 | | 2 | | 4 | 2 |
| Accessibility | | | | | 6 | | | | | | | | | 6 | 1 |
| Interaction with child | | | 6 | 2 | | | | 2 | | | | | | 10 | 3 |
| Caring | | | 2 | | | | | 2 | | | | | | 4 | 2 |
| Personal reas. | | 2 | 2 | | | | | | | | | | | 4 | 2 |
| Reputation | | 2 | | 3 | | 2 | | | | | | | | 7 | 3 |
| Scientific | | 4 | | 2 | | 2 | | | 2 | | | | | 10 | 4 |
| Info dissemination | | | | | | | 3 | | | | | | | 3 | 1 |
| Fast | | | | | 2 | | | | | | | | | 2 | 1 |
| Detailed | | | | | | 2 | | | | | | | | 2 | 1 |
| Convenient | | | | | 2 | | | | | | | | | 2 | 1 |
| Hope | | | | | | 2 | | | | | | | | 2 | 1 |
| Timeliness | | | | | 2 | | | | | | 2 | | | 4 | 2 |
| Amount of relevant info | 2 | 3 | | 2 | 4 | | | | | | | | | 11 | 4 |
| Informative | 2 | | | 2 | | | 2 | | | | | | | 6 | 3 |
| Networking | 2 | | | | | | 5 | | | | | | | 7 | 2 |
| Speciality | 2 | 3 | | | | | | | | | | | | 5 | 2 |
| Practical | 4 | | | | | 2 | | | | | | | | 6 | 2 |
| Reliability | 4 | 4 | 2 | 3 | | | | 3 | 3 | | | 2 | | 21 | 7 |
| Empathy | 10 | 3 | | | | | 2 | | 2 | | | | | 17 | 4 |
| Experience | 11 | | | 4 | | | | | 2 | | | | | 17 | 3 |

**Table 5-18: IQ dimensions having negative impact on parents' source preference**

| | Other parents (17) | Doctors (16) | Personal experience (14) | Therapist/Trainer (14) | WWW (16) | Books (9) | Social Networks (8) | Professionals (6) | Mass media (5) | Officials (3) | Sum | T.N. of sources |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interaction with child | | 7 | | 2 | | | | | | | 9 | 2 |
| Financially Biased | | 7 | | 3 | | | | | | | 10 | 2 |
| Amount of relevant info | 3 | 3 | | | 4 | 3 | | 2 | 2 | | 17 | 6 |
| Time | | | | | | | 2 | | | | 2 | 1 |
| Frightening | | | | | | 2 | | | | | 2 | 1 |
| Understand-ability | | | | | 2 | | | | | | 2 | 1 |
| Scientific | | | | | 2 | | | | | | 2 | 1 |
| Reputation | | | | | 2 | | | | | | 2 | 1 |
| Timeliness | | | | | 3 | | | | | | 3 | 1 |
| Technical issue | | | | | 3 | | 2 | | | | 5 | 2 |
| Categorising | | | | | 3 | | | | | | 3 | 1 |
| L. internet literacy | | | | | 3 | | | | | | 3 | 1 |
| Language | | | | | 6 | 2 | | | | | 8 | 2 |
| Comparison | | | | 3 | | | | | | | 3 | 1 |
| Personal reason | | | 2 | 2 | 2 | | | | | | 6 | 3 |
| Experience | | | 2 | | | | | | | | 2 | 1 |
| Responsibility | | | 2 | | | | | | | | 2 | 1 |
| Rush | | | 2 | | | | | | | | 2 | 1 |
| Accessibility | | 2 | | | | | | | | | 2 | 1 |
| Practical | | 2 | | 2 | 3 | 3 | | | 2 | 2 | 14 | 6 |
| Hope | | 2 | | 2 | | | | | | | 4 | 2 |
| Impolite | | 2 | | | | | | | | | 2 | 1 |
| Empathy | | 3 | | | | | | | | | 3 | 1 |
| Expenses | | 3 | | | | | | | | | 3 | 1 |
| Detailed | | 4 | | 2 | | 2 | | | | | 8 | 3 |
| Speciality | | 5 | | | | | | | | | 5 | 1 |
| Caring | | 5 | | 3 | | | | | | | 8 | 2 |
| Filtered info | 2 | | | | | | | | | | 2 | 1 |
| Stubborn | 2 | | | | | | | | | | 2 | 1 |
| Biased info | 4 | | | | | | | | | | 4 | 1 |
| Reliability | 10 | 6 | 2 | 7 | 6 | 4 | 2 | | | | 37 | 7 |
| Diversity | 11 | | | | | | 2 | | | | 13 | 2 |

The next section filters Table 5-17 and Table 5-18 through four perspectives to determine the priority of quality requirements needed by parents.

### 5.4.1.2 Priority of IQ requirement dimensions to users

Batini et al. (2009) indicate that *there is no general agreement between scholars on which set of IQ dimensions should be used to measure information quality*.

Therefore, in this section the priority of required IQ dimensions to parents of children with autism is analysed. To meet the requirements of critical realism and explore the reality through multiple perspectives, the priority of IQ dimensions for parents have been analysed through four perspectives as follows:

1 Frequently indicated quality dimensions (all information system)**
   - Filters the quality dimensions considered frequently for all information sources. It sorts Table 5-17 and Table 5-18 by the total number of individuals (sum) and selects the top 10 frequently indicated dimensions.

2 Quality dimension popularity **
   - Counts the number of individuals who have considered an IQ dimension for source evaluation (e.g. 13/17 parents have considered experience as a reason to use information sources).

3 Frequently indicated quality dimensions for the top four sources (most important information zone)*
   - Filters the quality dimensions considered frequently for the top four popular information sources. Based on Table 5-11, this analysis keeps only the top four sources and then sorts the remainder of Table 5-17 and Table 5-18 by the total number of individuals (sum) and selects the top 10 frequently indicated dimensions.

4 Quality dimensions causing sources' average use change over time*
   - Filters the quality dimensions considered more frequently for the sources that their popularity increases or decreases considerably over time. By comparing Table 5-11 and Table 5-12, this analysis keeps only the sources with considerable popularity change (more than 10% increase or decrease in popularity or keeping above 50% popularity) and then sorts the remainder of Table 5-17 and Table 5-18 by the total number of individuals (sum) and selects the top 10 frequently indicated dimensions.

* Categorised based on information use.

** Can be used only for determining the entire information horizon IQ requirements.

Amongst the four defined perspectives to filter the priority of IQ dimensions, quality dimension popularity perspective (second perspective in the above list) uses a different logic from the others. The differentiation of this perspective with the other three to determine the priority of IQ dimensions is explained by an example. If an interviewee has indicated reliability for using both doctors and other parents as information sources, this perspective counts the popularity of reliability dimension as one. For the other three perspectives on the other hand, if an interviewee has mentioned reliability for using both doctors and other parents, reliability dimension earns the support of 2 individuals if reliability has the support of other informants for the same sources.

All four defined perspectives return a list of IQ dimensions as the high priority IQ dimensions. To sort the priority IQ dimensions, perspectives number 1, 3 and 4, must filter Table 5-17 and Table 5-18. For instance, applying perspective number 3 (i.e. frequently indicated quality dimensions for top four sources) on these two tables generates Table 5-19 and Table 5-20, respectively. The IQ dimensions in these two tables are parents' reasons for preferring the top four popular information sources in their information horizon.

**Table 5-19: IQ dimensions positively impact the use of the top four information sources (perspective 3)**

| | Empathy | Reliability | Experience | Amount of relevant info | Interaction with child | Accessibility | Speciality | Personal reas. | Scientific | Practical |
|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 4 | 11 | 2 | | | 2 | | | 4 |
| **Doctors (16)** | 3 | 4 | | 3 | | | 3 | 2 | 4 | |
| **Personal experience (14)** | | 2 | | | 6 | | | 2 | | |
| **WWW (10)** | | | | 4 | | 6 | | | | |
| **Sum** | 13 | 12 | 11 | 9 | 6 | 6 | 5 | 4 | 4 | 4 |
| **T.N. of sources** | 2 | 3 | 1 | 3 | 1 | 1 | 2 | 2 | 1 | 1 |

**Table 5-20: IQ dimensions negatively impact the use of the top four information sources (perspective 3)**

| | Reliability | Diversity | Amount of relevant info | Financially Biased | Interaction with child | Language | Practical | Caring | Speciality | Personal reason | Detailed | Biased info |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 3 | | | | | | | | | 4 |
| **Doctors (16)** | 6 | | 3 | 7 | 7 | | 2 | 5 | 5 | | 4 | |
| **Personal experience (14)** | 2 | | | | | | | | | 2 | | |
| **WWW (16)** | 6 | | 4 | | | 6 | 3 | | | 2 | | |
| **Sum** | 24 | 11 | 10 | 7 | 7 | 6 | 5 | 5 | 5 | 4 | 4 | 4 |
| **T.N. of sources** | 4 | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 |

Table 5-21 and Table 5-22 provide IQ dimensions with the positive and negative impact on parents' source preference behaviour derived from all four analysis perspectives[46]. To calculate the total importance of each dimension, the importance of the first top five IQ dimensions derived from each analysis technique is rated as 1, second top five as 0.5 and the rest as 0.25. Adding these rates together generates the total importance for each dimension.

**Table 5-21: Synthesis of IQ requirement dimensions with positive impact**

| **Perspective 1 (Individuals/source)** | **Perspective 2 (Individuals /popularity)** | **Perspective 3 (Top 4 sources)** | **Perspective 4 (Time change)** | **Total** |
|---|---|---|---|---|
| Reliability | Experience | Empathy | Empathy | Empathy 4 |
| Empathy | Reliability | Reliability | Experience | Reliability 3+.5 |
| Experience | Empathy | Experience | Networking | Amount of rel. info 3+.25 |
| Amount of relevant information | Scientific | Amount of relevant information | Amount of relevant information | Experience 3 |
| Scientific | Reputation | Interaction with child | Accessibility | Scientific 2+.5 |
| Interaction with child | Informative | Accessibility | Informative | Accessibility 1+1+.25 |
| Reputation | Interaction with child | Speciality | Reliability | Interaction with child 1+1 |
| Networking | Accessibility | Personal reasons | Practical | Networking 1+1 |
| Informative | Practical | Scientific | | Practical 1+1 |
| Practical | Networking | Practical | | Reputation 1+.5 |
| Accessibility | Timeliness | | | Informative 1+.5 |
| Speciality | Personal reasons | | | Speciality .5+.5 |
| Timeliness | Amount of relevant information | | | Personal reasons .5+.5 |
| Personal reasons | Hope | | | Timeliness .5 |
| Caring | Detailed | | | Caring .5 |
| Consulting | Speciality | | | Consulting .25 |
| | Caring | | | Hope .25 |
| | | | | Detailed .25 |

[46] Detailed results of the other three analysis perspectives i.e. perspectives 1, 2, and 4, are presented in Appendix section 7.3.5.1.

**Table 5-22: Synthesis of IQ requirement dimensions with negative impact**

| Perspective 1 (Individuals/source) | Perspective 2 (Individuals /popularity) | Perspective 3 (Top 4 sources) | Perspective 4 (Time change) | Total |
|---|---|---|---|---|
| Reliability | Reliability | Reliability | Financially biased | Reliability 4 |
| Amount of relevant information | Amount of relevant information | Diversity | Interaction with child | Financially biased 3+.5 |
| Practical | Diversity | Amount of relevant information | Reliability | Interaction with child 2+1 |
| Diversity | Practical | Financially biased | Caring | Diversity 3 |
| Financially biased | Speciality | Interaction with child | Speciality | Amount of rel. info. 3 |
| Detailed | Language | Language | Detailed | Speciality 2+.5+.25 |
| Interaction with child | Financially biased | Practical | | Caring 1+1.5 |
| Language | Interaction with child | Caring | | Practical 2+.5 |
| Caring | Caring | Speciality | | Detailed 1+.5 |
| Personal reasons | Personal reasons | Personal reasons | | Language 1+.5 |
| Speciality | Expenses | Detailed | | Personal reasons 1+.5 |
| Hope | Biased information | Biased information | | Hope .5 |
| | Time | | | Biased info. .5 |
| | Accessibility | | | Expenses .25 |
| | Hope | | | Time .25 |
| | Detailed | | | Accessibility .25 |

***Empathy, reliability, amount of relevant information, experience and scientific*** were considered as the first top five quality dimensions to use an information source by parents. On the other hand ***reliability***, being ***financially biased***, not enough ***interaction with child, diversity*** of children and ***amount of relevant information*** are mentioned as the top five quality dimensions which negatively affect parents' decision on whether use an information source.

Identifying the high priority IQ requirements is suggested to assist IS practitioners in developing information systems by illustrating users' expectation of the proposed information system. Unlike other IQ measurement methods, the QRD method does not evaluate IQ of an isolated system, instead it looks for the most important IQ dimensions that positively or negatively impact users' source preference behaviour in the entire information horizon. Consequently, the QRD method will return a general understanding of IQ requirements in the context of interest.

The subsequent section provides the definition and measurement factors for parents' IQ requirements.

#### 5.4.1.3 Measurement factors and definitions of the required IQ dimensions

There are seventeen unique IQ dimensions amongst the top ten IQ dimensions that impact parents' source preference behaviour positively or negatively (illustrated in Table 5-21 and Table 5-22). In this section these IQ dimensions and their measurement factors are defined. During the interview, the researcher asked interviewees to explain how they measure each IQ dimension in practice. Also, as described in section 4.6.1.3.4, interviewees were asked to think aloud while they were filling the information horizon and pathway diagrams. During this step and also when parents were describing the IQ dimensions they consider for using information sources, most of parents explained the IQ dimensions' measurement factors to some degree.

Analysing the measurement factors led the researcher into identifying two categories of IQ dimension measurement factors: 1) information specific, and 2) source specific factors. Information specific factors are the ones in which information and information alone carries the quality dimension. For example, when a piece of information (a message) does not "carry contradictions" it does not matter from which source/media the user has obtained it. In other words, it does not matter if the seeker finds the information in the web and in an unknown website or heard it from a friend or a doctor, this piece of information does not carry any contradictions. On the contrary, source specific factors are the ones which are evaluated based on the source/media which is carrying the information. Regardless of the information specific quality, any information obtained from a specific media/source carries its source specific factors. For example, if a professional is known to the user as being financially biased, it does not matter what he/she says, that piece of information (message) will be evaluated as a potential financially biased piece of information, and the same story is valid when the source is known as experienced.

Table 5-23 outlines the most frequently[47] indicated IQ dimensions and their measurement factors. It should be noted that each IQ dimension may have both source and information specific measurement factors. For example, to *rely* on a

[47] Definition of IQ dimensions and their measurement factors are explained in more detail in Appendix sections 7.3.5.2 and 7.3.5.3.

message parents consider a number of source and information specific factors. Table 5-23 includes quality dimensions with both positive and negative impact on parents' behaviour. The ones which are tagged with "P" are dimensions that their availability makes a positive impact on parents' source preference behaviour. On the contrary, "N" tag indicates that availability/absence of this dimension has a negative impact on parents source preference behaviour. It should be considered that dimensions with negative impact may have more severe effects on parents' behaviour as availability of one negative dimension may prevent parents of using an information source but usually not a single positive quality dimension may cause them to use one.

**Table 5-23: Most frequently indicated IQ dimensions and their measurement factors**

| **Dimension (Positive - Negative)** | **Definition** | **Source specific measurement factors** | **Information specific measurement factors** |
|---|---|---|---|
| **Empathy P** | This dimension is available in a source when parents know that the source also has experienced the same or similar problems as they do. Other parents of children with autism carry this factor better than others. | | |
| **Reliability P-N** | It is a multi-dimension dimension which means seekers may rely and use the information obtained from a source. It indicates the degree to which seeker can trust the information/source. | Type of source (published or face to face sources are more reliable), positive experience with the source, reputation, caring, not being financially biased, having academic degree or ties, knowing the speaker personally/be a parent | Referencing, availability of author's CV, no contradiction in given info, providing evaluated info/experience, accuracy, scientific, timeliness, evidence based info (no pure opinion) |
| **Amount of relevant information P-N** | This dimension is about the volume of information that parents expect from a source. This dimension is in a close relationship with "Completeness". | Many number of available sources, speciality | International team, multi dimension info (completeness), reliability |
| **Experience P** | It refers to having a long experience in domain of autism, as a parent, therapist, doctor, official or else. Having tried interventions, plans and different professionals in the region are the most important expected outputs from experience. Provided | Source has other similar cases, parents as information source | - |

| | | | |
|---|---|---|---|
| | information by parents carries this factor. | | |
| **Scientific P** | Refers to a piece of information written by an author with academic degree and academic information, who has publications and/or works at university. Information itself should not be an everyday kind of news should include statistics and academic references. | Reputation, source's academic ties or degree | Referencing, international, timeliness, statistics and diagrams |
| **Networking P** | Provides parent with the ability to contact other parents or professionals. | | |
| **Interaction with child P-N** | This dimension is in close relationship with "Diversity". As children with autism symptoms are very diverse, parents have the feeling that only people who have a long interaction with their children and know them well are able to help them with their problems as they exactly know their child's specific problems and potentials. | | |
| **Accessibility P** | Refers to the availability of information source and convenient of access to information by it. | | |
| **Practical P-N** | Refers to a type of information which can be implemented in practice (e.g. do and do not list, problems and list of solutions for each, nutrition and therapeutic plans, available services in the region). These plans and options should be in detail (close relationship with "Detailed"). Practical information should avoid being very general. | | Referencing, offers solution options, detailed, experience, scientific |
| **Reputation P** | It is earned from recommendations of trusted individuals or other parents dealing with the same problem. Also, strong CV of the author will earn him/her the reputation. | Academic degree or ties, source is a parent | |
| **Informative P** | Refers to sources which have the ability to add to parents' knowledge (even small pieces). | | |
| **Financially biased N** | By financially benefitting from the advices that the information source gives, or if source earns more by the increase in number of patients it advices/visits, parents may become suspicious about the source to be financially biased. | | |
| **Diversity N** | It refers to the differentiation between children with autism and wide spectrum of problems which change over time. These criteria make it hard for parent to use successful experiences for their problems as very few similar cases may have the very same problem as theirs. | | |
| **Detailed N** | Information should be specific, complete and includes all the details. | | |
| **Caring N** | This dimension refers to human sources. A caring source should show signs of caring about parents. The mentioned signs are: spending time, being kind, being patient, listening well, do not focusing only on fulfilling the duty and being passionate about their job. | | |
| **Speciality N** | Information source knows about the problem in question and how to deal with it, do not do trial and error, passed relevant trainings, experienced in the subject and carries relevant academic degree. Specialty is in a close relationship with "amount of information". A person/source carrying high amount of relevant information will be considered a specialist. | Amount of relevant info, not doing trial and error, academic degree or ties | Scientific |
| **Language P-N** | To be presented in reader's mother language. | | |

It should be noted that generally most of the dimensions indicated in the Table 5-23 can have both positive and negative impacts on users' behaviour. However Table 5-23 just reports the high priority IQ dimensions indicated by parents of children with autism. So while inaccessibility of an information source in general has a negative impact on users' source preference behaviour but in this case accessibility has not been amongst the high priority IQ dimensions impacting parents' behaviour negatively. This could be because of the importance of the information being sought which causes other dimensions overweigh accessibility. This also acknowledges the user and context sensitivity of IQ.

A number of measurement factors identified for the quality dimensions may sound irrelevant but they are the ones indicated by parents. For example, reliability has been indicated as a measure for the amount of relevant information. While it may sound logically irrelevant, it could be assumed that parents believe that reliable sources provide enough volume of information, not more, not less. IQ dimensions' measurement factors are defined in detail in Appendix section 7.3.5.3 Table 7-30.

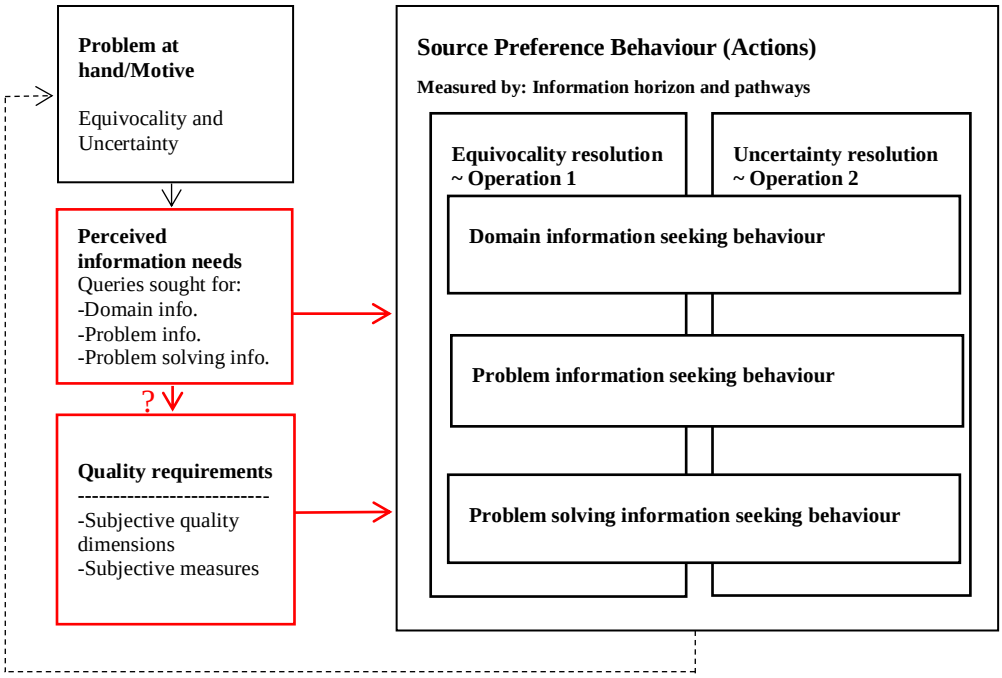
Following the identification of parents' IQ requirements, their priority and definitions, the subsequent section explains the relationship between information needs and quality requirements.

### 5.4.2 Impact of information needs on user's quality requirements

There are two constructs involved in the relationship between information needs and IQ requirements which both have been explained in sections 5.3.1 and 5.4.1, respectively. This section focuses on the evidence that the researcher could find in the data to support the relationship between information needs and quality requirements.

Asking parents directly about their quality requirements for each category of their information needs is not applicable due to the complexity of the question and the relationship. To overcome this limitation, the researcher is using an indirect relationship to explain the relationship between information needs and quality requirements, which is displayed in red in Figure 5.1.

**Figure 5.1. The relationships leveraged to explain the impact of information needs on quality requirements**




The researcher argues that since there is a relationship between IQ requirements and source preference behaviour (C. Chen & Hernon, 1982; Julien & Michels, 2004; O'Reilly, 1982; Savolainen & Kari, 2004; Savolainen, 2007, 2008) parents IQ requirements to use information sources providing different types of information needs, are in fact a representative of their IQ requirement for each category of information needs. For instance, from the IQ dimensions that parents have considered to use domain information sources, the researcher can derive the domain information IQ requirements. From the answer to RQ1, the researcher knows the information sources that parents have used for each category of information needs. These categorised sources are used in RQ2 to determine parents' quality requirements for each category of their information needs.

As described earlier, to determine the priority of IQ dimensions for users, the researcher compares their IQ requirements through four perspectives. Two of these perspectives (i.e. number 3 and 4) were used to determine the IQ requirements of each type of information needs. These two perspectives are:

1 Frequently indicated quality dimensions for top four sources (most important information zone)

- Filters the quality dimensions considered frequently for top four popular information sources. Based on Table 5-11, this analysis keeps only the top four sources and then sorts the remainder of Table 5-17 and Table 5-18 by the total number of individuals (sum) and selects the top 10 frequently indicated dimensions.

2 Quality dimensions causing sources' average use change over time

- Filters the quality dimensions considered more frequently for the sources that their popularity increases or decreases considerably over time. By comparing Table 5-11 and Table 5-12, this analysis keeps only the sources with considerable popularity change (more than 10% increase or decrease in popularity or keeping above 50% popularity) and then sorts the remainder of Table 5-17 and Table 5-18 by the total number of individuals (sum) and selects the top 10 frequently indicated dimensions.

Table 5-24 outlines[48] the top 10 frequently indicated quality dimensions that parents have indicated for having a positive or negative impact on their source preference for different categories of information needs. To determine the top four popular sources, only parents' latest ISB have been considered because of the following four reasons:

a. Parents may remember the sources they have used in an incident that happened at least five years ago, but remembering their preference logic is unlikely.
b. At "early after receiving the diagnosis" stage, parents had no previous experience with information sources to evaluate them based on their quality.
c. Parents' unexperienced quality expectations are included in their current indicated quality dimensions. In fact, part of parents' evaluation of the information sources' quality is the reflection of their early met or unmet perceived quality requirements.

[48] Details of the analysis are presented in Appendix section 7.3.5.4.

d. Quality requirements develop gradually over time in the mind of parents. So, data would be inaccurate if the researcher had asked parents to ignore a part of their experience.

In Table 5-24 to merge the data analysed by the two analysis perspectives, the five top dimensions in each analysis perspective were rated as 1, and the second top five were rated as 0.5. Comparing the IQ dimensions that parents have considered for each category of information needs, illustrates a considerable differentiation. Despite the similarity of three out of the five top IQ dimensions in all categories (i.e. reliability, experience and interaction with child), there are other dimensions which are different. For instance, in one hand empathy has been indicated among the top five IQ dimensions for using domain and problem solving sources, but not for sources providing problem specific information. On the other hand, problem specific sources are preferred when they are accessible and provide the required amount of relevant information while these dimensions are not amongst the top five IQ dimensions for the two other categories. Furthermore, being financially biased is more important if observed in problem and problem solving information sources than in domain information sources. All in all, Table 5-24 shows that parents have different IQ requirements when seeking different categories of information needs.

**Table 5-24: IQ dimensions required for categories of parents' information needs**

| | **Domain info.** | **Problem info.** | **Problem solving info.** |
|---|---|---|---|
| **Positive** | Empathy 2 | Accessibility 2 | Experience 2 |
| | Experience 2 | Amount of relevant information 2 | Empathy 2 |
| | Reliability 2 | Interaction with child 2 | Reliability 1+.5 |
| | Networking 2 | Reliability 1 | Informative 1+.5 |
| | Interaction with child 1+.5 | Experience 1 | Practical 1 +.5 |
| | Amount of relevant information 1 | | Amount of relevant information 1 |
| | Practical .75 | | Networking 1 |
| | Accessibility .5 | | Scientific 1 |
| | Speciality .5 | | Accessibility .5 |
| | Informative .5 | | Reputation .5 |
| **Negative** | Reliability 2 | Reliability 2 | Reliability 2 |
| | Practical 1+.5 | Amount of relevant information 2 | Financially biased 2 |
| | Detailed 1+.25 | Diversity 1 | Interaction with child 2 |
| | Diversity 1 | Financially biased 1 | Caring 1.5 |
| | Amount of relevant information 1 | Interaction with child 1 | Speciality 1.5 |
| | Financially biased 1 | Personal reasons 1 | Detailed 1 |
| | Interaction with child 1 | Language 1 | Diversity 1 |
| | Language .5 | Practical 1 | Amount of relevant information 1 |
| | Technical issues .5 | Caring .5 | Practical .5 |
| | Caring .5 | Speciality .5 | Language .5 |

The subsequent section concluded the response to RQ2.

### 5.4.3 Conclusion to RQ2

Identifying the high priority IQ requirements dimensions is suggested to assist IS practitioners in developing information systems by illustrating users' expectation of the proposed information system. Reminding from RQ1, for instance other parents were the most popular information source to provide domain information. This could suggest social media as a platform to deliver domain information to parents of children with autism. Following that findings of RQ2 indicates that the domain information delivered by the designed system (e.g. social media) must consider the following IQ dimensions parents expect from a good domain information source: empathy, experience, reliability, networking, interaction with child, detailed, practical, consider the diversity and not being financially biased.

To identify parents' IQ requirements, RQ2 concentrated on:

1 Unpacking users' IQ requirement in an equivocal decision making context.
2 Explaining the relationship between users' information needs and IQ requirements.

To answer the first part, IQ requirements of parents of children with autism as a case of IDMES, has been unpacked. To this purpose, parents' IQ requirements have been analysed based on the IQ dimensions they need, priority of IQ dimensions to them and IQ dimensions subjective definition and measurements.

As cited in the literature review chapter, there are several studies conducted on quality dimensions. For instance Eysenbach et al. (2002) in a comprehensive review has gone through quality dimensions considered in health information searches over the web. *Accuracy, completeness, readability, design, disclosure and reference provided* have been the most frequently used dimensions in that context. In another comprehensive review, Batini et al. (2009) also study all the available methodologies for assessing information and data quality and report *accuracy, completeness, consistency and timeliness* as the most important dimensions to assess information/data quality. This study adds that in the context of parenting children with autism, ***empathy, reliability, amount of relevant information, experience and scientific*** are determined as the top five quality dimensions having a positive impact on parents' source preference behaviour. Also ***reliability,*** being ***financially biased,*** not enough ***interaction with child, diversity*** of children and ***amount of relevant information*** are identified as top five quality dimensions having a negative impact on parents' source preference behaviour. Comparing the results of the review of literature with the IQ dimensions identified in this study, confirms the fact that most IQ dimensions are subjective and context sensitive and so their priority to users should be determined prior to developing an information system in the field.

Implementing most of IQ dimensions is not a simple task. For instance, "reliability" is a very complex dimension to measure and to implement. Parents named many factors to measure reliability and its availability in a source. It is also interconnected with other quality dimensions. Furthermore, reliability is the most

frequent quality dimension with strongest positive and negative impact on parents' information source preference. As a result RQ2 has determined IQ dimensions subjective measures. These measurement factors are proposed to provide IS practitioners with an improved understanding of how to implement a quality dimension in the final product.

In addition to IQ dimensions identified in the context of parenting children with autism, it is inferred that information sources in this context are preferred to be ***interactive***. Even though parents have not mentioned it frequently, 3/4 sources being used by them are human sources through face to face communications, which is amongst the richest media and being interactive is one of the main characteristics of such sources.

To evaluate the relationship between information needs and users' IQ requirements, the IQ dimensions that parents indicated for using the information sources providing each category of information needs have been leveraged. The comparison between these IQ dimensions, demonstrates that beside some similarities, parents also have considered a number different IQ dimensions for each category of their information needs.

As described in section 5.3.3 the information sources used by parents of children with autism are categorised based on the cognitive role they play in the information horizon. Information sources roles (e.g. information sources that resolve uncertainty for problem solving) have been used to fill the first nine cells in Table 5-25 with the relevant information sources (highlighted in yellow). Following that the findings of RQ2 which are the categorised IQ requirements are used to fill the quality requirements columns of the QRD presentation matrix shown in Table 5-25. The dimensions listed as positive quality dimensions are the top five IQ dimensions that their availability positively impacts parents decision on using an information source. On the other hand the dimensions listed as negative quality dimensions are the top five IQ dimensions that their availability or absence negatively impacts parents decision on using an information source.

**Table 5-25: QRD presentation matrix: context of parenting children with autism**

| | **Equivocality resolution (Recommending)** | **Confirming (Balanced)** | **Uncertainty resolution (Focusing)** | **Positive quality dimensions** | **Negative quality dimensions** |
|---|---|---|---|---|---|
| **Domain** | Doctors<br>WWW<br>Therapist/trainer | Personal experience<br>Books | Other parents<br>Social media | Empathy<br>Experience<br>Reliability<br>Networking<br>Interaction with child | Reliability<br>Practical<br>Detailed<br>Diversity<br>Amount of rel. info. |
| **Problem** | Doctors<br>Personal experience | Other parents<br>WWW<br>Books | Therapist/trainer | Accessibility<br>Amount of rel. info.<br>Interaction with child<br>Reliability<br>Experience | Reliability<br>Amount of rel. info.<br>Diversity<br>Financially biased<br>Interaction with child |
| **Problem solving** | Doctors | WWW<br>Other parents<br>Therapist/trainer<br>Social media<br>Books | Personal experience | Experience<br>Empathy<br>Reliability<br>Informative<br>Practical | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Speciality |

To conclude the findings of this section, Table 5-26 summarises Table 5-21, Table 5-22 and Table 5-23 to create a ***quality to do list*** to be used for designing an information system in the case of caring children with autism. Table 5-26 includes all the top ten IQ dimensions for all three categories of information needs that should be considered by IS practitioners. IQ dimensions are sorted top to bottom based on their importance priority to parents and are marked by "-". Under each IQ dimension its measurement factors are listed which are marked by "*". In three cases a top ten quality dimension and all its measurement factors are used to measure a high level IQ dimension, in those cases the IQ dimension is marked by both "-" and "*". Table 5-26 groups similar interconnected IQ dimensions together and illustrates their measurement factors under each group. When interconnected IQ dimensions do not share all measurement factors, they and their measurement factors are marked with same numbers. Furthermore, Table 5-26 categorises the parents' quality requirements into information and source specific dimensions to simplify the implementation.

**Table 5-26: Quality requirements to do list**

| Source specific | Information specific |
|---|---|
| - Empathy, Experience<br>* Use parents provided information<br>- Reliability, 2-Scientific , 3-Speciality<br>*- Reputation (2)(3)<br>* Has academic ties/degree (2)(3)<br>* Knowing the Author/Speaker/Parent<br>*- Not being financially biased (source does not benefits from provided information)<br>* Caring<br>* User has previous experience with source<br>* Information be in a written or face to face format<br>- Amount of relevant info.<br>* Alternative information sources be available<br>* Does not practice trial and error<br>* Has academic ties<br>- Considers the diversity of children<br>- To be simple to access<br>- Knows child well and has interactions with him/her<br>- Practical information<br>* Recommends solution options<br>- Caring<br>* Represents sympathy and care<br>- Provide the opportunity to meet other parents/professionals<br>- Explains in details<br>- Interactive | - Reliability, 2-Scientific, 3-Speciality<br>* Timeliness (2)<br>* Referencing (2)<br>* Has international Authors (2)<br>* Includes statistics and diagrams (2)<br>* No contradicting information<br>* Accuracy<br>* Author CV (Has related/specific academic degree(s), has experiences in similar cases)<br>* Evaluated/tested information (no pure opinion)<br>- Amount of relevant information<br>* Multidimensional information (cover all the aspects)<br>* Has international Authors<br>- Considers the diversity of children<br>- Practical<br>* Recommends solution options<br>* Referencing<br>*- Explains in details<br>- Empathy, Experience<br>* Use parents information<br>- Language<br>* To be written in user's mother tongue |

Leveraging a qualitative approach enabled the researcher to determine a list of IQ dimensions specific to the context of study. However, usually qualitative analysis cannot be conducted for large groups of participants. As a result to determine the priority of IQ dimensions required by users in large cases, it is recommended to future researchers that following the identification of IQ dimensions through a qualitative approach, they perform a quantitative study to evaluate them. This mixed method have been tried similarly in a number of IQ assessment methods (Batini et al., 2009).

In addition to answers to the RQ2, the researcher observed the impact of the role of information sources on users IQ requirements as well. Similar to the analysis techniques used for generating Table 5-24 for categories of information needs, Table 5-27 outlines[49] the IQ requirements identified for different roles that information sources play in parents' information horizon (i.e. recommending, balanced and focusing sources). To create this table, the researcher identifies the IQ dimensions that parents have considered for using each category of information

[49] Details of the analysis are presented in Appendix section 7.3.5.5.

sources playing similar roles. In Table 5-27 to merge the data analysed by the two analysis perspectives (i.e. perspectives number 3 and 4 which are the top four popular sources and time change evaluation), the top five dimensions in each analysis perspective were rated as 1, and the second top five were rated as 0.5. Their amalgamated rates are used to identify the top 10 IQ dimensions.

**Table 5-27: IQ requirements of information sources playing different roles in parents' information horizon**

| | **Recommending sources** | **Balanced sources** | **Focusing sources** |
|---|---|---|---|
| **Positive** | Reliability 2 | Experience 2 | Experience 2 |
| | Amount of relevant info 2 | Empathy 2 | Empathy 2 |
| | Interaction with child 2 | Reliability 2 | Reliability 2 |
| | Accessibility 2 | Amount of relevant info 2 | Networking 2 |
| | Scientific 1.5 | Interaction with child 2 | Informative 1.5 |
| | Personal reasons 1.5 | Informative 1 | Interaction with child 1 |
| | Reputation 0.5 | Practical 1 | Practical 1 |
| | Experience 0.5 | Accessibility 1 | Amount of relevant info 1 |
| | | Networking 0.5 | |
| | | Reputation 0.5 | |
| **Negative** | Reliability 2 | Reliability 2 | Reliability 2 |
| | Financially biased 2 | Diversity 2 | Diversity 2 |
| | Interaction with child 2 | Amount of relevant info 2 | Biased info 2 |
| | Caring 1.5 | Language 2 | Personal reasons 1 |
| | Practical 1.5 | Practical 1.5 | |
| | Amount of relevant info 1.5 | Personal reasons 1.5 | |
| | Language 1.5 | Biased info 1 | |
| | Personal reasons 1 | Technical issues 0.5 | |
| | Detailed 1 | Detailed 0.5 | |
| | Speciality 1 | | |

In the following section, the QRD presentation matrix has been modified and populated with the analysis of parents' ISB. Following that, it has been presented to IS practitioners in order to evaluate the practical uses of the QRD presentation matrix.

## 5.5 RQ3: What are the practical uses of the QRD model for IS practitioners when determining information requirements?

The results of any IRD method conducted by information analysts should be presentable to, and usable by other interested stakeholders involved in the information system development (e.g. other information analysts, system analysts, designers, system developers, content developers and managers). There is a little agreement between scholars on the activities which should be performed and the information that should be collected during the IRD phase in different contexts. Therefore, RQ3 focuses on validating the practical uses proposed for the employing

the QRD model for determining information requirements. Hence, to answer RQ3, the information requirements presented by the QRD presentation matrix has been evaluated by the IS practitioners with experience in system development. It must be reminded that in this study, the QRD model, its presentation matrix and the methods and techniques used to analyse and present the data, all together are referred as the QRD method.

To evaluate the usability of the determined information requirements, this information should be initially presented to IS practitioners. The QRD model takes advantage of a predesigned presentation structure defined in section 2.4 as the QRD presentation matrix. Six hypotheses are proposed for the practical uses anticipated from the information presented in the QRD presentation matrix that are as follows:

- H1: Users' categorised queries represent seekers' information needs and are useful for content development.
- H2: Categorised information sources and IQ dimensions are useful for context analysis and defining the problem space.
- H3: Identifying potential users' IQ requirements is useful to develop quality information systems.
- H4: Identifying IQ dimensions measurement factors is useful for implementing IQ dimensions.
- H5: Identifying equivocality and uncertainty resolution sources assist designers and developers in developing the information flow in their systems.
- H6: The QRD method is applicable in other contexts.

During the data analysis conducted to answer RQ2, the researcher discovered a new analysis technique potentially useful for information system design. In this section, this new analysis is added to the original presentation structure and is leveraged to create an additional hypothesis to be evaluated by IS practitioners. This new hypothesis has been explained in details in this section and is as follows:

- H7: Analysis of users' information behaviour change over time/experience is useful to identify the gaps in the information horizon (problem definition).

The QRD presentation matrix required a number of improvements to gain the ability to present all the determined information. As a result, to answer RQ3, firstly H7 is explained and then the QRD presentation matrix has been updated, populated with data and finally evaluated by eight IS practitioners. It should be noted that apart from testing the hypotheses to answer RQ3, the researcher also was looking for discovering the emergent potential uses for the QRD method.

### 5.5.1 Emerging practical use for the QRD presentation matrix: Hypothesis 7

To analyse users' source preference behaviour, users were queried about two ISB incidents in which they sought information. First one was about users' latest ISB and second was about a behaviour taken place in the past. Comparing the changes in users' ISB over time has already been used for determining the priority of IQ dimensions to users. However, it is proposed to be helpful in defining the problem environment as well.

The idea is generated from the fact that when there is a consistent problem or advantage in the context, it gradually impacts information seekers' behaviour. As a result users' change of behaviour over time can be used to trace the problem or advantage. In this regard, it is proposed that rating success and failure of information sources in gaining popularity over time is beneficial for identifying the problems in the users' information horizon which turns into H7 as follows:

- H7: Analysis of users' information behaviour change over time/experience is useful to identify the gaps in the information horizon (problem definition).

Popularity of information sources may change based on their success in fulfilling their expected responsibilities in the information horizon. For instance, the researcher's observations indicate that at least in 23% (4/17) of interviews, parents were still struggling with the equivocality (learnt from their high level queries as parents were just describing the problem. These parents also were expressing their

confusion). Parent's confusion could be the result of their inability to resolve the equivocality raised from problems they have. Table 5-25 suggests that personal experience and doctors are the most commonly used recommending sources (equivocality resolving) for problem information. So, it is inferred that parents' confusion is the result of the failure of these two sources in fulfilling their anticipated role in the information horizon.

To rate information source's success or failure, H7 suggests the *change in average use of information sources* and *the change in sources' average importance* to users as indicators of success and failure of information sources in fulfilling their expected responsibilities over time. These two rating factors are leveraged to update the QRD presentation matrix.

### 5.5.2 The QRD presentation matrix: improvements

The QRD presentation matrix has already been updated twice. Once in RQ1 due to its inability to accommodate balanced information sources and another time in RQ2 to accommodate information and source specific categories of IQ dimensions and their measurement factors. These two changes has updated the QRD presentation matrix into Figure 5.2.

**Figure 5.2: QRD presentation matrix: context of parenting children with autism**

| | **Equivocality resolution (Recommending)** | **Confirming (Balanced)** | **Uncertainty resolution (Focusing)** | **Positive quality dimensions** | **Negative quality dimensions** |
|---|---|---|---|---|---|
| **Domain** | Doctors<br>WWW<br>Therapist/trainer | Personal experience<br>Books | Other parents<br>Social media | Empathy<br>Experience<br>Reliability<br>Networking<br>Interaction with child | Reliability<br>Practical<br>Detailed<br>Diversity<br>Amount of rel. info. |
| **Problem** | Doctors<br>Personal experience | Other parents<br>WWW<br>Books | Therapist/trainer | Accessibility<br>Amount of rel. info.<br>Interaction with child<br>Reliability<br>Experience | Reliability<br>Amount of rel. info.<br>Diversity<br>Financially biased<br>Interaction with child |
| **Problem solving** | Doctors | WWW<br>Other parents<br>Therapist/trainer<br>Social media<br>Books | Personal experience | Experience<br>Empathy<br>Reliability<br>Informative<br>Practical | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Speciality |

| **Source specific** | **Information specific** |
|---|---|
| - Empathy, Experience<br>* Use parents provided information<br>- Reliability, 2-Scientific , 3-Speciality<br>*- Reputation(2)(3)<br>* Has academic ties/degree (2)(3)<br>* Knowing the Author/Speaker/Parent<br>*- Not being financially biased (source does not benefits from provided information)<br>* Caring<br>* User has previous experience with source<br>* Information be in a written or face to face format<br>- Amount of relevant info.<br>* Alternative information sources be available<br>* Does not practice trial and error<br>* Has academic ties<br>- Considers the diversity of children<br>- To be simple to access<br>- Knows child well and has interactions with him/her<br>- Practical information<br>* Recommends solution options<br>- Caring<br>* Represents sympathy and care<br>- Provide the opportunity to meet other parents/professionals<br>- Explains in details<br>- Interactive | - Reliability, 2-Scientific, 3-Speciality<br>* Timeliness (2)<br>* Referencing (2)<br>* Has international Authors (2)<br>* Includes statistics and diagrams (2)<br>* No contradicting information<br>* Accuracy<br>* Author CV (Has related/specific academic degree(s), has experiences in similar cases)<br>* Evaluated/tested information (no pure opinion)<br>- Amount of relevant information<br>* Multidimensional information (cover all the aspects)<br>* Has international Authors<br>- Considers the diversity of children<br>- Practical<br>* Recommends solution options<br>* Referencing<br>*- Explains in details<br>- Empathy, Experience<br>* Use parents information<br>- Language<br>* To be written in user's mother tongue |
| - Represents a quality dimension<br>* Represents a measurement factor | |

As explained in section 5.5.1, the researcher suggests the *change in average use of information sources* and *the change in sources' average importance* to users as indicators of success and failure of information sources in fulfilling their expected responsibilities over time. These two rating factors are leveraged to upgrade the QRD presentation matrix by rating the information sources in it.

#### 5.5.2.1 Change in source average use over time as a success measure

To compare the information sources' average use in both ISBs pursued by parents of children with autism, Table 5-28 has been established. It compares information sources' average use in parents' "early after receiving the diagnosis" and latest ISBs and reports the change. Two factors have been identified with an impact on sources' average use. One is the general change in parents' interest for different categories of information over time, and second is their change of interest to use each information source. The process of neutralising the impact of parents' change of interest for different categories of information, has been explained by an example as follows. For example, the average number of sources being used for domain information has been reduced from 4.64 in the "early after receiving the diagnosis" ISB to 3.38 in recent seeking incidents. Therefore, a 27% decrease in all domain sources' average use is anticipated due to parents' change of interest over time, not sources' inability in fulfilling expected duties and qualities. The formula through which this effect has been neutralised has been explained at the bottom of Table 5-28. In this table when the average use of an information source is increased it has been colour coded in green, when it is decreased it is in red and when it does not change, it is in black.

**Table 5-28: Change in average use and roles of information sources in seeking pathways**

| Source | Popularity in info. horizon | Average use# | Change of use (%) | domain | problem | Problem solving |
|---|---|---|---|---|---|---|
| **Doctors** | 94% (2nd) | 54% | 18 ↓ 63→45<br>24↓Anticipation | 26 ↓ 64→38<br>9↓Anticipation | 41 ↓ 86→45<br>55↓Anticipation | 0 50→50<br>18↓Anticipation |
| **Social networks** | 47% (7th) | 12% | 18 ↑ 3 → 21<br>18↑Anticipation | 29 ↑ 9 →38<br>31↑Anticipation | 9 ↑ 0→9<br>9↑Anticipation | 21 ↑ 0→21<br>21↑Anticipation |
| **WWW** | 59% (5th) | 38% | 15 ↑ 30→45<br>10↑Anticipation | 7 ↓ 45→38<br>5↑Anticipation | 41 ↑ 14→55<br>37↑Anticipation | 18 ↑ 25→43<br>9↑Anticipation |
| **Other parents** | 100% (1st) | 62% | 10 ↑ 57→67<br>5↑Anticipation | 15 ↑ 73→88<br>35↑Anticipation | 2 ↑ 43→45<br>10↓Anticipation | 21 ↑ 50→71<br>3↑Anticipation |
| **Books** | 53% (6th) | 30% | 0 30→30<br>3↓Anticipation | 39 ↓ 64→25<br>22↓Anticipation | 31 ↑ 14→45<br>27↑Anticipation | 13 ↑ 8→21<br>10↑Anticipation |
| **Personal experience** | 82% (3rd) | 43% | 5 ↑ 40→45<br>1↑Anticipation | 2 ↑ 36→38<br>12↑Anticipation | 21 ↑ 43→64<br>9↑Anticipation | 6 ↓ 42→36<br>21↓Anticipation |
| **Therapist/ trainer** | 82% (3rd) | 38% | 2 ↑ 37→39<br>1↓Anticipation | 33 ↓ 45→12<br>21↓Anticipation | 12 ↑ 43→55<br>0↑Anticipation | 18 ↑ 25→43<br>9↑Anticipation |
| **Average number of sources used** (total collected diagrams) | | | p- 3.4<br>3.73<br>9%* ↑ | p- 4.64 (11)<br>3.38 (8)<br>27%* ↓ | p- 3 (7)<br>3.82 (11)<br>27%* ↑ | p- 2.5 (12)<br>3.86 (14)<br>35%* ↑ |

* For domain information, anticipated average change in use is -27%. It means that if the initial average use is 45% it is anticipated to decrease to 33% (45-(45*27%)). Any changes more or less than that has been considered as **above or under anticipation**.
# Unit of analysis for usage is number of filled diagrams.

To rate information sources with a considerable change in popularity, Table 5-29 displays all the information sources showing more than 10% change in usage over time. It also illustrates the sources that have retained their higher than 50% or lower than 20% usage average. The red columns illustrate the positive changes and red columns indicate the negative changes.

**Table 5-29: Considerable change in the average use of information sources over time**

| **General change** | | **Domain information** | | **Problem information** | | **Problem solving information** | |
|---|---|---|---|---|---|---|---|
| Decrease | Increase | Decrease in usage | Increase in usage | Decrease in usage | Increase in usage | Decrease in usage | Increase in usage |
| Doctors (24%↓) | Social networks (18%↑)<br>WWW (10%↑)<br>Other parents (>50%) | Books (22%↓)<br>Therapist/ trainer (21%↓) | Other parents (35%↑) (>50%)<br>Social networks (31%↑)<br>Personal experience (12%↑) | Doctors (55%↓)<br>Other parents (10%↓)<br>Social networks (<20%) | WWW (37%↑)<br>Books (27%↑)<br>Personal experience (>50%) | Personal experience (21%↓)<br>Doctors (18%↓) | Social networks (21%↑)<br>Books (10%↑)<br>Other parents (>50%) |

To rate each source based on its average use, if it earns or loses more than 10% usage over time, it earns a +1 or -1, respectively. Sources also earn a +1 if they retain their high usage (higher than 50%) and lose 1 (-1) if they retain their low usage (lower than 20%). The rest of the sources are rated as 0 as they have not shown any positive or negative changes.

The following section explains how information sources are rated based on the change of their importance to users over time.

#### 5.5.2.2 Change of source importance over time as a success measure

Taking advantage of the concept of zones within information horizons enables the researcher to ask parents about the importance of information sources to them. In the information horizon and pathway diagrams that parents drew, they had the option to draw each information source in either the most important, partially important or peripherally important zones. The researcher rated the most important information zone as 3, partially important as 2 and peripherally important zones as 1. Leveraging these rates enabled the researcher to calculate the average importance of information sources to parents. Table 5-30 displays the changes of sources importance over time (derived from Table 5-11 and Table 5-12).

**Table 5-30: Change of source importance over time**

| Source | Average use | Domain * | Problem * | Problem solving * |
|---|---|---|---|---|
| **Other parents** | 67% | 2.25→2.29 | 3→2.6 | 2.83→2.4 |
| **Doctors** | 45% | 2.43→2.33 | 2.67→2 | 2.67→2.71 |
| **Internet (WWW)** | 45% | 2.2→1.67 | 3→2.5 | 1.67→2.17 |
| **Personal experience** | 45% | 2.25→3 | 2.33→3 | 2.8→3 |
| **Therapist/trainer** | 39% | 2.8→1 | 3→2 | 3→2.5 |
| **Books** | 30% | 2.57→1.5 | 3→2.6 | 3→2.67 |
| **Social networks** | 21% | 3→2.33 | -- →2 | -- →2.23 |
| * Past importance average → Present importance average | | | | |

To rate the information sources based on their importance to users, if it falls to a lower zone[50] or if it remains as peripherally important, it loses 1 point (-1). If the source importance rises to a higher zone or remains in most important zone, it gains +1. Finally, remaining in partially important zone will earn the source a 0.

[50] The importance range for each zone: 2.5→3 most important, 1.5→2.49 partially important, 1→1.49 peripherally important.

The following section rates all the information sources in users' information horizon.

#### 5.5.2.3 Rated information horizon

As defined in the previous two sections, the information sources in users' information horizon can be rated based on the *change in average use of information sources* and *the change in sources' average importance* to users. Table 5-31 leverages these two evaluation criteria and the data presented in Table 5-29 and Table 5-30 to rate the information sources in parents' information horizon. Table 5-31 adds the information sources rates and introduces a marking system ranged from -2 to 2 in which -2 is the lowest success and is +2 is the highest. In Table 5-31 the information sources which have earned a +2 are colour coded in green and the one earned a -2 are colour coded in red. The rest of sources are colour coded in black.

**Table 5-31: Rated information sources in parents' information horizon**

| | **Recommending*<br>Equivocality resolution** | **Balanced*<br>Confirming** | **Focusing*<br>Uncertainty resolution** |
|---|---|---|---|
| **Domain** | Doctors (0+0)=0<br>WWW (0+0)=0<br>Therapist/trainer (-1-1)=-2 | Personal experience (+1+1)=2<br>Books (-1-1)=-2 | Other parents (0+1)=1<br>Social media (-1+1)=0 |
| **Problem** | Doctors (-1-1)=-2<br>Personal experience (1+1)=2 | Other parents (1-1)=0<br>WWW (-1+1)=0<br>Books (1+1)=2 | Therapist/trainer (-1+0)=-1 |
| **Problem solving** | Doctors (1-1)=0 | WWW (0+0)=0<br>Other parents (-1+1)=0<br>Therapist/trainer (-1+0)=-1<br>Social media (--+1)=1<br>Books (1+1)=2 | Personal experience (1-1)=0 |
| * The numbers in brackets represent: importance average change and usage average change respectively. | | | |

Table 5-31 shows that most of information sources in the system cannot be named as a success or a failure. However, it makes one point clear, that is the poor service in majority of information horizon's applications. This shortcoming could be the reason for the parents information related challenges in this context.

The subsequent section leverages all the updates presented in this section to present the final QRD presentation matrix.

### 5.5.3 The QRD presentation matrix

Entering the evaluation of information sources to the QRD presentation matrix and also the addition of the role specific IQ requirements generates the final version ready to be evaluated by IS practitioners. The final QRD presentation matrix is displayed in Figure 5.3.

**Figure 5.3: QRD presentation matrix**

| Type of information | Equivocality resolution ** | Confirming | Uncertainty resolution | Positive | Negative |
|---|---|---|---|---|---|
| Domain<br>Focus of unexperienced parents | Doctors (0+0)=0<br>WWW (0+0)=0<br>Therapist/trainer (-1-1)=-2 | Personal experience (+1+1)=2<br>Books (-1-1)=-2 | Other parents (0+1)=1<br>Social media (-1+1)=0 | Empathy<br>Experience<br>Reliability<br>Networking<br>Interaction with child | Reliability<br>Practical<br>Detailed<br>Diversity<br>Amount of rel. info. |
| Problem | Doctors (-1-1)=-2<br>Personal experience (1+1)=2 | Other parents (1-1)=0<br>WWW (-1+1)=0<br>Books (1+1)=2 | Therapist/trainer (-1+0)=-1 | Accessibility<br>Amount of rel. info.<br>Interaction with child<br>Reliability<br>Experience | Reliability<br>Amount of rel. info.<br>Diversity<br>Financially biased<br>Interaction with child |
| Problem solving<br>Focus of experienced parents | Doctors (1-1)=0 | WWW (0+0)=0<br>Other parents (-1+1)=0<br>Therapist/trainer (-1+0)=-1<br>Social media (--+1)=1<br>Books (1+1)=2 | Personal experience (1-1)=0 | Experience<br>Empathy<br>Reliability<br>Informative<br>Practical | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Speciality |
| Role specific quality dimensions | Reliability<br>Amount of rel. info<br>Interaction with child<br>Accessibility<br>Scientific | Experience<br>Empathy<br>Reliability<br>Amount of rel. info<br>Interaction with child | Experience<br>Empathy<br>Reliability<br>Networking<br>Informative | | |
| | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Practical | Reliability<br>Diversity<br>Amount of rel. info<br>Language<br>Practical | Reliability<br>Personal reasons<br>Diversity<br>Biased info | | |
| ** The numbers in brackets represent: importance average change[51] and usage average change respectively. | | | | | |
| The entire information horizon | | | | | |
| Source specific factors (Must have): | | | Information specific factors (Must have): | | |

[51] The importance range for each zone: 2.5→3 most important, 1.5→2.49 partially important, 1→1.49 peripherally important.

| | |
|---|---|
| - Empathy, Experience<br>* Use parents provided information<br>- Reliability, 2-Scientific, 3-Speciality<br>*- Reputation(2)(3)<br>* Has academic ties/degree (2)(3)<br>* Knowing the Author/Speaker/Parent<br>*- Not being financially biased (source does not benefits from provided information)<br>* Caring<br>* User has previous experience with source<br>* Information be in a written or face to face format<br>- Amount of relevant info.<br>* Alternative information sources be available<br>* Does not practice trial and error<br>* Has academic ties<br>- Considers the diversity of children<br>- To be simple to access<br>- Knows child well and has interactions with him/her<br>- Practical information<br>* Recommends solution options<br>- Caring<br>* Represents sympathy and care<br>- Provide the opportunity to meet other parents/professionals<br>- Explains in details<br>- Interactive | - Reliability, 2-Scientific, 3-Speciality<br>* Timeliness (2)<br>* Referencing (2)<br>* Has international Authors (2)<br>* Includes statistics and diagrams (2)<br>* No contradicting information<br>* Accuracy<br>* Author CV (Has related/specific academic degree(s), has experiences in similar cases)<br>* Evaluated/tested information (no pure opinion)<br>- Amount of relevant information<br>* Multidimensional information (cover all the aspects)<br>* Has international Authors<br>- Considers the diversity of children<br>- Practical<br>* Recommends solution options<br>* Referencing<br>*- Explains in details<br>- Empathy, Experience<br>* Use parents information<br>- Language<br>* To be written in user's mother tongue |
| Measurement factors for few quality dimensions are similar with few other and in some cases to avoid repetition they have not been repeated (Words coming after "-" are dimensions, after "*" are factors, when a word performs both as a dimension and a factor is has both) | |

The sources listed in the QRD presentation matrix are extracted from experienced parents' behaviour since it is designed for context analysis at the present time. The matrix cells are colour coded based on the rates of the information sources in each cell. To rate the success of each cell which represents a responsibility or an application in information horizon, "OR" logic has been adapted. It means, at least one successful information source should be available in each application to call that application a good one. Therefore if a good and a bad source are available in an application, that application is rated as good, unless if the only good source is personal experience which in that case the user had no other option except using his/her experience. So, if an application is coloured as ***green***, it means it includes at least one good information source. Colour coding a cell in ***red*** means that there are bad information sources active in the application and no good alternative source is available.

Following the finalising the QRD presentation matrix, its evaluation took place by presenting it to eight IS practitioners with experience in information system

development. Evaluation of the QRD presentation matrix is the subject of the subsequent section.

### 5.5.4 Evaluation of the usability of the QRD presentation matrix

The group of practitioners interviewed in this study are selected from IS practitioners with experience in information system development who reside in Cork and Dublin in Ireland. Table 5-32 provides the list of IS practitioners who were interviewed in this study. The interviewees were asked one open question in order to find evidence supporting the validity of the seven proposed hypotheses outlined in section 5.5. This data is also used to discover the other emergent potential uses for the data presented in the QRD presentation matrix.

**Table 5-32: IS practitioners being interviewed to evaluate the QRD presentation matrix**

| ID | Experiences in IS development | Project size |
|---|---|---|
| 01 | System designer, system analyst | Small |
| 02 | System/information analyst, system developer, technical manager | Small-large |
| 03 | System developer | Small |
| 04 | System developer | Large |
| 05 | Designer, information analyst, system analyst, system developer | Small |
| 06 | Websites design and development, requirement gathering for app development, UI analyst | Small-Large |
| 07 | Development for web projects, project manager for mobile projects | Small-Large |
| 08 | Requirement gathering, design, development, project manager | Small-Large |

The interviews involved the presentation of the queries indicated by parents, the QRD presentation matrix and the employed data collection and analysis techniques followed by a single open-ended question. The question was about how this information could be useful for IS practitioners in their IS development experiences. Table 5-33 leverages the IS practitioners quotes to justify the proposed hypotheses. This table also reports the parts of the QRD presentation matrix or list of queries found useful by the IS practitioners in their experience. Furthermore, Table 5-33 illustrates the uses that IS practitioners indicated for each part of the QRD presentation matrix or list of queries.

**Table 5-33: Hypotheses evaluation table**

| ID | Useful for | How | Useful part | Justifying hypothesis |
|---|---|---|---|---|
| 05 | FAQ | Help to provide the right information for users (what they need), it is useful for FAQ | List of queries | H1 |
| 02 | Context analysis and problem definition | Help people who are not the domain experts (e.g. technical staff) to get a sense of the context. I am not an expert in autism but in half an hour I learnt simply what is going on there. It also highlights the problems in the pathways. | Source categorisations /pathways | H2 |
| 05 | Context analysis | This technique gives a good understanding of the context and how things work prior to development. Can provide a good starting point to develop any type of information source. | Source categorisations /pathways-whole matrix | H2 |
| 02 | Use specific context analysis for uncertain situations | Give a general idea about the characteristics of the system to be, it represents users' real needs not experts interpretations. It is useful for complex and uncertain situations. It is good to "understand as-is situation" and show how effective available systems are, as a starting point. | Whole matrix /technique | H2 |
| 06 | Problem definition | It is useful for the time when the problem is not completely known, or the project is about users' active information seeking. It is useful for adoption, or when there not enough background information available. | Whole matrix | H2 |
| 08 | Problem definition for uncertain situations | "People are good in telling you what the problem is", complexity of problem and users' struggle visualised in the analysis which gives deeper understanding of the behaviour, this way both problems and solutions used can be seen. This technique is good for visualising the complicated situations, it breaks the problem down into its parts. | Whole matrix | H2 |
| 02 | Implementing IQ | Help content providers on how to meet required IQ. | Required IQ dimensions | H3 |
| 01 | Selecting proper solutions | Required IQ dimensions made me think about solutions through which we can meet the requirements. | Required IQ dimensions | H3 |
| 05 | Selecting proper solutions | It represents the breakdown of users' expectation and sources abilities and help designers to find the best matches for what users' need (e.g. something that other parents offer, doctors may not). | Required IQ dimensions | H3 |
| 07 | Effective requirement analysis | Working with multiple stakeholders is the greatest challenge, IQ provides a common landscape to serve the needs of multiple stakeholders more effectively, IQ dimensions "would allow us to prioritise the information and features more effectively". When the structure is not the same a few factors may be | Required IQ dimensions | H3 |

| | | | | |
|---|---|---|---|---|
| | | overlooked. | | |
| 08 | Problem definition /Common language | IQ could be used by all stakeholders involved in a health project as a manner for evaluating involved parties in the care. Comparing all parities feedbacks could lead to find the gap/problem in the system. | Required IQ dimensions | H3 – H2 |
| 07 | Context analysis /Common language | Used as a "common language" for the starting point as oppose to starting with more biased view (public health nurse in our case), single user view or starting from blank canvas. | Required IQ dimensions | H3 – H2 |
| 01 | Implementing IQ | It is useful to know how to implement required IQ dimensions. | IQ measurement factors | H4 |
| 01 | Designing System's information flow | Information pathways help to learn the users information journey and helps developers/designer on finding how to start and how to end information presentation (e.g. start with specific medical info from doctors and end with weblogs). | Source categorisations /pathways | H5 |
| 02 | Designing System's information flow/UI | Help designers on the steps through which they present the information. It makes data presentation more practical by letting the UI design to be based on current pathways and replicating the existing experiences. | Source categorisations /pathways | H5 |
| 05 | Designing System's information flow | Learning how users think and act help designers in designing the work flow which is simple to use and design, it helps designing the flow of information including the information to disseminate and the order of presentation (order of pages) and sources to be used. | Source categorisations /pathways | H5 |
| 02 | Designing System's information flow/UI | Gives designers an idea about how content should evolve over time, it categorises information need based on users experience (e.g. proposed source should have one section for new users and one for experienced). | Source evaluation over time | Emergent 1 (E1) |
| 05 | Designing System's information flow | It shows how users' behaviour change over time and so different work flow is required in the system [for users with different experience]. | Source evaluation over time | E1 |
| 01 | Suggesting information sources/services to be used in the system | Having the list of used sources is useful as I would not assume parents differ between doctors' and therapists' information.<br>Popular information sources suggest the information sources which should definitely be included in the system (e.g. popularity of other parents shows the importance of using blogs). | Information horizon /zones | E2 |
| 02 | Quality enabled Implementation | Reduces the implementation complexity and delivers better quality systems. | Whole matrix | E3 |

The number of interviewees supporting each hypothesis is summarised in Table 5-34. This table also counts the number of interviewees who have suggested other practical uses for different parts of the QRD presentation matrix.

**Table 5-34: Number of practitioners supporting each hypothesis**

| Hypothesis (useful part) | Useful for (the number of interviewees supporting) | Sum of supporting interviewees (n=8) |
|---|---|---|
| H1 (Query list) | FAQ (1) | 1 |
| H2 (Whole matrix) | Context analysis/problem definition for uncertain situations (5) | 5 |
| H3 (IQ dimensions) | Implementing IQ (1)<br>Selecting proper solutions (2)<br>Effective requirement analysis (1)<br>Context analysis (2)<br>Common language (2) | 5 |
| H4 (IQ dimension measurements) | Implementing IQ (1) | 1 |
| H5 (Categorised pathway) | Designing System's information flow/UI (3) | 3 |
| H7 (Behaviour change over time) | Proposed to be useful for identifying the gap in the system | 0 |
| E1 (Behaviour change over time) | Designing System's information flow/UI (2) | 2 |
| E2 (Information horizon) | Suggesting information sources/services to be used in the system (1) | 1 |
| E3 (Whole matrix) | Quality enabled implementation (1) | 1 |
| H6 (usefulness in other contexts) | ------ | 6/8 |

Two interviewees, with pure system development backgrounds, did not find the presented information useful in their experiences. From the six other interviewees, one interviewee found the list of queries collected from users useful for a FAQ section of information systems (H1). Five IS practitioners found the presented information useful for context analysis and problem definition in their experiences (H2). Similarly five interviewees indicated varied uses for users' IQ requirements (H3). It was emerged from IS practitioners' evaluation that IQ has the ability to be used as a common language between several stakeholders using the same system (e.g. doctors, nurses, patients) and therefore it may increase the quality of the proposed solutions. Moreover three IS practitioners also found categorisation of information sources based on the role they play and the information they provide, useful for user interface design (H5). Unlike H2, H3 and H5, H4 could not find a strong support (1/8). It is inferred to be because IQ dimensions' measurement factors are useful for content providers (e.g. health professionals in health projects) and no one with such experience was interviewed. H7 also could not find any support during the interviews but interestingly two interviewees found the change in behaviour over

time useful for designing the proposed system's user interface, an application that the researcher had not foreseen. All the quotes supporting any of the hypotheses are considered as a support for H6 as well since they indicate the usefulness of the presented information in other contexts. Therefore, 6 out of 8 interviewees (all with management or analyst background) found the QRD method useful in other contexts.

Three emergent uses were suggested by the interviewees for different parts of the QRD presentation matrix and its development tools which are coded as E1 to E3. As explained, interviewees did not support the H7 and no one mentioned that users' ISB change over time could be useful for identifying gaps in the system but two found it useful for user interface design (coded as E1). In addition to that, one interviewee indicated that users' information horizon can be used for suggesting the information sources to be used for developing the information systems (coded as E2). Finally, one interviewee specified that the QRD method can reduce the complexity of information system development which can lead into quality systems (coded as E3).

As anticipated, the researcher observed that two factors impact IS practitioners' opinions about the usefulness of the QRD presentation matrix, that are ***type of projects they have worked in*** and their ***role in those projects***. Two interviewees with experience in health projects in which information system has been developed to be used by health practitioners (ID06 and ID08) did not find most parts of this technique useful in their experiences. They mentioned that when "there are already guidelines there" to follow and when the system is not used directly by patients, there is no value in analysing practitioners' behaviour (as users). In general, three interviewees (ID02, ID06 and ID08) directly indicated that the QRD method is good for uncertain situations where the problem is not clearly known. They also specified that the QRD method is not needed for straight forward situations with defined problems and available guidelines. Interviewees ID03 and ID04, who had worked only as developers, also indicated that they could not see any use for the result of the sample analysed data in their positions. They indicated that developers purely develop what analysts ask and analysts are those who conduct the requirement analysis and may need this method. However, one of them mentioned that developers' responsibilities are indirectly affected by the results of IRD methods. Table 5-35 lists the situations with no use for the QRD method.

**Table 5-35: The situations in which IS practitioners found no use for the QRD method**

| ID | Situation |
|---|---|
| 02 | Not useful for simple situations. |
| 03 | There is no use for this information for developers. |
| 04 | At large projects, high level designers who need high level view of the system and business analysts may use it, but developers just develop what analysts request after they conduct the requirement analysis. In small projects one individual may be responsible for several roles and so they may find the technique useful but even then their development role does not need it. |
| 06 | "when it is going to be a diagnosis tool, and there are already guidelines there, I don't know the value of asking other people". |
| 06 | For web development when the structure is simple and is dictated by the management there is no use for this method. Time constraints are the problems for using this method for such projects. |
| 06 | We would use expert opinions when we needed healthcare knowledge. |
| 08 | There is no use for it if the system is not used directly by patients. |

The following section provides an example of how the data presented in the QRD presentation matrix can be interpreted into specifications of the problem space.

### 5.5.5 Analysing the problem space using the QRD method

IS practitioners found applying the QRD method useful for the context analysis, problem definition, designing the information flow, user interface design, selecting proper solutions and building a common language between the involved stakeholders. To implement the analysed data in practice, IS practitioners need to interpret the presented data into the system's specifications. In this section, it has been suggested that each cell of the QRD presentation matrix represents an application of the information system. By providing the context into the subject, this section analyses the context in detail, defines the problem space and suggests solutions. The following section begins with defining the specifications of the first cell of the QRD presentation matrix (see Figure 5.3).

#### 5.5.5.1 Application 1 (recommending sources providing domain information)

This application is mostly required by unexperienced parents, but experienced parents also have general questions in their minds motivating them to seek domain information. At the beginning of their ISB, parents seek to resolve the equivocality as they may not even know exactly what they should looking for. To resolve the equivocality parents have searched their general queries on the ***web*** or have asked

them from ***doctors*** and ***therapist/trainers***. These information sources are used to break parents' general queries into more specific ones, answer them and/or refer them to other sources for the answers.

Any solution being designed to provide the needs of this application should consider this application's specifications defined in Table 5-36. This table outlines the settings of application 1 by comparing the IQ dimensions required by domain and equivocality resolution sources. It should be noted that since 2/3 sources performing this application are human sources that are used through face to face media. As a result being ***interactive*** is also one of the required qualities of this application.

**Table 5-36: Application 1 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Doctors<br>WWW<br>Therapist/Trainer | Resolve the equivocality for domain information requirements | Reliability, amount or rel. info, interaction with child, practical | Poor |

In application 1 parents as the potential system users, have used "doctors", "WWW sources" and "therapist/trainers". These three sources earned success rates of 0, 0 and -2, respectively, which altogether represent a weak application. These sources need to have the processing ability to resolve the equivocality parents are facing and possibly provide answers for their queries but their success rates do not suggest that they had been very successful for this purpose. Sonnenwald et al. (2001) suggest that one of the factors in information pathways we can use to explain success or failure of a recommending source is its success in recommending the focusing sources. Table 5-37 states the focusing sources recommended by the recommending sources in application 1.

**Table 5-37: Connecting nodes for domain recommending sources**

| Past | Present |
|---|---|
| Doctors (6)<br>- Other parents<br>- Books (2)<br>- Personal experience<br>WWW (3) - had been a balanced source –<br>- -----<br>Therapist/trainer (6)<br>- Other parents (2)<br>- Books (2) | Doctors (3)<br>- Other parents (2)<br>- Facebook/Viber<br>WWW (4)<br>- Other parents<br>Therapist/Trainer (4)<br>- ---- |
| The number in the brackets are the number of outgoing and incoming queries to the sources | |

Doctors are one type of information sources that work as a recommending source for all categories of parents' information needs. Unlike in problem and problem solving behaviours, doctors' average use has not been decreased dramatically for domain information over time. One of the reasons could be their ability to recommend suitable focusing sources. As illustrated in Table 5-37, 4/6 sources recommended to unexperienced parents by doctors were focusing sources. Over time this rate increases to 3/3 which means parents have kept seeing doctors who were more successful in recommending focusing sources and stopped visiting the others.

WWW success rate in application 1 also is low (0). WWW could refer 1/4 of experienced parents to focusing sources which was 0 for unexperienced parents, this could be the reason for its slight usage average improvement. Therapist/trainers on the other hand are rated as a failure (-2). Both their usage average and importance to seekers has been reduced over time. Their success rate in referring to focusing sources also shows a decrease over time. In the "early after receiving the diagnosis" ISB, 4/6 of their referred sources had been focusing but in their latest ISB amongst the four sources referred by recommending sources there is no focusing source.

Ideally the information sources active in application 1 should meet all the quality requirements of domain and recommending information sources (defined in section 5.4.1), however the priority is to meet the dimensions that both types have in common. To increase the quality of application 1 in the proposed information system, it is suggested to 1) meet the quality dimensions required by this application, 2) resolve parents' equivocality and answer parents' questions, or 3) recommend good focusing sources to answer defined specific queries.

#### 5.5.5.2 Application 2 (balanced sources providing domain information)

This application is to provide complementary information to confirm the information provided by recommending and focusing sources for domain information. Because of the information critical use, parents check the accuracy of their obtained information with information sources in this application. Collected data identified application 2 as a failure because one of its two available sources (books) is rated as -2 and other one which is rated +2 is personal experience. In this application it is assumed that personal experience has become a popular source

because there had been no other good option. The sources active in this application should meet the quality requirements of both domain and balanced information sources, the dimensions common between these two types are listed in Table 5-38.

**Table 5-38: Application 2 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Personal experience Books | Complementary domain information | Empathy, experience, reliability, amount of relevant info, interaction with child, diversity, practical | Poor |

To provide domain information, books are rated as the worst source in the entire information horizon. This means both of their average usage and importance to users have decreased over time. Many reasons could be identified for this failure. Considering the required quality dimensions indicated by parents for this application highlights the point that books as a media hardly can see some of parents' required IQ dimensions. For example, it is almost impossible to personalise books for each child to handle the diversity, this automatically increases the amount of irrelevant information. Yet books could potentially provide practical and detailed information which represent the experience of practitioners or parents to regain their popularity. The failure of books as media/sources could be the result of poor recommendations made by the recommending sources. If a recommending resource refers parents to weak books, this will negatively impact parents' perception about the quality of books in general. Since balanced information sources may provide complementary information for both recommending and focusing sources, they may require to provide less specific but more complete information.

#### 5.5.5.3 Application 3 (focusing sources providing domain information)

This application provides answers to parents' specific domain queries. These queries are formed during the equivocality resolution process. Majority of parents have found the experience of other parents helpful in answering their specific domain queries. Other parents who have experiences about the subject of a parent's query, can explain the disorder, intervention processes, what should be done and what are the expected results. Other parents' experience and also their reliability for none-expert domain information are the main reasons for their popularity in application 3. The sources active in this application should meet the quality requirements of both

domain and focusing information sources. The dimensions common between these two types are outlined in Table 5-39. It should be noted that since 2/2 sources in this application are interactive sources, being ***interactive*** is also one of the required qualities for this application.

**Table 5-39: Application 3 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Other parents<br>Social media | Providing answers to parents specific domain queries | Reliability, empathy, experience, networking, interaction with child, diversity, interactive | Good |

Domain information in general is the main need of unexperienced parents and other parents have proven to act well in providing this type of information (88% of parents use other parents as a source for domain information. It gains the highest popularity amongst all other information sources). Social media also acts as a media which connects parents to each other. Social media show a considerable increase in average use but a decrease in importance. This application seems to act well enough, however parents have indicated that ***availability of well organised and reliable groups in social media including parents of children with autism*** could help them. Popularity and success of other parents in meeting the requirements of this application, indicates that their information should be used for developing domain information sources.

#### 5.5.5.4 Application 4 (recommending sources providing problem information)

Problem information is in a close relationship with diagnosis. Application 4 provides parents with the ability to analyse the problems or in other words the ability to resolve the equivocality caused by the problem. For example, a parent may visit a doctor to ask his/her opinion about why his/her child is afraid of doctors' offices and starts screaming when they come close to the office. Doctors may ask questions about the types of doctors he/she is afraid of, type of offices and environments that the child shows the hardest reactions against and try to learn the root of the fear. Over the course of time, parents have learnt that the best information source to analyse the problem and resolve the equivocality is themselves. This is because each child is unique and parents are the ones who have the most interaction with the child. They have not been very satisfied with doctors' analysis of the problem (doctors are

rated -2) but they are happy with their own work as personal experience has received +2 rate. The sources active in this application should meet the quality requirements of both problem and recommending information sources, the dimensions in common between the two types are outlines in Table 5-40. It should be noted that since 2/2 sources in this application are human sources used through face to face media, being ***interactive*** is one of the required qualities for this application.

**Table 5-40: Application 4 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Doctors<br>Personal experience | Analysing the problems children and their parents are experiencing | Reliability, amount of relevant info, interaction with child, accessibility, financially biased, interactive | Poor |

The relationships between recommending and focusing sources for problem information were weak and so could be the result for poor performance of this application. None of the information sources in application 4 were successful in referring parents to the focusing sources. In parents' last ISB only 1/5 sources suggested by doctors were focusing and only 2/7 sources referred by personal experience were focusing. Similar rates also derived from parents' "early after receiving the diagnosis" ISB.

While one of the sources in this application is rated well (i.e. personal experience), the application in total suffers from a severe problem. 4/17 interviewees have reported very general queries concentrated on describing the problem only and expressed their anxiety regarding their child's care. In these cases doctors were unsuccessful in defining the problem for parents and also parents' personal experience did not have the ability to define the problem for them. As a result these parents became stressed and the care process did not go ahead very well. In short, the most important problem in this application is its reliance on parents' personal experience as the main equivocality resolving source.

Problem definition becomes problematic when parents do not have enough processing capacity to properly handle the equivocality resolution process. Following this the entire care process may fail and this causes parents stress and anxiety. To reduce the processing pressure from parents it is recommended that other sources with long term interactions with the child attend the process of diagnosis and problem definition. Doctors' top negative IQ dimensions are their low interaction

with children, being financially biased and reliability. Doctors' disadvantages are amongst other parents' top positive attributes. Therefore, the answer to the problems of this application could be 1) finding a solution to give doctors a better understanding of children conditions and history in detail (e.g. specific electronic patient history), and 2) working with parents as a team. To reduce parents' suspicion about doctors' financial motivations, availability of a system to rate doctors' reliability could be helpful.

#### 5.5.5.5 Application 5 (balanced sources providing problem information)

There are three sources available in this application, which are to provide complementary information about the problem. Its success has been rated as good because books in this application are rated +2 and WWW and other parents also do not act badly (both rated 0). Similar to other balanced information sources, this application also can be assisted by additional source providing problem information. It is important that these sources address both high level queries and also try to root them into their reasons. In this application, balanced sources are expected to define the roots of the problems as these sources should both enhance equivocality resolution and finalise the answers for specific problem queries. The sources active in this application should meet the quality requirements of both problem and balanced information sources. The IQ dimensions in common between the two types are outlined in Table 5-41.

**Table 5-41: Application 5 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Other parents<br>WWW<br>Books | Providing complementary information about the problem | Experience, reliability, amount of relevant info, interaction with child, diversity | Good |

The reason for success of books could be parents' satisfaction with their own equivocality resolution taken place in application 4. Knowing the specific queries they seek to answer eases parents' job in finding the books that are answering them.

#### 5.5.5.6 Application 6 (focusing sources providing problem information)

This application is expected to provide complete and detailed definition of the problem. Application 4 is responsible for breaking the high level queries about problems into smaller ones and refer the seeker to the sources with the ability to

resolve the uncertainties. It is very important to consider that problems of children with autism are very unique and vary between children. Therefore, the information provided for each case should consider this diversity and provide personalised information. For example, for children who are afraid of doctors' offices, it could be because of a previous bad experienced, maybe the crowd, colour, smell and many other reasons that varies between children. This uniqueness causes that only experienced people who have sufficient interaction with the child can define his/her problems and possibly their roots. The sources active in this application should meet the quality requirements of both problem and focusing information sources. The dimensions in common between the two types are outlined in Table 5-42. It should be noted that since the only source in this application is a human source used through face to face media, being ***interactive*** is one of the required qualities for this application.

**Table 5-42: Application 6 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Therapist/trainer | Defining detailed problems | Reliability, experience, interaction with child, diversity, financially biased, interactive | Very poor |

Parents have used therapist/trainers as the only focusing source for defining the problems. The reason for choosing them was probably because parents had no other available option. They are the only people who have spent sufficient time with the child to know his/her problems well. But as an information source they are not reliable and are financially biased. To strengthen this application, interactive sources who/which have a good knowledge about child's behaviour are required. Comprehensive databases listing all the problems are needed in this application. These databases then should be referred by the recommending sources.

#### 5.5.5.7 Application 7 (recommending sources providing problem solving information)

Problem solving information is the focus of experienced parents. Experienced parents know most of domain information already and the information they seek is usually about the problems and how to solve them. It should be noted that problem and problem solving ISB may happen together, different sources may be used but the

queries and results are deeply mixed. For example, when parents go to doctors for a problem usually at the same visit they seek problem solving options too.

Doctors are the only popular information source that parents have used for equivocality resolution and providing them with solutions options. It must be considered that providing solution options for a problem follows a good definition of the problem. If doctors do not determine the detail of a problem then their effort to find a solution for it might not be successful. Therefore, while diversity of children has not been mentioned for problem solving information requirements but through problem information it impacts the parents problem solving information behaviour. Application 7 is a recommending application. Thus, the quality dimensions required by recommending sources also should be met by doctors as well as quality requirements of problem solving sources (see Table 5-43). Since the only source in this application is a human source used through a face to face media, being ***interactive*** is one of the required qualities for this application.

**Table 5-43: Application 7 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Doctors | Providing available options to treat a problem | Reliability, interaction with child, financially biased, caring, practical, interactive | poor |

Application 7 is rated as poor as its only information source (doctors) is rated 0 with the average usage of 50% and being categorised as a partially important source. Doctors also do not seem successful in referring queries to focusing sources since they referred 0/6 of their outgoing queries to a focusing source in parent's latest ISB and 1/5 of them in the "early after receiving the diagnoses" ISB.

#### 5.5.5.8 Application 8 (balanced sources providing problem solving information)

Most of information sources providing problem solving information act as a balanced source. These information sources are used to provide complementary information about the available options and proper option to be tried. 5/7 sources being used for problem solving information are balanced sources. Amongst them books have met parents' expectations over time and other parents also earn the highest average use (71%). The rest of sources also did not perform poorly (had been rated as 0 and 1), only therapist/trainers did not perform as successful (rated -1). But

it is not all positive. These findings are in accord with one parent's comment that "information is given to us in bits and pieces" and so they should collect it from anywhere they can. This indicates that doctors as the only recommending source for problem solving information were not successful in recommending all available solution options for the problem at hand and so parents have looked into other sources hoping to find other options. Also, not seeing positive impacts of trying doctors' recommendations may have impacted this behaviour. The sources active in this application should meet the quality requirements of both problem solving and balanced information sources. The dimensions in common between the two types are outline in Table 5-44. Since 3/5 sources in this application are interactive sources, being ***interactive*** is one of the required qualities for this application.

**Table 5-44: Application 8 setting**

| Active sources | Responsibilities | Specific quality requirements | Success | Potential problems spotted |
|---|---|---|---|---|
| WWW<br>Other parents<br>Therapist/trainer<br>Social media<br>Books | Providing complementary information about available options and proper option to be tried | Reliability, experience, empathy, interaction with child, practical, interactive | Good | Information overloading |

Application 8 seems to have met the expectations. One source (i.e. books) have been rated +2 and social media also is rated +1. In addition to that, two other sources (i.e. other parents and WWW rated 0) are available to provide information in this application. The only severe problem which can be spotted in this application is the possibility of "information overloading". There are many sources available in this application and parents find all of their information useful. Their information need is critical and they do not know which source should be preferred and which information should be used as all are good. These criteria beside the availability of enormous amount of information may lead into situations in which parents become information overloaded. To handle information overloading, availability of solutions like Decision Support Systems (DSS) with the ability to filter information and return only relevant and reliable information could be very beneficial for this application.

#### 5.5.5.9 Application 9 (focusing sources providing problem solving information)

This application is where the final decisions are being made in. In this application parents decide about the solution options which should be selected and tried for their problem at hand. At the information horizon under study this application does not perform well. For several reasons like the lack of reliability, suspicion of being financially biased, diversity of children, and professionals' low interaction with the child, parents may not be able to rely on doctors and other professionals' recommendations and make all the final decisions relying on themselves. But over time they have shown that they are not satisfied with relying on themselves.

At application 9 no information source has proved to have the ability to provide the necessary information to reduce uncertainty. One of the reasons which could be suggested for this problem is inability of information sources in meeting parents' quality requirements. So, parents could not rely on any of them for making critical decisions. To reduce this application's problems, parents have made interesting recommendations. These recommendations are mainly focused on increasing the ***reliability*** and ***practicality*** of the information and its ability to be ***personalised***. The sources active in this application should meet the quality requirements of both problem solving and focusing information sources. The dimensions in common between the two types are outlined in Table 5-45.

**Table 5-45: Application 9 setting**

| Active sources | Responsibilities | Specific quality requirements | Success |
|---|---|---|---|
| Personal experience | Choosing the right option to try | Experience, empathy, reliability, informative, biased info | Poor |

Due to the close relationship between problem and problem solving information behaviours, it could be claimed that diversity of children with autism also impacts the problem solving. To address the diversity of children and provide personalised solution options for each child, a DSS with access to child's medical history could be beneficial. This DSS should be able to match children's identified and specific conditions (identified in application 7) to suggest the best available options.

In the past nine sections the problem context was analysed by the researcher in the instrumental case study. In the following section the technical solutions which could assist parents are recommended.

#### 5.5.5.10 **Recommending solutions leveraging users' behaviour and experience**

Following the context analysis and IRD phase, the determined information requirements must be used for determining the specifications of the proposed solution(s). In practice this step is being done by a team consisting of information analysts, system analysts, developers and users. The following table is presented as an example illustrating how the results of context analysis performed by the QRD method can enhance this phase. Table 5-46 suggests solutions for the nine applications identified and described in parents information horizon. These solutions are the recommendations of the researcher who plays the role of an information analyst when applying the QRD method for the context analysis.

**Table 5-46: Categorised recommendations**

| | **Equivocality resolution Recommending** | **Confirming Balanced** | **Uncertainty resolution Focusing** |
|---|---|---|---|
| **Domain information** | Recommending good focusing sources for each specific query | Provide less specific but more ***complete*** information to provide a source for confirming the accuracy of parents obtained information | Classes and workshops to train parents on how to help parents with newly diagnosed children with autism. Also solutions for strengthening parents relationships are required |
| **Problem information** | - Children's specific e-health record to be used by doctors<br>- Doctors CV and rating for parents | Availability of sources which address high level queries and also analyse them into their reasons and define the reasons | Comprehensive data bases listing and explaining all the problems being referred by recommending sources |
| **Problem solving information** | DSSs with access to child's medical history could be beneficial. This DSS should be able to handle the diversity of children and can match their conditions to best available options | To handle information overload, availability of solutions like DSS with the ability to filter information and returns only relevant and reliable information could be beneficial for this subsystem/application | Providing perfect sources meeting all the quality requirements as very critical decisions should be made here |

Comparing the quality requirements and Silver (1991 p. 107) definitions for forms of decisional guidance also can be used to find the type of DSS required[52] for each application. Quality requirements can suggest the specifications of the proposed system. For example, in the context of caring of children with autism, if a DSS is going to be implemented, it is very important that the DSS proves that it only ***provides unbiased suggestions, and includes parents' opinions in its recommendations***. Unbiased suggestions and parents' indication of importance of their own personal experience in decision making process proves that ***DSS mode of guidance should be participative.*** Also, DSS should try not to ***information overload*** seekers more than what they already are, and so ***suggestive guidance***[53] might be preferred in this context over the informative guidance. This information helps to find DSS mechanisms through which the most effectiveness is anticipated (e.g. suggestive guidance through a participative mode for application 9). The provided information also should use ***scientific*** literature mixed with ***parents' experience***, and be ***accessible*** by both ***parents and doctors***. The rest of the identified quality requirements presented in the QRD presentation matrix also would be interpreted similarly into the system.

In the addition to leveraging IS practitioners opinions, the researcher also suggests leveraging the users' experience (users' opinions) to determine the required solutions. To collect users' opinions, in the instrumental case study conducted in this study, the researcher asked parents of children with autism about their recommendations for the required systems. This question was not a part of the main study and was done solely as a feasibility test for the future studies.

Parents' recommendations in this section are categorised in two groups. One of which is on quality requirement implementation and the other is on the specifications of the solutions that parents need. Table 5-47 merged parents' similar recommendations together and labelled them with relevant representative quality

[52] It must be noted that the focus of this study is only on information needs and not the decision algorithms and user interfaces.

[53] "Suggestive guidance makes judgmental recommendations (what to do, what input values to use) to the decision maker. Informative guidance provides pertinent information that enlightens the decision maker's judgment, without suggesting how to act." A DSS may include a combination of both. "In fact, at any point of judgment, a system may offer suggestions, pertinent information, or both" (Silver, 1991, p. 113).

dimension or the IS solution. The numbers in brackets are the number of recommendations which are used to generate each row. The rows recommending a solution are coloured in light blue and the rows recommending how to implement quality dimensions are in white.

**Table 5-47: Parents recommendations about their ideal system**

| Quality dimension/Solution | Definition/Indicator |
|---|---|
| Equivocality resolution system (7) | Recommends doctors, plans, other scientific/reliable information sources for each question/problem (for individuals or groups) |
| DSS (6)[54] | Recommends the best options to families based on statistics and scientific findings, Recommends options (interventions) based on child's diagnosis, available therapists and parents experiences for different problems. This system should suggest successful interventions by mentioning their effectiveness rate |
| Multimedia (3) | To watch the therapies in practice |
| Social group (2) | A group shaped by parents with similar children, disseminate only relevant information, members' creditability have been checked, members know each other, parents see the communication between professionals |
| List of professionals | List of all doctors … |
| Practical/detailed /personalisation (8) | Searched results should be specific to a topic (e.g. evaluating child's strength, sport), Should not have cliché information, step by step action plan, explains everything in great detail, explains the practical use of everything and personalised for category of children |
| Completeness (5) | Step by step action plan for whole process (whole time), explains all options, list of doctors and caregivers and all services, all problems and how to solve them, child's abilities and disabilities, child's future, includes all professionals' and parents' opinions |
| Experience (4) | Parents' experience on choosing their children physical activity, coping. Other professionals' experience |
| Reliability (4) | Polls, presented information being approved by professionals, people rank professionals, mentions Author's name (even if it is parent's experience and be sure she/he is whom she claims is), includes success rate of interventions |
| Categorised (3) – related to completeness - | Categorises the process step by step, based on age groups (i.e. children and adults) and type of problems |
| Language (3) | Sources be in Persian |
| Interactive | Can discuss my recommendations |
| Diversity | List of parents having children with similar diagnosis |
| Timeliness | Publishes in progress studies |
| Innovative | Recommends innovative solutions |
| Understandable | Simple to understand by parents, simple terminology |

Parents' opinions may assist IS practitioners on recommending solutions for different applications of the system. Accompanied by IS practitioners opinions, this information can be used to suggest the specifications of the proposed system as illustrated in Table 5-48.

[54] By comparing the definitions provided by parents and (Silver, 1991), this field has been named as DSS.

**Table 5-48: Categorised recommendations**

| | **Equivocality resolution Recommending** | **Confirming Balanced** | **Uncertainty resolution Focusing** |
|---|---|---|---|
| **Domain information** | Recommending good focusing sources for each specific query | Provide less specific but more ***complete*** information to provide a source for confirming the accuracy of parents obtained information | Classes and workshops to train parents on how to help parents with newly diagnosed children with autism. Also solutions for strengthening parents relationships are required |
| **Parents' recom.** | Equivocality resolving system | --- | Social groups |
| **Problem information** | - Children's specific e-health record to be used by doctors<br>- Doctors CV and rating for parents | Availability of sources which address high level queries and also analyse them into their reasons and define the reasons | Comprehensive data bases listing and explaining all the problems being referred by recommending sources |
| **Parents' recom.** | - Equivocality resolving system<br>- List of professionals | --- | List of professionals |
| **Problem solving information** | DSSs with access to child's medical history could be beneficial. This DSS should be able to handle the diversity of children and can match their conditions to best available options | To handle information overload, availability of solutions like DSS with the ability to filter information and returns only relevant and reliable information could be beneficial for this subsystem/application | Providing perfect sources meeting all the quality requirements as very critical decisions should be made here |
| **Parents' recom.** | - List of professionals<br>- Equivocality resolving system<br>- DSS (focused on informative guidance) | - Multimedia<br>- Social group | - Multimedia<br>- DSS (focused on suggestive guidance) |

Table 5-48 compares parents' recommendations with the experts' suggested requirements to determine the solutions necessary to address the problems in the context. For example, for problem solving ISB which is the focus of experienced parents and is one of the most problematic categories, characteristics of a DSS has been recommended by parents to be used for both applications 7 and 9.

The following section concludes the findings of RQ3.

### 5.5.6 Conclusion to RQ3

The QRD model and its presentation matrix shown in Figure 5.3 (page 204) provide an understanding of users' information horizon as a representation of the problem context. To define the problem in more details, information pathways and

analysis of the changes in users' information behaviour over time have been leveraged to define the QRD presentation matrix. The QRD model and its presentation matrix leverages a nine cell matrix with each cell representing a cognitive role played by the information sources in the users' information horizon. These cells are called application 1 to application 9. Depending on the goal of the information system, its expected responsibilities may fall into one or a few of these applications. Users' expectation of each application presented in the QRD presentation matrix highlights to characteristics of quality information systems required for that application.

To evaluate the usability of the QRD presentation matrix, users' information requirements determined by the QRD method from the instrumental case study was presented to eight IS practitioners. The results of evaluating the QRD presentation matrix provide support and explanations for 4/7 proposed hypotheses (H2, H3, H5 and H6). 5/8 interviewees found the QRD presentation matrix beneficial for context analysis and problem definition which supports H2. Similarly 5/8 interviewees supported H3 as they found analysis of IQ requirements useful for selecting suitable solutions, effective requirement analysis, implementing IQ, context analysis and common language. Moreover 3/8 informants described categorising users' information horizon useful for designing information flow and user interface that is supporting H5. To support H6, 6/8 interviewees (all with management backgrounds or previous experience as an analyst) found the QRD method useful in other contexts. Two other practical uses emerged during the analysis which gained more than one individual's support. 2/8 interviewees found studying users' change of behaviour over time useful for user interface design.

The following section concludes the analysis and discussion chapter.

## 5.6 Chapter summary

To achieve the research objective, a conceptual model (the QRD model) was established from the literature in chapter three. The three research questions which were discussed in this chapter, all were focused on investigating and evaluating the QRD model and its presentation matrix from different angles.

To investigate the validity of the relationships suggested in the QRD model, RQ1 investigates the relationship between users' information needs and source preference behaviour by the data collected from parents of children with autism as a case in which decision making is equivocal. The planned and emergent results of RQ1 are as follows:

- Parents consider different priorities for information sources' they use when seeking distinct types of information.
- The role each information source plays (recommending, balanced or focusing) can be matched with equivocality and uncertainty resolution behaviour and be used for categorising information sources in users' information horizon (emergent result).
- The same information source may play different roles (recommending, balanced or focusing) for providing different categories of information.
- Parents' information behaviour change over time (as a result of increased experience).

Information quality dimensions in the QRD model have been used as a way to quantify characteristics of users' required information. RQ2 is focused on measuring the quality requirements construct of the QRD model and its relationship with perceived information needs. RQ2 determines users' required IQ dimensions and defines their measurement factors. The planned and emergent results of RQ2 are as follows:

- Information quality dimensions considered by parents for seeking each category of their information needs.
- Measurement factors used by parents to evaluate IQ dimensions in their information horizon.
- Few IQ dimensions are interdependent and their availability affects each other (emergent result).
- IQ dimensions/measurement factors can be categorised into information specific and source or media specific dimensions/factors (emergent result).
- Different information quality dimensions are considered by parents when seeking distinct types of information (leverages the results of RQ1).

RQ3 investigates the applicability of users' determined information requirements by the QRD model that is presented by its presentation matrix. Eight IS practitioners with experience in information system development are interviewed to evaluate the applicability of the information presented in the QRD presentation matrix. Seven practical uses were proposed for the QRD method by the researcher. During the investigation, four of these proposed uses gained support from IS practitioners. IS practitioners also suggested one other potential use for the QRD presentation matrix which is presented along with the other hypotheses as follows (number of individuals supporting each hypothesis is provided in brackets):

- H2: Categorised information sources and IQ dimensions are useful for context analysis and defining the problem space (5 out of 8).
- H3: Identifying potential users' IQ requirements is useful to develop quality information systems (5 out of 8).
- H5: Identifying equivocality and uncertainty resolution sources assist designers and developers in developing the information flow in their systems (3 out of 8).
- H6: The QRD method is applicable in other contexts (6 out of 8).
- Emergent use 1: Studying users change in behaviour over time is useful for designing user interface (2 out of 8).

The next chapter outlines the conclusions drawn from this study.

# CHAPTER SIX: CONCLUSIONS

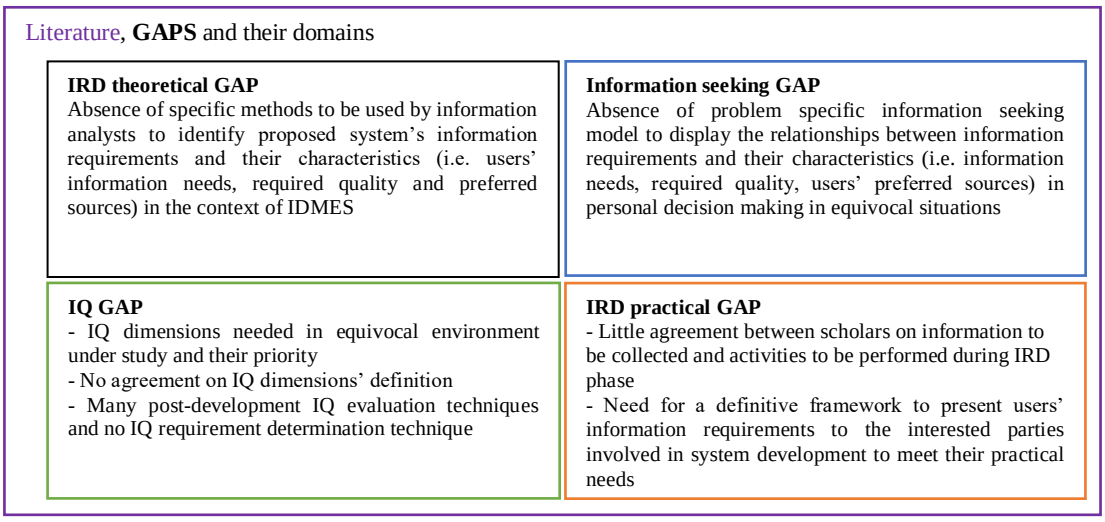
## 6.1 Introduction

This study's research objective was concentrated on investigating the applicability of the QRD model in determining and presenting system users' perceived information needs, quality requirements and preferred sources in the context of IDMES. To achieve the research objective, three research questions were formulated. The answers to these research questions and their contributions to theory and practice are outlined in section 6.2. Following that section 6.3 outlines the ultimate output of this study which is the ***QRD method*** as its contribution to practice. Subsequently, in section 6.4 the limitations of this research study are specified and at the end in section 6.5 the recommendations for the future researchers are outlined.

## 6.2 Contribution to theory

To contribute to theory, this study established and evaluated a theoretical model from the literature, named Quality Requirement Determination (QRD) model (Figure 3.2). The QRD model conceptualises the impact of information needs and quality requirements on individuals' source preference behaviour through the information horizon and pathway concepts and activity theory. This model is constructed on the basis of four fundamental gaps which chapter two uncovers from literature. These four gaps are illustrated in Figure 6.1.

**Figure 6.1: The gaps identified in the literature**

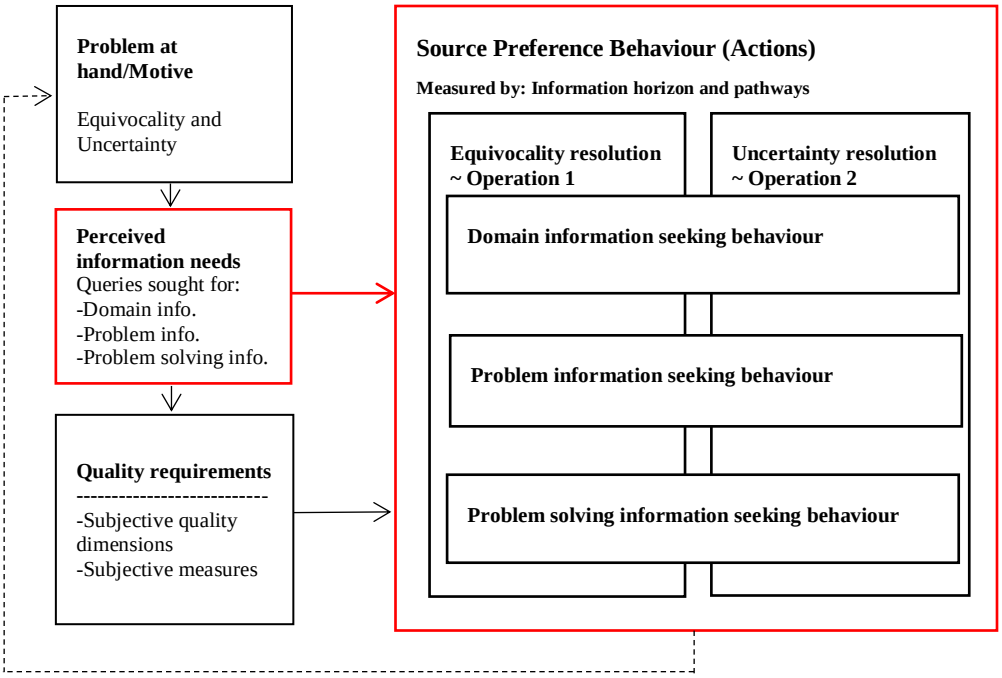


Based on this theoretical examination, this study developed three research questions to investigate the applicability of the QRD model in determining and presenting individuals' information requirements. Hence, RQ1 studied information needs and source preference behaviour constructs of the QRD model in depth and evaluated their relationship in the case of parenting children with autism. RQ2 studied the quality requirement construct of the QRD model in depth and leveraged the findings of RQ1 to evaluate its relationship with information needs. RQ3 on the other hand, was focused on evaluating the applicability of in depth analysis and evaluated relationships in practice. The following three sections explain the contributions of these three research questions to theory.

### 6.2.1 RQ1: How do perceived information needs impact users' source/media preference behaviour in the QRD model?

The QRD model (Figure 6.2) proposes that for different categories of perceived information needs, users show different behaviours (marked in red).

**Figure 6.2: Focus of RQ1 in the QRD model**




This relationship has received limited support from the literature. Therefore, in this study this relationship was empirically evaluated through a sample context analysis conducted on the case of parenting children with autism. The researcher used the queries in the minds of parents as a measure for their information needs and

information horizons and pathways as measures for their source preference behaviour. The planned and emergent results of RQ1 are as follows:

- Parents consider different priorities for information sources they use when seeking distinct types of information (supports the proposed relationship in the QRD model).
- The role each information source plays (recommending, balanced or focusing) can be matched with equivocality and uncertainty resolution behaviour and can be used for categorising information sources in users' information horizon (emergent result).
- The same information source may play different roles (recommending, balanced or focusing) for providing different categories of information (supports the proposed relationship in the QRD model).
- Parents' information behaviour changes over time (evaluates the impact of experience on seekers' source preference behaviour).

Equivocality resolving sources are proposed to need the richest media (Daft & Lengel, 1986; Sonnenwald et al., 2001). The findings of this study is in line with this proposition since the data shows that 70% (7/10) of recommending sources and 100% of popular starting nodes have been selected from the human/face-to-face sources. In the age of social media, it is important to realise that in critical equivocal contexts, a premium is still attached to face to face communication. On the other hand, this study also indicates the rising importance of social media enabled interaction. One could argue that the average use of social media will increase further in future years following its rapid popularity increase. Middle age Iranian society for instance has shown an incredible interest in the mobile social networks in the past few years (e.g. Viber, Telegram, Whatsapp). The data collected in this study also highlights social networks as the media showing the highest increase of average use in comparison to the other information sources in parents' information horizon by 18% increase in usage. This popularity increase, indeed makes social media a strong platform candidate for development of information systems to be used by parents of children with autism in Iran. However, it must be noted that only 47% of parents have used social media for seeking information which makes it the 7$^{th}$ popular source in their information horizon.

The findings of this study are not in line with one part of the findings of Savolainen (2008) study. Savolainen (2008) indicates that information seekers use information sources in the same order as their importance to users. It means that, an information seeker uses the most important source first, then the partially important sources and subsequently the peripherally important sources. However, the findings of this study suggest that the sequence through which users seek information in most cases is not related to the importance of sources to the users. This is probably due to the complexity of the decision they should make. For example, people may use peripherally important sources first, then the most important sources and then partially important ones. As a result, in this study it has been suggested that in equivocal decision making situations the sequence through which users access information sources is due to sources' equivocality and uncertainty resolution abilities not their importance to users.

### 6.2.2 RQ2: How does the QRD model unpack users' information quality requirements and its relationship with information needs in equivocal situations?

RQ2 also is using the data collected from parents of children with autism. Its focus is twofold which are as follows:

- Unpacking users' IQ requirement to address its measurement and applicability challenges i.e. identifying the context specific IQ dimensions, their priority and definitions for users.
- Explaining the relationship between users' IQ requirements and information needs.

Interviewing parents provided a list of IQ dimensions that they consider when evaluation information sources. To determine the priority of IQ dimensions to parents, the researcher has leveraged the following four perspectives to prioritise the IQ dimensions:

1. Frequently indicated quality dimensions (all information sources)
2. Quality dimension popularity

3 Frequently indicated quality dimensions for the top four sources (most important information zone)

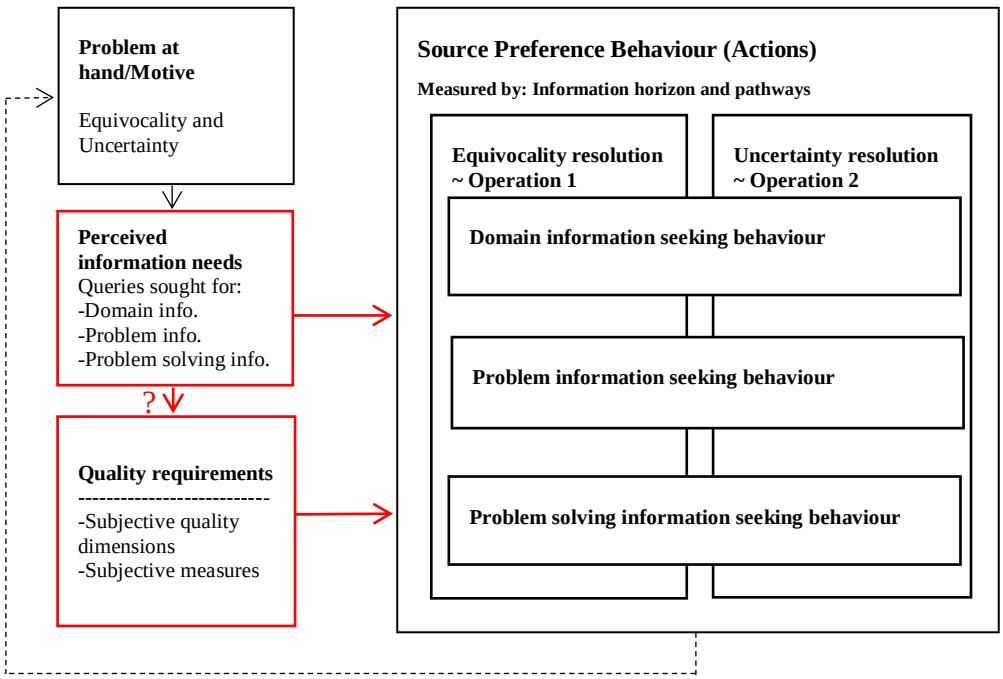
4 Quality dimensions causing sources' average use change over time

The results of RQ2 indicates that in the context of parenting children with autism, ***empathy, reliability, amount of relevant information, experience and scientific*** are the top five quality dimensions having a positive impact on parents' source preference behaviour. ***Reliability,*** being ***financially biased,*** not enough ***interaction with child, diversity*** of children and ***amount of relevant information*** are identified as the top five quality dimensions having a negative impact on parents' source preference behaviour. Comparing the results of the review of literature with the IQ dimensions identified in this study, confirms the fact that most IQ dimensions are subjective and context sensitive and so their priority to users should be determined prior to developing an information system in the context of interest.

In addition to IQ dimensions identified in the context of parenting children with autism, it is inferred that information sources in this context are preferred to be ***interactive***. Even though parents have not indicated it frequently, 3/4 sources being used by them are human sources through face to face communications, which is amongst the richest media and being interactive is one of the main characteristics of such sources (Daft & Lengel, 1986).

To investigate the relationship between perceived information needs and quality requirement, asking parents directly about their quality requirements for each category of their information needs is not applicable due to the complexity of the question and the relationship. To overcome this limitation, the researcher has leveraged an indirect relationship to explain the relationship between information needs and quality requirements, which is displayed in Figure 6.3.

**Figure 6.3: The relationships leveraged to explain the impact of information needs on quality requirements**




The results of data analysis indicate that parents have considered different IQ dimensions for each category of their information needs. In summary, the planned and emergent results of RQ2 are as follows:

- Information quality dimensions considered by parents for seeking each category of their information needs.
- Measurement factors used by parents to evaluate IQ dimensions in their information horizon.
- Few IQ dimensions are interdependent and their availability affects each other (emergent result).
- IQ dimensions/measurement factors can be categorised into information specific and source or media specific dimensions/factors (emergent result).
- Different information quality dimensions are considered by parents when seeking distinct types of information (supports the proposed relationship in the QRD model).

RQ2 identifies the IQ dimensions that information users need and defines the relationship between type of information and users' IQ requirements. This information accompanied by user's source preference behaviour is proposed to be beneficial for information system design. This claim has been evaluated in RQ3.

### 6.2.3 RQ3: What are the practical uses of the QRD model for IS practitioners when determining information requirements?

RQ3 investigates the usability of the information requirements determined by applying the QRD model and presented by the QRD presentation matrix for developing information systems. From the literature, the researcher derived six potential uses (i.e. hypothesis one to six) for the information analysed and presented by the QRD method. One more hypothesis also was identified by the researcher during the data analysis processes which was added to these six. Eight IS practitioners with experience in information system development were interviewed to evaluate the seven proposed hypotheses. During the investigations, four of these proposed uses gained support from IS practitioners. IS practitioners also suggested one other potential use for the analysed information which are as follows (number of individuals supporting each hypothesis are provided in brackets):

- H2: Categorised information sources and IQ dimensions are useful for context analysis and defining the problem space (5 out of 8). Interview data suggests that the information analysed by the QRD method is useful to "understand as-is situation", visualising the complicated situations, learn the starting point and define the problem and its parts.
- H3: Identifying potential users' IQ requirements is useful to develop quality information systems (5 out of 8). IS practitioners stated that identifying users' information requirement dimensions is useful for implementing IQ, selecting proper solutions, effective requirement analysis, context analysis and as a common language between different parties involved in the information system development.
- H5: Identifying equivocality and uncertainty resolution sources assist designers and developers in developing the information flow in their systems (3 out of 8). IS practitioners indicated that this part of the QRD presentation matrix helps them learn how users think, find their starting and ending points and help them in designing the steps through which information should be presented to users.
- H6: The QRD method is applicable in other contexts (6 out of 8). All the quotes supporting any of the hypotheses are considered as a support for H6

as well since IS practitioners were defining the usability of the data in their experience in other contexts.

- Emergent use 1: Studying users change in behaviour over time is useful for designing user interface (2 out of 8). Two IS practitioners stated that analysing the different information requirements of new and experienced users is useful for user interface design.

The findings of RQ3 validates the practical applicability of applying the QRD model constructs for determining users' information requirements. IS practitioners found different aspects of users' information needs, quality requirements and source preference behaviour useful for information system development. Following this, the subsequent section explains the contribution of this study to practice.

## 6.3 Contribution to practice

Contribution of this study to practice is twofold, first and main contribution of this study to practice is the ***QRD method***. This practical IRD method, consists of the QRD model, data collection, analysis and presentation techniques to provide IS practitioners with novel tools to determine and present users' information requirements. In the context of IDMES, the QRD method steps address the challenges associated with determining users' perceived information needs, quality requirements and preferred information sources for doing a specific task or making a specific decision. IS practitioners identified the QRD method useful for a number of key practical activities in the IRD process, namely: context study, problem definition, quality requirement analysis, quality implementation, designing information flow and user interface design. The QRD method has been outlined in section 4.7, Figure 4.11 and Figure 4.12.

The second contribution of this study to practice took place by leveraging the QRD method to determine the information requirements of parents of children with autism when they need to decide for an intervention required for their child. Even though the instrumental case study has been conducted to evaluate the applicability of the QRD method in identifying users' information requirements, yet its' empirical findings can be practically used by IS practitioners or managers who want to design an information source to assist parents of children with autism in their decision

makings. Section 5.5.3 organises all the empirical data collected from users' behaviour into the QRD presentation matrix and following that section 5.5.5.10 takes advantage of this data and users recommendations to suggest required solutions in the context.

The following section explains the limitations that constraints this study.

## 6.4 Limitations of this study

The research projects by nature are often constrained by a number of reasons such as limitations in financial resources, time and access to empirical data. This study is not an exception in this regard and its quality could be criticised through a number of perspectives which are explained as follows.

### 6.4.1 Nature of the empirical study

The case study approach followed in this study provided a considerable amount of empirical data sourced from interviews and graphical data collection instruments filled during the interviews. One of the complexities associated with this study is the result of its reliance on the ability of interviewees and interviewer in categorising users' queries on the fly during the interview. Categorising users' queries and studying its impact on their source preference behaviour and quality requirements is the focus of RQ1 and RQ2 and is an important step in the QRD method.

To categorise users' queries during the interview, the interviewer had to explain the three types of information needs to the interviewee and ensure they have understood it. It is very important because the interviewees need to recall the information sources that they have used for each type of their information needs. To minimise the errors in the categorisation of queries, three activities were performed by the researcher which are as follows:

- The researcher constantly updated the factors he used for categorising information needs by the observations he made in each interview to make them more accurate and applicable in the context.

- When categorising the queries, he discussed the process with the interviewees for validation purposes and also to update the categorising factors.
- When asking the interviewees to fill the information pathway diagrams, the information categories were defined to the interviewees once again using the examples of their own queries.

However, the researcher still considers some room for error at this stage.

Experience is one of the factors impacting the ISB. To analyse that two options were available. The first option was to conduct a longitudinal study on parents that their children were recently diagnosed with autism and continue the study for a few years until they cope with the situation. This option was not feasible in a PhD research considering the time and financial constraints. The second option then was using the critical incident technique.

A challenges involved in using critical incident technique in this study is that, parents are asked to recall an incident that has happened at least five years ago. However, for two reasons it is inferred that parents should be able to recall the old incident. 1) Early stages after diagnosis is a challenging and important stage of parents' lives. Memories of such important and unique incident are better remembered. 2) Parents, actively seek information, analyse and implement them. They are not just given all the information they need. This active (not passive) seeking behaviour increases the chance of behaviour to be recalled. Therefore, critical incident method was used[55]. However, the accuracy is expected to be lower than recalling a recent behaviour.

### 6.4.2 **Sample size**

Because of the explanatory nature of this study, it should be conducted qualitatively. To evaluate the QRD model, the researcher stopped at the 17th interview because he reached the theoretical saturation point. Generalisation of the findings requires larger sample size, however the time and financial resources

[55] During the data collection all interviewed parents indicated that they clearly recall the old incident.

constraints did not allow the researcher to adapt a mixed method to evaluate the QRD model through a quantitative approach with a larger sample size as well.

In addition to the relationships in the QRD model that were studied in this thesis, the relationships between problem at hand and perceived information needs, and problem at hand and source preference behaviour also have not received significant attention from the literature. However, analysing these relationships is left for the future studies considering the following limitations:

- Studying all the relationships at once would make the study more complicated and given the small sample sizes, it could possibility make tracing the chain of relationships impossible. Therefore, while all presented relationships are worthy of study, it was decided to take one step at a time.
- Studying all the relationships required a larger sample size and consequently larger data analysis which was not feasible due to the timeframe and financial constraints.

The next section provides a few recommendations for the future researchers.

## 6.5 Recommendations for further study

During this study several interesting ideas emerged but due to time and financial constraints the researcher could not pursue them all. In this section, these ideas are provided. It is suggested to the future researchers to:

- Evaluate the relationships between problem at hand and perceived information needs, and problem at hand and source preference behaviour in the QRD model.
- Test the QRD method in other equivocal contexts.
- Enhance the QRD method with a quantitative approach following the qualitative phase.
- Modify information horizon and pathway data collection tool to be used in quantitative approaches. Implementing a web information horizon and pathway diagram with drag and drop ability to select the sources and IQ

dimensions could be used as a tool to collect large amount of quantitative data.

- Evaluate the results by a larger group of IS practitioners.
- In other contexts, it is recommended to the researchers to categorise information needs differently (a different categorisation than domain, problem and problem solving) and study the impact.
- Use the results of this study to design information systems assisting parents of children with autism in their successive decision making behaviours.
- Evaluate the QRD method in practice.
- By loosening the sampling criteria, behaviour of a larger variation of information seekers will be included in the information seeking and pathways diagrams that may return interesting results.

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# Appendix

## 7.1 Ethical approval

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Oifig an Leas - Uachtaráin Taighde agus Nuálaíochta
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Amin Mousavinejad,
BIS

16th September 2014

Dear Amin,

Thank you for submitting your research (project entitled: To develop a framework to enhance information quality evaluation and requirement gathering phase of web information source developments by mapping users' source preference behaviour) to SREC for ethical perusal. I am pleased to say that we see no ethical impediment to your research as proposed and we are happy to grant approval.

We wish you every success in your research.

Yours sincerely,

Mike Murphy,
Chair of Social Research Ethics Committee

Professor Anita R.Maguire BSc PhD CChem MRSC
Vice President for Research and Innovation

Ollscoil na hÉireann, Corcaigh
National University of Ireland, Cork

## 7.2 SQL statements ran on database

| # | SQL statement |
|---|---|
| Q1 | SELECT [Q].Type_of_intervention, Count([Q].Type_of_intervention) AS Total<br>FROM (SELECT DISTINCT Queries.User_ID, Queries.Type_of_intervention FROM Queries WHERE Queries.Note<>'Map_Dropped') AS Q<br>GROUP BY [Q].Type_of_intervention; |
| Q2 | SELECT User_ID, Sources.source, reason_to_use, problems_to_use<br>FROM Sources<br>WHERE reason_to_use IS NOT NULL OR problems_to_use IS NOT NULL<br>ORDER BY source, User_ID; |
| Q3 | SELECT [%$##@_Alias].Type_of_intervention, [%$##@_Alias].Source, Count([%$##@_Alias].Source) AS [Total number of use], [***].Total AS [Total number of intervention cases]<br>FROM (SELECT DISTINCT Queries.User_ID, Queries.Type_of_intervention, Sources.Source FROM Queries, Sources WHERE Queries.Note<>'Map_Dropped' AND Queries.User_ID=Sources.User_ID AND Sources.Type_of_query IS NOT NULL) AS [%$##@_Alias], [***]<br>WHERE [%$##@_Alias].Type_of_intervention=[***].Type_of_intervention<br>GROUP BY [%$##@_Alias].Type_of_intervention, [%$##@_Alias].Source, [***].Total<br>ORDER BY [%$##@_Alias].Type_of_intervention, Count([%$##@_Alias].Source) DESC; |
| Q4 | SELECT [***S-SC/TOI].Type_of_intervention, Sum([***S-SC/TOI].[Total number of use]) AS [Total number of sources used], [***].Total AS [Total number of cases], Sum([***S-SC/TOI].[Total number of use])/[***].Total AS [Average number of sources per case]<br>FROM [***S-SC/TOI], [***]<br>WHERE [***S-SC/TOI].Type_of_intervention=[***].Type_of_intervention<br>GROUP BY [***S-SC/TOI].Type_of_intervention, [***].Total; |
| Q5 | SELECT COUNT(Source) AS Total<br>FROM (SELECT DISTINCT Source FROM Sources) AS [%$##@_Alias]; |
| Q6 | SELECT COUNT(Source) AS Total<br>FROM (SELECT DISTINCT Source FROM Sources WHERE Sources.Type_of_query IS NOT NULL) AS [%$##@_Alias]; |
| Q7 | SELECT Queries.Query, Queries.Type_of_intervention, Queries.Type_of_query, count(Queries.Query) AS [Number of appearance]<br>FROM Queries<br>GROUP BY Queries.Type_of_intervention, Queries.Type_of_query, Queries.Query; |
| Q8 | SELECT Queries.Query, Queries.Type_of_intervention, Queries.Type_of_query, count (Queries.Query) AS [Number of appearance]<br>FROM Queries<br>WHERE Queries.Sought_this_time=No<br>GROUP BY Queries.Type_of_query, Queries.Type_of_intervention, Queries.Query; |
| Q9 | SELECT Queries.Query, Queries.Type_of_intervention, Queries.Type_of_query, count (Queries.Query) AS [Number of appearance]<br>FROM Queries<br>WHERE Queries.Sought_this_time=Yes<br>GROUP BY Queries.Type_of_query, Queries.Type_of_intervention, Queries.Query; |
| Q10 | SELECT Type_of_query, SUM (Number) AS [Total number of sources used], 31 AS [Number of cases(17 current+14 past)], Round((SUM(Number)/31),2) AS [Average number of sources used per case], Count (Type_of_query) AS [Number of filled maps], Round((AVG(Number)),2) AS [Average number of sources used per filled maps]<br>FROM (SELECT Type_of_query, Number FROM (SELECT DISTINCT Sources.User_ID, Sources.Type_of_query, Sources.Current_source, Sources.Old_source, Count (Sources.source) AS [Number] FROM Sources GROUP BY Sources.User_ID, Sources.Type_of_query, Sources.Current_source, Sources.Old_source) AS [%$##@_Alias]) AS [%$##@_Alias]<br>GROUP BY Type_of_query; |
| Q11 | SELECT Type_of_query, SUM (Number) AS [Total number of sources used], 17 AS [Number of cases], Round((SUM(Number)/17),2) AS [Average number of sources used per case], Count (Type_of_query) AS [Number of filled maps], Round((AVG(Number)),2) AS [Average number of sources used per filled maps]<br>FROM (SELECT Type_of_query, Number FROM (SELECT DISTINCT Sources.User_ID, Sources.Type_of_query, Count (Sources.source) AS [Number] FROM Sources WHERE Sources.Type_of_query IS NOT NULL AND Current_source=Yes GROUP BY Sources.User_ID, Sources.Type_of_query) AS [%$##@_Alias]) AS [%$##@_Alias]<br>GROUP BY Type_of_query; |
| Q12 | SELECT Type_of_query, SUM (Number) AS [Total number of sources used], 14 AS [Number of cases], Round((SUM(Number)/14),2) AS [Average number of sources used per case], Count |

| | |
|---|---|
| | (Type_of_query) AS [Number of filled maps], Round((AVG(Number)),2) AS [Average number of sources used per filled maps]<br>FROM (SELECT Type_of_query, Number FROM (SELECT DISTINCT Sources.User_ID, Sources.Type_of_query, Count (Sources.source) AS [Number] FROM Sources WHERE Sources.Type_of_query IS NOT NULL AND Old_source=Yes GROUP BY Sources.User_ID, Sources.Type_of_query) AS [%$##@_Alias]) AS [%$##@_Alias]<br>GROUP BY Type_of_query; |
| Q13 | SELECT Source, count(source) AS [Number of parents mention it], 17 AS [Number of cases], Round((count(source))*100/17) AS [Popularity %]<br>FROM (SELECT DISTINCT Sources.User_ID, Sources.Source FROM Sources) AS [%$##@_Alias]<br>GROUP BY Source<br>HAVING count(source)>1<br>ORDER BY count(source) DESC; |
| Q14 | SELECT Source, count(source) AS [Number of parents mention it], 17 AS [Number of cases], Round((count(source))*100/17) AS [Popularity %]<br>FROM (SELECT DISTINCT Sources.User_ID, Sources.Source FROM Sources) AS [%$##@_Alias]<br>GROUP BY Source<br>ORDER BY count(source) DESC; |
| Q15 | SELECT Sources.User_ID, Sources.Source, Sources.Type_of_query, Sources.Sequence, Sources.Current_source<br>FROM Sources<br>WHERE Sources.Source=[enter source name] AND Sources.Type_of_query="Domain info" AND Sources.Current_source=Yes; |
| Q16 | SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round((AVG(Sources.Importance_number)),2) AS [Importance Average], 93 AS [Total number of maps inc blanks], Round((Count(Sources.Source)*100/93),2) AS [Popularity %]<br>FROM Sources<br>WHERE Sources.Type_of_query IS NOT NULL<br>GROUP BY Sources.Source<br>HAVING Count(Sources.Source)>4<br>ORDER BY Count(Sources.Source) DESC; |
| Q17 | SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round((AVG(Sources.Importance_number)),2) AS [Importance Average], 30 AS [Number of filled maps], Round(((Count(Sources.Source)/30)*100),0) AS [Popularity %]<br>FROM Sources<br>WHERE Old_source=Yes AND Sources.Type_of_query IS NOT NULL<br>GROUP BY Sources.Source<br>HAVING Count(Sources.Source)>2<br>ORDER BY Count(Sources.Source) DESC , AVG(Sources.Importance_number) DESC; |
| Q18 | SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], 33 AS [Number of filled maps], Round(((Count(Sources.Source)/33)*100),0) AS [Popularity %]<br>FROM Sources<br>WHERE Sources.Current_source=Yes AND Sources.Type_of_query IS NOT NULL<br>GROUP BY Sources.Source<br>HAVING Count(Sources.Source)>2<br>ORDER BY Count(Sources.Source) DESC , AVG(Sources.Importance_number) DESC; |
| Q19 | SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round((AVG(Sources.Importance_number)),2) AS [Importance Average], 93 AS [Total number of maps inc blanks], Round((Count(Sources.Source)*100/93),2) AS [Popularity %]<br>FROM Sources<br>WHERE Sources.Type_of_query IS NOT NULL<br>GROUP BY Sources.Source<br>HAVING Count(Sources.Source)>4<br>ORDER BY Count(Sources.Source) DESC; |
| Q20 | SELECT Sources.Source, Count(Sources.Source) AS [Total number of appearence], Round((AVG(Sources.Importance_number)),2) AS [Importance Average], 63 AS [Total number of maps drawn], Round((Count(Sources.Source)*100/63),2) AS [Popularity %]<br>FROM Sources<br>WHERE Sources.Type_of_query IS NOT NULL<br>GROUP BY Sources.Source<br>ORDER BY Count(Sources.Source) DESC; |
| Q21 | SELECT Sources.User_ID, Sources.Source, [**S-SC/C-No-Lim].[Popularity %], Sources.Reason_to_use, Sources.Problems_to_use<br>FROM Sources, [**S-SC/C-No-Lim] |

| | |
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| | WHERE (Sources.source=[**S-SC/C-No-Lim].Source) And (Sources.Reason_to_use Is Not Null Or Sources.Problems_to_use Is Not Null)<br>ORDER BY [**S-SC/C-No-Lim].[Popularity %] DESC , Sources.source, Sources.User_ID; |
| Q22 | SELECT Sources.Source, Sources.Importance, Count(Sources.Source) AS [Number of appearence], 63 AS [Total number of maps filled]<br>FROM Sources<br>WHERE Type_of_query IS NOT NULL<br>GROUP BY Sources.Source, Sources.Importance<br>ORDER BY Sources.Importance DESC , Count(Sources.Source) DESC; |
| Q23 | SELECT Sources.Source, Sources.Importance, Count(Sources.Source) AS [Number of appearence], 30 AS [Total number of maps filled]<br>FROM Sources<br>WHERE Sources.Old_source=Yes AND Type_of_query IS NOT NULL<br>GROUP BY Sources.Source, Sources.Importance<br>ORDER BY Sources.Importance DESC , Count(Sources.Source) DESC; |
| Q24 | SELECT Sources.Source, Sources.Importance, Count(Sources.Source) AS [Number of appearence], 33 AS [Total number of maps filled]<br>FROM Sources<br>WHERE Sources.Current_source=Yes AND Type_of_query IS NOT NULL<br>GROUP BY Sources.Source, Sources.Importance<br>ORDER BY Sources.Importance DESC , Count(Sources.Source) DESC; |
| Q25 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of apprearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], [**S-AS/U].[Number of filled maps], Round(((Count(Sources.Source)/[**S-AS/U].[Number of filled maps])*100),0) AS [Popularity %]<br>FROM Sources, [**S-AS/U]<br>WHERE (((Sources.Type_of_query) Is Not Null)) AND [**S-AS/U].Type_of_query=Sources.Type_of_query AND [**S-AS/U].Type_of_query=Sources.Type_of_query<br>GROUP BY Sources.Source, Sources.Type_of_query, [**S-AS/U].[Number of filled maps]<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q26 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], [**S-AS/U+OT].[Number of filled maps], Round(((Count(Sources.Source)/[**S-AS/U+OT].[Number of filled maps])*100),0) AS [Popularity %]<br>FROM Sources, [**S-AS/U+OT]<br>WHERE (((Sources.Old_source)=Yes) And ((Sources.Type_of_query) Is Not Null) And [**S-AS/U+OT].Type_of_query=Sources.Type_of_query)<br>GROUP BY Sources.Source, Sources.Type_of_query, [**S-AS/U+OT].[Number of filled maps]<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q27 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], 14 AS [Total number of maps inc blanks], Round(((Count(Sources.Source)/14)*100),0) AS [Popularity %]<br>FROM Sources<br>WHERE (((Sources.Old_source)=Yes) And ((Sources.Type_of_query) Is Not Null))<br>GROUP BY Sources.Source, Sources.Type_of_query<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q28 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], [**S-AS/U+CT].[Number of filled maps], Round(((Count(Sources.Source)/[**S-AS/U+CT].[Number of filled maps])*100),0) AS [Popularity %]<br>FROM Sources, [**S-AS/U+CT]<br>WHERE (((Sources.Current_source)=Yes) AND ((Sources.Type_of_query) Is Not Null) AND [**S-AS/U+CT].Type_of_query=Sources.Type_of_query)<br>GROUP BY Sources.Source, Sources.Type_of_query, [**S-AS/U+CT].[Number of filled maps]<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q29 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of |

| | |
|---|---|
| | appearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], 17 AS [Total number of maps inc blanks], Round(((Count(Sources.Source)/17)*100),0) AS [Popularity %]<br>FROM Sources<br>WHERE (((Sources.Current_source)=Yes) AND ((Sources.Type_of_query) Is Not Null) )<br>GROUP BY Sources.Source, Sources.Type_of_query<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q30 | SELECT Sources.Source, Sources.Type_of_query, Count(Sources.Source) AS [Total number of apprearence], Round((Avg(Sources.Importance_number)),2) AS [Importance Average], 31 AS [Total number of maps inc blanks], Round(((Count(Sources.Source)/31)*100),0) AS [Popularity %]<br>FROM Sources<br>WHERE Sources.Type_of_query Is Not Null<br>GROUP BY Sources.Source, Sources.Type_of_query<br>HAVING (((Count(Sources.Source))>2))<br>ORDER BY Sources.Type_of_query, Count(Sources.Source) DESC , Avg(Sources.Importance_number) DESC; |
| Q31 | SELECT Min([%$##@_Alias].Total) AS [MIN], Max([%$##@_Alias].Total) AS [MAX], Avg([%$##@_Alias].Total) AS [AVG], [***Total-SM].Total AS [Total unique sources MENTIONED]<br>FROM (SELECT User_ID, Count (Source) AS Total FROM (SELECT DISTINCT Sources.User_ID, Sources.Source FROM Sources) AS [%$##@_Alias] GROUP BY User_ID) AS [%$##@_Alias], [***Total-SM]<br>GROUP BY [***Total-SM].Total; |
| Q32 | SELECT Min([%$##@_Alias].Total) AS [MIN], Max([%$##@_Alias].Total) AS [MAX], Avg([%$##@_Alias].Total) AS [AVG], [***Total-SU].Total AS [Total unique sources USED]<br>FROM (SELECT User_ID, Count (Source) AS Total FROM (SELECT DISTINCT Sources.User_ID, Sources.Source FROM Sources WHERE Sources.Type_of_query IS NOT NULL) AS [%$##@_Alias] GROUP BY User_ID) AS [%$##@_Alias], [***Total-SU]<br>GROUP BY [***Total-SU].Total; |
| Q33 | SELECT [#1].Factor, Count ([#1].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor] WHERE Positive=No) AS [#1]<br>GROUP BY [#1].Factor<br>ORDER BY Count ([#1].Factor) DESC; |
| Q34 | SELECT [Source-Factor].Factor, Count ([Source-Factor].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor] WHERE [Source-Factor].positive=NO AND [Source-Factor].Source=[Enter Source]) AS [%$##@_Alias]<br>GROUP BY [Source-Factor].Factor<br>ORDER BY Count ([Source-Factor].Factor) DESC; |
| Q35 | SELECT [#1].Factor, Count ([#1].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor]) AS [#1]<br>GROUP BY [#1].Factor<br>ORDER BY Count ([#1].Factor) DESC; |
| Q36 | SELECT [Source-Factor].Factor, Count ([Source-Factor].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor] WHERE [Source-Factor].Source=[Enter Source]) AS [%$##@_Alias]<br>GROUP BY [Source-Factor].Factor<br>ORDER BY Count ([Source-Factor].Factor) DESC; |
| Q37 | SELECT [#1].Factor, Count ([#1].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor] WHERE Positive=Yes) AS [#1]<br>GROUP BY [#1].Factor<br>ORDER BY Count ([#1].Factor) DESC; |
| Q38 | SELECT [Source-Factor].Factor, Count ([Source-Factor].Factor) AS [Frequency (person)]<br>FROM (SELECT DISTINCT [Source-Factor].User_ID, [Source-Factor].Factor FROM [Source-Factor] WHERE [Source-Factor].positive=YES AND [Source-Factor].Source=[Enter Source]) AS [%$##@_Alias]<br>GROUP BY [Source-Factor].Factor<br>ORDER BY Count ([Source-Factor].Factor) DESC; |
| Q39 | SELECT Factors.Factor, Count(Factors.Factor) AS [Count]<br>FROM Factors<br>GROUP BY Factors.Factor |

| | |
|---|---|
| | ORDER BY Count(Factors.Factor) DESC; |
| Q40 | SELECT Factors.Factor, Count(Factors.Factor) AS [Count]<br>FROM Factors<br>WHERE Factors.Content_dependent_factor=Yes<br>GROUP BY Factors.Factor<br>ORDER BY Count(Factors.Factor) DESC; |
| Q41 | SELECT Factors.Factor, Count(Factors.Factor) AS [Count]<br>FROM Factors<br>WHERE Factors.Channel_dependent_factor=Yes<br>GROUP BY Factors.Factor<br>ORDER BY Count(Factors.Factor) DESC; |
| Q42 | SELECT Factors.Factor, Count(Factors.Factor) AS [Count]<br>FROM Factors<br>WHERE Factors.Possitive_factor=No<br>GROUP BY Factors.Factor<br>ORDER BY Count(Factors.Factor) DESC; |
| Q43 | SELECT Factors.Factor, Count(Factors.Factor) AS [Count]<br>FROM Factors<br>WHERE Factors.Possitive_factor<br>GROUP BY Factors.Factor<br>ORDER BY Count(Factors.Factor) DESC; |
| Q44 | SELECT CodeGroup, Factors.Factor, Factors.Indicators, Factors.Interconnected, User_ID<br>FROM Factors<br>ORDER BY CodeGroup; |

## 7.3 Presentation of data

### 7.3.1 Decisions to be made

The decisions parents make are in a close relationship with the problems they wanted to solve. Two types of triggers for parents' ISB were identified during the interviews.

a. Having a problem which parents look for an intervention to solve it (e.g. low attention)
b. Parents hear about an interesting intervention which they think could be beneficial for their child (e.g. hearing about nutrition intervention to improve children with autism overall mind activity)

Regardless of how parents begin the process of decision making, that decision often is to solve a specific problem/equivocality. The following list shows the problems parents were seeking to solve (the numbers in brackets are the number of individuals naming the same problem).

- Which school is the right one to choose (3)?
- Issue of shallow learning (2)
- Problem with repetitive behaviour (2)
- Fear of water (2)

- What should be done for autism? (2)
- Maturity problems
- Resistance against learning
- Issue with low attention
- Choosing the right occupational therapist
- Choosing the right speech therapist

### 7.3.2 Perceived information needs

**Table 7-1: parents' queries sought in the latest ISB incident, categorised by type of information needs**

| Query | Type of query |
|---|---|
| Can ABA be used for home education? | Domain info |
| Can children with autism learn how to read and write? | Domain info |
| Can children with autism use of their ability to read and write at all? | Domain info |
| Do educational interventions affect children at all? | Domain info |
| How important is the educational interventions? | Domain info |
| How much does education cost? Time/cost? Total time? | Domain info |
| Looking for evidence of educational intervention effectiveness on her child | Domain info |
| Looking for slightest hope | Domain info |
| Which education method is better? | Domain info |
| Benefits and side effects of medicines | Domain info |
| Complete medicines' information | Domain info |
| Is there a medicine to help a child with autism? | Domain info |
| Medicine's side effects? | Domain info |
| What are medicine's good effects? | Domain info |
| Can medicine help my child? | Domain info |
| Am I doing a right thing to proceed this intervention? | Domain info |
| Is the sport intervention required? | Domain info |
| Does play and group therapy works at all? | Domain info |
| Financial costs | Domain info |
| Is my decision right? | Domain info |
| Is play and group intervention a valid one? | Domain info |
| Do school's benefits outweigh the problems associated with attending school? | Problem info |
| How to deal with his masturbating problems? | Problem info |
| How to teach him not to take off his cloths before getting in bathroom? | Problem info |
| How to teach him to avoid improper acts? | Problem info |
| How to teach him to wash himself properly at shower? | Problem info |
| looking for similar people's experience in ordinary and special schools (with exact problem) | Problem info |
| Should I put him through more experiments to find the problem? | Problem info |
| To what extent an academic education may affect my child particularly? | Problem info |
| What in school has hurt him? | Problem info |
| What to do to educate him not to masturbate in public? | Problem info |
| Why does he learn selectively? | Problem info |
| Why does he memorise selectively? | Problem info |
| Why does he resist against everything he is told to do? | Problem info |
| Why does my child resist against learning? | Problem info |
| Why does not he learn deeply? | Problem info |
| Why is he so unstable which prevents him from concentrating? | Problem info |
| Why my child does not cooperate? | Problem info |

| | |
|---|---|
| Worried about child being misbehaved at school | Problem info |
| List of neurologist doctors familiar with autism, with their address and CV | Problem info |
| Is there a relationship between child's food preference and what is said to be harmful for children with autism? | Problem info |
| What can help him with his speech/balance/behaviour problems? | Problem info |
| What food might be harmful for these children? | Problem info |
| Why my child likes yogurt and starch? | Problem info |
| Does his resistance against education cause his resistance in learning to swim? Because he used to love water | Problem info |
| Does the anxiety increases or he overcomes? (for swimming) | Problem info |
| Does the feeling of being unsupported in water increase his anxiety? As he always been very supported | Problem info |
| Have I chosen the right trainer? (for swimming) | Problem info |
| Is it my anxiety or my son's? Am I amplifying his anxiety? | Problem info |
| Not sure if I rushed in sending him to swimming class | Problem info |
| Am I responsible for his being scared of water by sending him to swimming class? | Problem info |
| What is the reason of his anxiety? Is it because of entering deep water with no support? | Problem info |
| Why is he scared of water? | Problem info |
| Can something be done for his sensing and repetitive behaviour problems? Looking for confirmation "Yes" | Problem info |
| Is he lazy? | Problem info |
| Why doesn't he want to get involved with others? | Problem info |
| Looking for clips to show how similar problems are treated | Problem solving info |
| Does ABA helps without sport/behaviour therapy/medicine? | Problem solving info |
| Does practice help? Is there any better ways to teach him? | Problem solving info |
| Evaluation of the school they have registered their child in | Problem solving info |
| How to motivate child to learn? | Problem solving info |
| How to strengthen the deep understanding in my child? | Problem solving info |
| How to teach him to be self-motivated? | Problem solving info |
| Looking for proper play grounds for my child to play in | Problem solving info |
| Looking for specialist centres to help child grow with no harm and experience a normal life | Problem solving info |
| Looking for specific play grounds for these children | Problem solving info |
| What type of school is better for my child? Ordinary or special, social or private? | Problem solving info |
| Which one is better, ABA at home or outside? | Problem solving info |
| Does (this specific) medicine's benefits overcome its side effects? | Problem solving info |
| Isn't (this specific) medicine addictive? | Problem solving info |
| What are this medicine's side effects? | Problem solving info |
| Which doctor is good? | Problem solving info |
| Seeking for consultancy on how to impact the problems her son has? | Problem solving info |
| What should be done for his overweight/behaviour/energy problems? | Problem solving info |
| Which doctor to go to? | Problem solving info |
| Which medicine to use? | Problem solving info |
| What nutrition can help me with my child's problems? (speech, balance, behaviour) | Problem solving info |
| Which side of brain is responsible for speech? What nutrition can empower it? | Problem solving info |
| Are the old ways good to reduce anxiety? (like ice cream and …) | Problem solving info |
| How successful mothers helped their children with his anxiety? | Problem solving info |
| If my child could decide would he choose the same person? (therapist) | Problem solving info |
| Is the person I have chosen is the best? | Problem solving info |
| Looking for a proper sport for him | Problem solving info |
| Looking for right person to guide me in finding the right sport for him | Problem solving info |

| | |
|---|---|
| Should he be sent to special needs children classes? | Problem solving info |
| Should he be sent to swimming classes now? Or wait longer so he may forget the bad memory | Problem solving info |
| looking for some video clips to compare | Problem solving info |
| What kind of person is the trainer? | Problem solving info |
| Would his father do the same? | Problem solving info |
| How to find a good speech therapist? | Problem solving info |
| Investigate about caregiver | Problem solving info |
| Investigate about caregiver's recommender | Problem solving info |
| Looking for a good occupational therapist | Problem solving info |
| Looking for a long term intervention method | Problem solving info |
| Looking for a smart and good speech therapist to pass my factors | Problem solving info |
| What should be done for his problems? | Problem solving info |

**Table 7-2: Parents' queries sought in an "early after receiving the diagnosis" ISB incident, categorised by type of information needs**

| Query | Type of query |
|---|---|
| Can children with autism communicate through writing if cannot speak? | Domain info |
| Can these children go to school? Do they have the ability to get educated? | Domain info |
| Learn about importance of education for these children | Domain info |
| Learn about importance of not letting these children fall behind others | Domain info |
| What is the reason for every child's behaviour? Or act? (e.g. resisting in writing is because of …) | Domain info |
| Is it right to prescribe medicine for these children? | Domain info |
| Does autism have a medicine? | Domain info |
| Find more about medicines and their side effects | Domain info |
| How can he live independently? | Domain info |
| How come he is very smart in some aspects and do not pay attention to other things at all? | Domain info |
| How come he understands things we cannot and have problems in understanding simple things? | Domain info |
| How come is he this much selective on things? | Domain info |
| What is the reason of autism? (*3) | Domain info |
| Is a new medicine coming? To cure? | Domain info |
| Is it right to prescribe medicine for these children? | Domain info |
| Learn more about child's maturity and its stages | Domain info |
| Looking for evidences to approve his chosen interventions | Domain info |
| Looking for general information about Asperger | Domain info |
| Looking for online tests | Domain info |
| Looking for other parents' opinion and working solutions | Domain info |
| Looking for successful Asperger people | Domain info |
| Parents - children relationship | Domain info |
| Should child's routines be interfered? | Domain info |
| Should I look for autism reason? Does it have any benefit? | Domain info |
| Should I talk about my problems to my parents? To my husband? | Domain info |
| To what extent each intervention is effective? | Domain info |
| What are generic interventions? | Domain info |
| What are parents' responsibilities? (What should parents do?) | Domain info |
| What will happen to him after us? (*3) | Domain info |
| What is autism? | Domain info |
| What is going on in child's mind? | Domain info |
| What parents of Asperger children should do in each period of child's life? | Domain info |
| What will be child's future? | Domain info |
| Why does he like only a certain type of music? | Domain info |
| Why with all the difference children with autism show some similarities? | Domain info |

| | |
|---|---|
| General information about sensing and repetitive behaviour problems | Domain info |
| What is autism physiological cause? | Domain info |
| What are repetitive behaviours? | Domain info |
| Does his problems related to the difficulties he had when he got born? | Problem info |
| Is it right that I push him to do something? I usually don't | Problem info |
| Can she hold a pen because of sensing problems? | Problem info |
| Looking for other parents in internet experiencing exact same problem | Problem info |
| In what range of autism my child falls? | Problem info |
| How did my child become Autistic? (examine the hypothesis) | Problem info |
| What is the reason for my child's different behaviour? Is he shy? ….? | Problem info |
| How to help him quit his irregular love to specific objects? | Problem solving info |
| Is the therapist I have chosen is the best? | Problem solving info |
| What kind of interventions can help my child to be independent? | Problem solving info |

### 7.3.3 Parents' source preference behaviour (latest ISB)

#### 7.3.3.1 Information horizon

##### 7.3.3.1.1 Domain information horizon

Amongst 17 parents interviewed 8 had sought domain queries in the latest ISB.

**Table 7-3: Parents' domain information horizon (latest ISB)**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Other parents | 7 | 2.29 | 88 |
| Personal experience | 3 | 3 | 38 |
| Doctors | 3 | 2.33 | 38 |
| Social Networks | 3 | 2.33 | 38 |
| WWW | 3 | 1.67 | 38 |
| Books | 2 | 1.5 | 25 |
| Teachers | 1 | 3 | 12 |
| Officials | 1 | 3 | 12 |
| Spouse | 1 | 2 | 12 |
| Scientific papers | 1 | 1 | 12 |
| Other informant | 1 | 1 | 12 |
| Therapist/trainer | 1 | 1 | 12 |

##### 7.3.3.1.2 Problem information horizon

Amongst 17 parents interviewed 11 had sought problem queries in the latest ISB.

**Table 7-4: Parents' problem information horizon (latest ISB)**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Personal experience | 7 | 3 | 64 |
| WWW | 6 | 2.5 | 55 |
| Therapist/trainer | 6 | 2 | 55 |
| Books | 5 | 2.6 | 45 |
| Other parents | 5 | 2.6 | 45 |
| Doctors | 5 | 2 | 45 |
| Professionals | 1 | 3 | 9 |
| Officials | 1 | 3 | 9 |

| | | | |
|---|---|---|---|
| Spouse | 1 | 3 | 9 |
| Social networks | 1 | 2 | 9 |
| Teachers | 1 | 2 | 9 |
| Scientific papers | 1 | 2 | 9 |
| Other informant | 1 | 1 | 9 |
| Mass media | 1 | 1 | 9 |

#### 7.3.3.1.3 Problem solving information horizon

Amongst 17 parents interviewed 14 had sought problem solving queries in the latest ISB.

**Table 7-5: Parents' problem solving information horizon (latest ISB)**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Other parents | 10 | 2.4 | 71 |
| Doctors | 7 | 2.71 | 50 |
| Therapist/trainer | 6 | 2.5 | 43 |
| WWW | 6 | 2.17 | 43 |
| Personal experience | 5 | 3 | 36 |
| Spouse | 3 | 2.67 | 21 |
| Books | 3 | 2.67 | 21 |
| Social networks | 3 | 2.33 | 21 |
| Teachers | 2 | 3 | 14 |
| Trusted doctors | 2 | 2.5 | 14 |
| Professionals | 2 | 2.5 | 14 |
| Medicine booklet | 1 | 3 | 7 |
| Clinics | 1 | 3 | 7 |
| autism communities | 1 | 2 | 7 |
| Family members | 1 | 2 | 7 |
| Other informant | 1 | 1 | 7 |

### 7.3.3.2 **Information seeking pathways**

#### 7.3.3.2.1 Domain information seeking pathways

8/17 parents sought domain information for the latest ISB.

**Figure 7.1: Domain information seeking pathways pursued in the latest ISB**

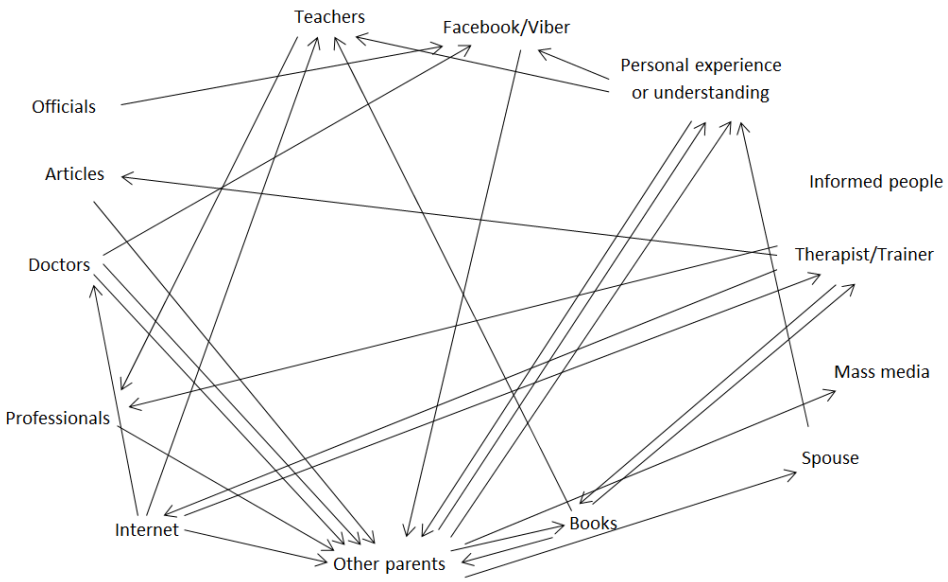



**Table 7-6: The role of information sources used in the latest ISB for domain information**

| Source | Incoming | Outgoing | Total links# | Type of source |
|---|---|---|---|---|
| Other parents | 8 | 5 | 13 | Focusing |
| Personal experience | 3 | 3 | 6 | Balanced |
| Therapist/Trainer | 2 | 4 | 6 | Recommending |
| WWW | 1 | 4 | 5 | Recommending |
| Books | 2 | 3 | 5 | Balanced |
| Doctors | 1 | 3 | 4 | Recommending |
| Teachers | 3 | 1 | 4 | Focusing |
| Social Networks | 3 | 1 | 4 | Focusing |
| Professionals | 2 | 1 | 3 | Balanced |
| Spouse | 1 | 1 | 2 | Balanced |
| Article | 1 | 1 | 2 | Balanced |
| Mass media (Medical news on autism) | 1 | 0 | 1 | Ending (Focusing) |
| Officials (e.g. Disables Sport Committee) | 0 | 1 | 1 | Starting (Recommending) |

#### 7.3.3.2.2 Problem information seeking pathways

11/17 parents sought problem information for the latest ISB.

**Figure 7.2: Problem information seeking pathways pursued in the latest ISB**

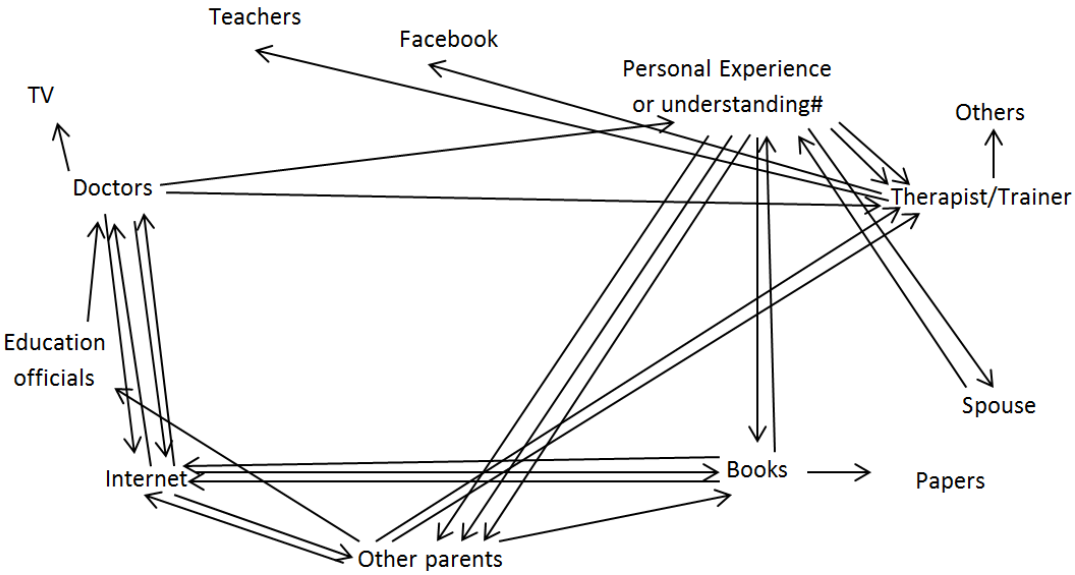



**Table 7-7: The role of information sources used in the latest ISB for problem information**

| Source | Incoming | Outgoing | Total links# | Type of source |
|---|---|---|---|---|
| Personal experience | 4 | 7 | 11 | Recommending |
| Other Parents | 4 | 5 | 9 | Balanced |
| WWW | 5 | 4 | 9 | Balanced |
| Doctors | 3 | 5 | 8 | Recommending |
| Therapist/Trainer | 5 | 3 | 8 | Focusing |
| Books | 3 | 4 | 7 | Balanced |
| Education Officials | 1 | 1 | 2 | Balanced |
| Spouse | 1 | 1 | 2 | Balanced |
| Papers | 1 | 0 | 1 | Ending (Focusing) |
| TV | 1 | 0 | 1 | Ending (Focusing) |
| Teachers | 1 | 0 | 1 | Ending (Focusing) |
| Others | 1 | 0 | 1 | Ending (Focusing) |
| Social network | 1 | 0 | 1 | Ending (Focusing) |

#### 7.3.3.2.3 Problem solving information seeking pathways

14/17 parents sought problem solving information for the latest ISB.

**Figure 7.3: Problem solving seeking pathways pursued in the latest ISB**

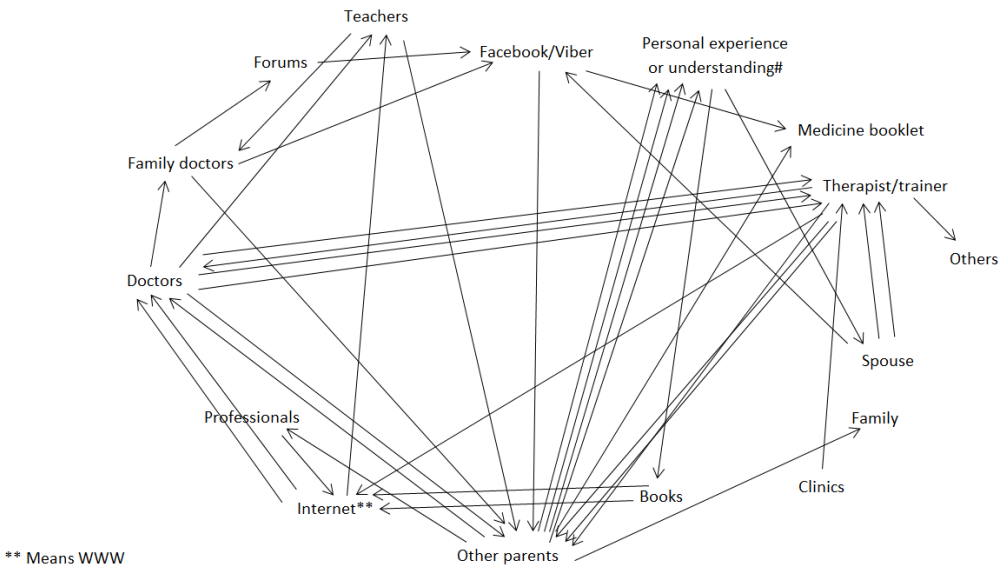



**Table 7-8: The role of information sources used in the latest ISB for problem solving information**

| Source | Incoming | Outgoing | Total | Type |
|---|---|---|---|---|
| Other parents | 7 | 8 | 15 | Balanced |
| Therapist/trainer | 6 | 6 | 12 | Balanced |
| Doctors | 4 | 6 | 10 | Recommending |
| WWW | 4 | 3 | 7 | Balanced |
| Personal experience | 5 | 2 | 7 | Focusing |
| Social network | 3 | 2 | 5 | Balanced |
| Trusted Doctors | 2 | 3 | 5 | Balanced |
| Teachers | 2 | 2 | 4 | Balanced |
| Spouse | 1 | 3 | 4 | Recommending |
| Books | 1 | 2 | 3 | Balanced |
| Clinics | 0 | 1 | 1 | Starting (Recommending) |
| Family member | 1 | 0 | 1 | Ending (Focusing) |
| Others | 1 | 0 | 1 | Ending (Focusing) |
| Medicine booklet | 2 | 0 | 2 | Ending (Focusing) |
| Forums | 1 | 1 | 2 | Balanced |
| Professionals | 1 | 1 | 2 | Balanced |

#### 7.3.3.2.4 First and second sources in the pathways

**Table 7-9: First and second sources in information pathways pursued in the latest ISB**

| Source | domain | | problem | | Problem solving | |
|---|---|---|---|---|---|---|
| | 1ST | 2nd | 1ST | 2nd | 1ST | 2nd |
| Doctors | 25% | 12% | 18% | 0% | 21% | 7% |
| Internet (WWW) | 13% | 12% | 0% | 18% | 7% | 14% |
| Other parents | 13% | 25% | 9% | 18% | 21% | 14% |
| Personal experience | 13% | 0% | 45% | 18% | 7% | 14% |
| Therapist/trainer | 13% | 0% | 0% | 9% | 7% | 21% |
| Spouse | 0% | 12% | 0% | 0% | 21% | 0% |
| Average number of sources used (total filled diagrams) | 3.38 (8) | | 3.82 (11) | | 3.86 (14) | |

### 7.3.4 Parents' source preference behaviour (early after receiving diagnosis ISB)

#### 7.3.4.1 Information horizon

##### 7.3.4.1.1 Domain information horizon

Amongst 14 parents interviewed for their unexperienced behaviour 11 had sought domain queries in an information seeking incident happened "early after receiving the diagnosis".

**Table 7-10: Domain information horizon for an "early after receiving the diagnosis" ISB incident**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Other parents | 8 | 2.25 | 73 |
| Books | 7 | 2.57 | 64 |
| Doctors | 7 | 2.43 | 64 |
| Therapist/trainer | 5 | 2.8 | 45 |
| WWW | 5 | 2.2 | 45 |
| Personal experience | 4 | 2.25 | 36 |
| Spouse | 3 | 3 | 27 |
| Mass media | 3 | 2.67 | 27 |
| Workshops | 2 | 2.5 | 18 |
| Teachers | 2 | 2.5 | 18 |
| Social Networks | 1 | 3 | 9 |
| Family members | 1 | 3 | 9 |
| Child | 1 | 3 | 9 |
| Friends | 1 | 2 | 9 |
| Trusted doctors | 1 | 2 | 9 |

#### 7.3.4.1.2 Problem information horizon

Amongst 14 parents interviewed for their unexperienced behaviour seven had sought problem queries in an information seeking incident happened "early after receiving the diagnosis".

**Table 7-11: Problem information horizon for an "early after receiving the diagnosis" ISB incident**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Doctors | 6 | 2.67 | 86 |
| Other parents | 3 | 3 | 43 |
| Therapist/trainer | 3 | 3 | 43 |
| Personal experience | 3 | 2.33 | 43 |
| Books | 1 | 3 | 14 |
| Spouse | 1 | 3 | 14 |
| Teachers | 1 | 3 | 14 |
| Officials | 1 | 3 | 14 |
| WWW | 1 | 3 | 14 |
| Scientific papers | 1 | 2 | 14 |

#### 7.3.4.1.3 Problem solving information horizon

Amongst 14 parents interviewed for their unexperienced behaviour 12 had sought problem solving queries in an information seeking incident happened "early after receiving the diagnosis".

**Table 7-12: Problem solving information horizon for an "early after receiving the diagnosis" ISB incident**

| Source | Number of parents using this source | Importance Average | Average use % |
|---|---|---|---|
| Other parents | 6 | 2.83 | 50 |
| Doctors | 6 | 2.67 | 50 |
| Personal experience | 5 | 2.8 | 42 |
| Therapist/trainer | 3 | 3 | 25 |
| WWW | 3 | 1.67 | 25 |
| Spouse | 2 | 2.5 | 17 |
| Teachers | 1 | 3 | 8 |
| Professionals | 1 | 3 | 8 |
| Other informant | 1 | 3 | 8 |
| Books | 1 | 3 | 8 |
| Family members | 1 | 2 | 8 |

### 7.3.4.2 **Information pathways**

#### 7.3.4.2.1 Domain information seeking pathways

11/14 parents sought domain information for an information seeking incident early after receiving the diagnosis.

**Figure 7.4: Domain information seeking pathways pursued in an "early after receiving the diagnosis" ISB**

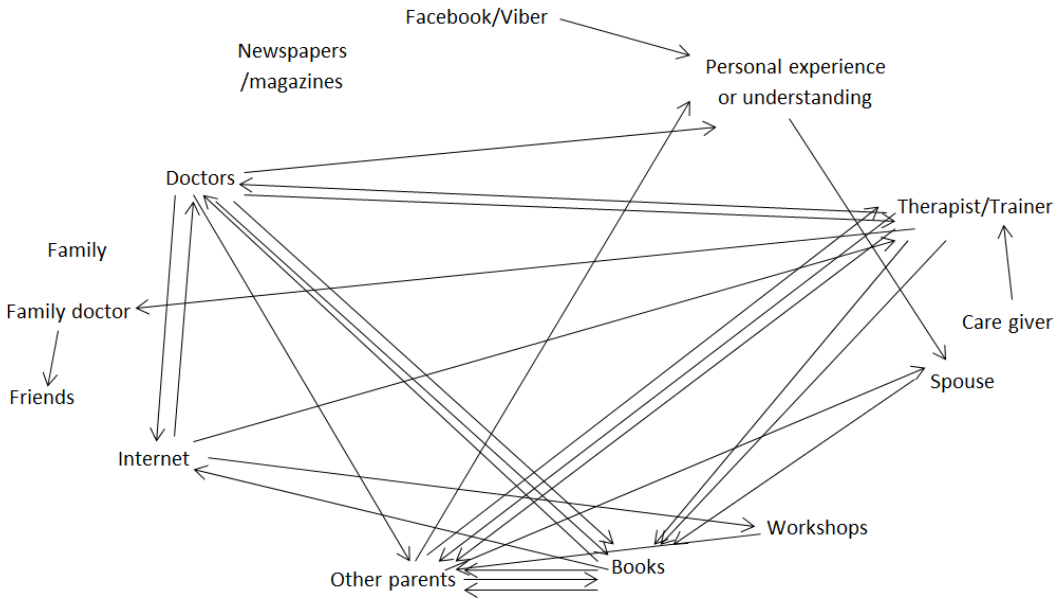



**Table 7-13: The role of information sources used in an "early after receiving the diagnosis" ISB for domain information**

| Source | Incoming | Outgoing | Total links# | Type of source |
|---|---|---|---|---|
| Other parents | 6 | 4 | 10 | Focusing |
| Therapist/Trainer | 4 | 6 | 10 | Recommending |
| Books | 6 | 4 | 10 | Focusing |
| Doctors | 3 | 6 | 9 | Recommending |
| WWW | 2 | 3 | 5 | Balanced |
| Personal experience | 3 | 1 | 4 | Focusing |
| Spouse | 2 | 1 | 3 | Balanced |
| Workshops | 1 | 1 | 2 | Balanced |
| Family doctor | 1 | 1 | 2 | Balanced |
| Friends | 1 | 0 | 1 | Ending (focusing) |
| Social Network | 0 | 1 | 1 | Starting (Recommending) |
| Care giver | 0 | 1 | 1 | Starting (Recommending) |

#### 7.3.4.2.2 Problem information seeking pathways

7/14 parents sought problem information for an information seeking incident near to the diagnosis.

**Figure 7.5: Problem information seeking pathways pursued in an "early after receiving the diagnosis" ISB**

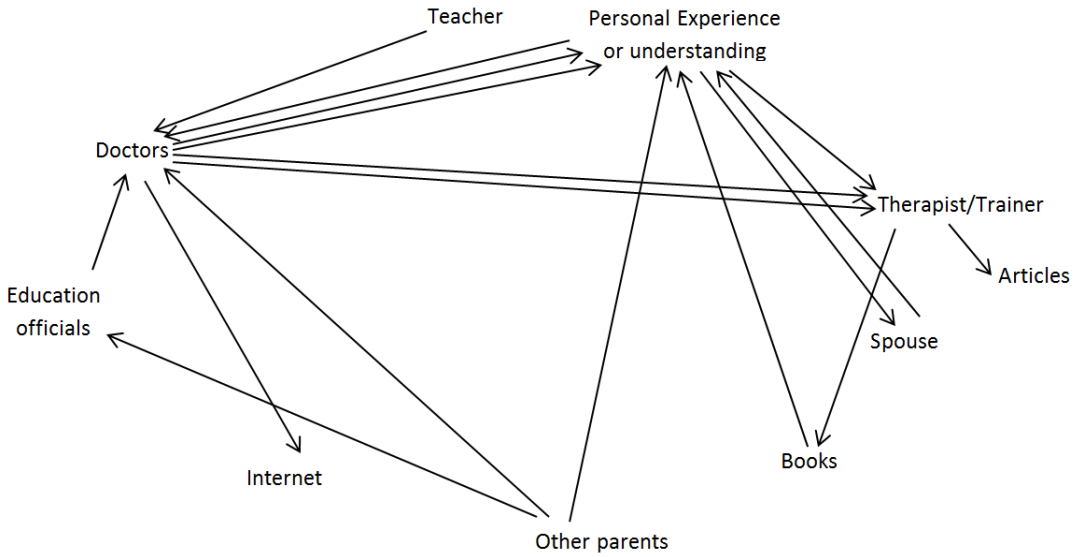



**Table 7-14: The role of information sources used in an "early after receiving the diagnosis" ISB for problem information**

| Source | Incoming | Outgoing | Total links | Type of source |
|---|---|---|---|---|
| Doctors | 4 | 5 | 9 | Balanced |
| Personal experience | 5 | 3 | 8 | Focusing |
| Therapist/trainer | 3 | 2 | 5 | Balanced |
| Other parents | 0 | 3 | 3 | Starting (Recommending) |
| Books | 1 | 1 | 2 | Balanced |
| Educational officials | 1 | 1 | 2 | Balanced |
| Spouse | 1 | 1 | 2 | Balanced |
| WWW | 1 | 0 | 1 | Ending (Focusing) |
| Teachers | 0 | 1 | 1 | Starting (Recommending) |
| Articles | 1 | 0 | 1 | Ending (Focusing) |

#### 7.3.4.2.3 Problem solving information seeking pathways

12/14 parents sought problem solving information for an information seeking incident near to the diagnosis.

**Figure 7.6: Problem solving information seeking pathways pursued in an "early after receiving the diagnosis" ISB**

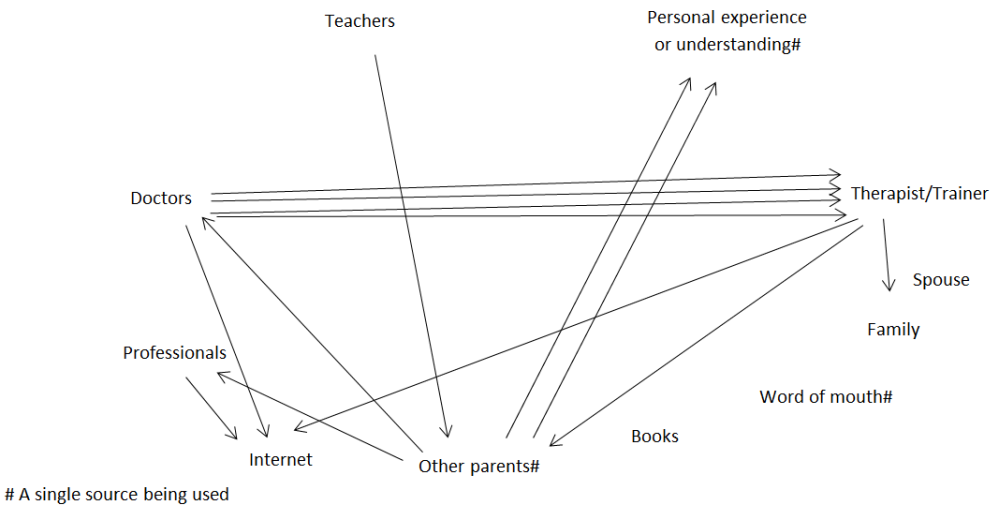



**Table 7-15: The role of information sources used in an "early after receiving the diagnosis" ISB for problem solving information**

| Source | Coming | Going | Total | Type |
|---|---|---|---|---|
| Other parents | 3 | 4 | 7 | Balanced |
| Therapist/Trainer | 4 | 3 | 7 | Balanced |
| Doctors | 1 | 5 | 6 | Recommending |
| WWW | 3 | 0 | 3 | Ending (Focusing) |
| Personal experience | 3 | 0 | 3 | Ending (Focusing) |
| Teachers | 1 | 1 | 2 | Balanced |
| Professionals | 1 | 1 | 2 | Balanced |
| Word of mouth | 1 | 0 | 1 | Ending (Focusing) |
| Family member | 1 | 0 | 1 | Ending (Focusing) |
| Books | - | - | - | - |

#### 7.3.4.2.4 First and second sources in the pathways

**Table 7-16: First and second sources in information pathways pursued in an "early after receiving the diagnosis" ISB**

| Source | domain | | problem | | Problem solving | |
|---|---|---|---|---|---|---|
| | 1ST | 2nd | 1ST | 2nd | 1ST | 2nd |
| Doctors | 27% | 18% | 29% | 42% | 33% | 8% |
| Internet (WWW) | 18% | 0% | 0% | 14% | 0% | 8% |
| Other parents | 0% | 18% | 42% | 0% | 33% | 8% |
| Personal experience | 9% | 18% | 14% | 14% | 8% | 17% |
| Therapist/trainer | 0% | 36% | 0% | 29% | 0% | 17% |
| Spouse | 9% | 9% | 0% | 14% | 8% | 0% |
| Average number of sources used (total filled diagrams) | 4.64 (11) | | 3 (7) | | 2.5 (12) | |

### 7.3.5 Quality requirements

#### 7.3.5.1 Priority of quality requirement dimensions for the entire information horizon

##### 7.3.5.1.1 Frequently indicated quality dimensions

To create Table 7-68 and Table 7-69, and filter the number of dimensions available in Table 5-17 and Table 5-18 only the factors which have been mentioned at least for two sources or four times for a single source are listed. The quality dimensions are sorted based on their importance from left to right.

**Table 7-17: Positive IQ dimensions indicated by parents to use all information sources**

| | Reliability | Empathy | Experience | Amount of relevant info | Scientific | Interaction with child | Reputation | Networking | Informative | Practical | Accessibility | Speciality | Timeliness | Personal reas. | Caring | Consulting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 4 | 10 | 11 | 2 | | | | 2 | 2 | 4 | | 2 | | | | |
| **Doctors (16)** | 4 | 3 | | 3 | 4 | | 2 | | | | | 3 | | 2 | | |
| **Personal experience (14)** | 2 | | | | | 6 | | | | | | | | 2 | 2 | |
| **Therapist/Trainer (14)** | 3 | | 4 | 2 | 2 | 2 | 3 | | 2 | | | | | | | |
| **WWW (10)** | | | | 4 | | | | | | | 6 | | 2 | | | |
| **Books (9)** | | | | | 2 | | 2 | | | 2 | | | | | | |
| **Social Networks (8)** | | 2 | | | | | | 5 | 2 | | | | | | | |
| **Teachers (6)** | 3 | | | | | 2 | | | | | | | | | 2 | |
| **Professionals (6)** | 3 | 2 | 2 | | 2 | | | | | | | | | | | |
| **Spouse (5)** | | | | | | | | | | | | | | | | 2 |
| **Mass media (5)** | | | | | | | | | | | | | 2 | | | |
| **Trusted doctors (3)** | 2 | | | | | | | | | | | | | | | 2 |
| **Sum** | 21 | 17 | 17 | 11 | 10 | 10 | 7 | 7 | 6 | 6 | 6 | 5 | 4 | 4 | 4 | 4 |
| **T.N. of sources** | 7 | 4 | 3 | 4 | 4 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 2 |

**Table 7-18: Negative IQ dimensions indicated by parents to use all information sources**

| | Reliability | Amount of relevant info | Practical | Diversity | Financially Biased | Interaction with child | Detailed | Language | Caring | Personal reason | Technical issue | Speciality | Hope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 3 | | 11 | | | | | | | | | |
| **Doctors (16)** | 6 | 3 | 2 | | 7 | 7 | 4 | | 5 | | | 5 | 2 |
| **Personal experience (14)** | 2 | | | | | | | | | 2 | | | |
| **Therapist/Trainer (14)** | 7 | | 2 | | 3 | 2 | 2 | | 3 | 2 | | | 2 |
| **WWW (16)** | 6 | 4 | 3 | | | | | 6 | | 2 | 3 | | |
| **Books (9)** | 4 | 3 | 3 | | | | 2 | 2 | | | | | |
| **Social Networks (8)** | 2 | | | 2 | | | | | | | 2 | | |
| **Professionals (6)** | | 2 | | | | | | | | | | | |
| **Mass media (5)** | | 2 | 2 | | | | | | | | | | |
| **Officials (3)** | | | 2 | | | | | | | | | | |
| **Sum** | 37 | 17 | 14 | 13 | 10 | 9 | 8 | 8 | 8 | 6 | 5 | 5 | 4 |
| **T.N. of sources** | 7 | 6 | 6 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 2 |

#### 7.3.5.1.2 Quality dimension popularity

Table 7-19 counts the number of parents considering each quality dimension. The numbers at Table 7-19 are calculated regardless of the number of times each dimension might have been mentioned and only counts number of individuals who have considered a quality dimension.

**Table 7-19: Popularity of quality dimensions (entire information horizon)**

| Negative dimensions | | Positive dimensions | |
|---|---|---|---|
| **Dimension** | **Frequency (Individuals)T=17** | **Dimensions** | **Frequency (Individuals)T=17** |
| Reliability | 14 | Experience | 13 |
| Amount of relevant info. | 11 | Reliability | 13 |
| Diversity | 11 | Empathy | 11 |
| Practical | 9 | Scientific | 10 |
| Speciality | 8 | Reputation | 9 |
| Language | 8 | Informative | 8 |
| Financially biased | 8 | Interaction with child | 8 |
| Interaction with child | 8 | Accessibility | 8 |
| Caring | 8 | Practical | 7 |
| Personal reasons | 7 | Networking | 7 |
| Expenses | 6 | Timeliness | 7 |
| Biased information | 6 | Personal reasons | 7 |
| time | 6 | Amount of relevant info. | 7 |
| Accessibility | 5 | hope | 5 |
| Hope | 5 | Detailed | 5 |
| Detailed | 5 | Speciality | 5 |
| | | caring | 5 |

#### 7.3.5.1.3 Frequently indicated quality dimensions for top four sources

Table 5-6 indicates that the average number of sources that experienced parents have used for an ISB is 3.7, so it can be concluded that the four most popular information sources[56] are the ones parents often use, so their reasons to use them are the most important ones. At this section the positive and negative dimensions being considered for the four most popular information sources is analysed and listed here in Table 7-20 and Table 7-21.

[56] These sources are labelled as “most important information zone” in this study

**Table 7-20: Positive IQ dimensions indicated by parents to use top four information sources**

| | Empathy | Reliability | Experience | Amount of relevant info | Interaction with child | Accessibility | Speciality | Personal reas. | Scientific | Practical |
|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 4 | 11 | 2 | | | 2 | | | 4 |
| **Doctors (16)** | 3 | 4 | | 3 | | | 3 | 2 | 4 | |
| **Personal experience (14)** | | 2 | | | 6 | | | 2 | | |
| **WWW (10)** | | | | 4 | | 6 | | | | |
| **Sum** | 13 | 12 | 11 | 9 | 6 | 6 | 5 | 4 | 4 | 4 |
| **T.N. of sources** | 2 | 3 | 1 | 3 | 1 | 1 | 2 | 2 | 1 | 1 |

**Table 7-21: Negative IQ dimensions indicated by parents to use top four information sources**

| | Reliability | Diversity | Amount of relevant info | Biased Financially | Interaction with child | Language | Practical | Caring | Speciality | Personal reason | Detailed | Biased info |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 3 | | | | | | | | | 4 |
| **Doctors (16)** | 6 | | 3 | 7 | 7 | | 2 | 5 | 5 | | 4 | |
| **Personal experience (14)** | 2 | | | | | | | | | 2 | | |
| **WWW (16)** | 6 | | 4 | | | 6 | 3 | | | 2 | | |
| **Sum** | 24 | 11 | 10 | 7 | 7 | 6 | 5 | 5 | 5 | 4 | 4 | 4 |
| **T.N. of sources** | 4 | 1 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 |

#### 7.3.5.1.4 Quality dimensions causing sources' average use change over time

Analysing the change in the use of information sources can provide valuable information about the reasoning for raising or falling their popularity. For example while "doctors" are amongst the top commonly used information sources but they have shown a sharp decrease in the average use over time which indicates their negative qualities worth an attention even more than their positive qualities. Table 7-22 compares the average use and role of information sources used by experienced and unexperienced seekers.

General focus of parents has been shifted from domain to problem and problem solving queries over time. Based on the average number of sources being used by experienced and unexperienced parents, some changes are anticipated in their behaviour. Table 7-22 considers this anticipated change to report the changes which are the result of quality conditions not the change in parents information needs.

**Table 7-22: Change in average use and roles of information sources in parents' seeking pathways**

| Source | Popularity in information horizon | Average use | Change of use (%) | domain | problem | Problem solving |
|---|---|---|---|---|---|---|
| **Doctors** | 94% (2nd) | 54% | 18 ↓ 63->45<br>24↓Anticipation<br>p- Recommending<br>Recommending | 26 ↓ 64->38<br>9↓Anticipation<br>p- Recommending<br>Recommending | 41 ↓ 86->45<br>55↓Anticipation<br>p- Balanced<br>Recommending | 0 50->50<br>18↓Anticipation<br>p- Recommending<br>Recommending |
| **Social networks** | 47% (7th) | 12% | 18 ↑ 3 -> 21<br>18↑Anticipation<br>p- -----<br>Focusing | 29 ↑ 9 ->38<br>31↑Anticipation<br>p- -----<br>Focusing | 9 ↑ 0->9<br>9↑Anticipation<br>p- -----<br>------- | 21 ↑ 0->21<br>21↑Anticipation<br>p- -----<br>Balanced |
| **Internet (WWW)** | 59% (5th) | 38% | 15 ↑ 30->45<br>10↑Anticipation<br>p- Focusing<br>Balanced | 7 ↓ 45->38<br>5↑Anticipation<br>p- Balanced<br>Recommending | 41 ↑ 14->55<br>37↑Anticipation<br>p- ------<br>Balanced | 18 ↑ 25->43<br>9↑Anticipation<br>p- Ending<br>Balanced |
| **Other parents** | 100% (1st) | 62% | 10 ↑ 57->67<br>5↑Anticipation<br>p- Recommending<br>Balanced | 15 ↑ 73->88<br>35↑Anticipation<br>p- Focusing<br>Focusing | 2 ↑ 43->45<br>10↓Anticipation<br>p- Starting<br>Balanced | 21 ↑ 50->71<br>3↑Anticipation<br>p- Balanced<br>Balanced |
| **Personal experience** | 82% (3rd) | 43% | 5 ↑ 40->45<br>1↑Anticipation<br>p- Focusing<br>Balanced | 2 ↑ 36->38<br>12↑Anticipation<br>p- Focusing<br>Balanced | 21 ↑ 43->64<br>9↑Anticipation<br>p- Focusing<br>Recommending | 6 ↓ 42->36<br>21↓Anticipation<br>p- Ending<br>Focusing |
| **Therapist/trainer** | 82% (3rd) | 38% | 2 ↑ 37->39<br>1↓Anticipation<br>p- Balanced<br>Balanced | 33 ↓ 45->12<br>21↓Anticipation<br>p- Recommending<br>Recommending | 12 ↑ 43->55<br>0↑Anticipation<br>p- Balanced<br>Focusing | 18 ↑ 25->43<br>9↑Anticipation<br>p- Balanced<br>Balanced |
| **Books** | 53% (6th) | 30% | 0 30->30<br>3↓Anticipation<br>p- Focusing<br>Recommending | 39 ↓ 64->25<br>22↓Anticipation<br>p- Focusing<br>Balanced | 31 ↑ 14->45<br>27↑Anticipation<br>p- Balanced<br>Balanced | 13 ↑ 8->21<br>10↑Anticipation<br>p- -----<br>Balanced |
| **Average number of sources used** (total filled diagrams) | | | p- 3.4<br>3.73<br>9 ↑ | p- 4.64 (11)<br>3.38 (8)<br>27* ↓ | p- 3 (7)<br>3.82 (11)<br>27* ↑ | p- 2.5 (12)<br>3.86 (14)<br>35* ↑ |

* For domain information, anticipated average change in use is -27%. It means that if the initial average use is 45% it is anticipated to decrease to 33% (45-(45*27%)). Any changes more or less than that has been considered as **above or under anticipation.** Unit of analysis is number of filled diagrams.

Table 7-23 lists all the information sources which are showing more than 10% increase or decrease in their average use over time.

**Table 7-23: Considerable change* in the average use of information sources over time**

| General change (all types of information) | | Domain information | | Problem information | | Problem solving information | |
|---|---|---|---|---|---|---|---|
| Decrease | Increase | Decrease in usage | Increase in usage | Decrease in usage | Increase in usage | Decrease in usage | Increase in usage |
| Doctors (24%↓) | Social networks (18%↑)<br>WWW (10%↑)<br>Other parents (>50%) | Books (22%↓)<br>Therapist/ trainer (21%↓) | Other parents (35%↑) (>50%)<br>Social networks (31%↑)<br>Personal experience (12%↑) | Doctors (55%↓)<br>Other parents (10%↓)<br>Social networks (<20%) | WWW (37%↑)<br>Books (27%↑)<br>Personal experience (>50%) | Personal experience (21%↓)<br>Doctors (18%↓) | Social networks (21%↑)<br>Books (10%↑)<br>Other parents (>50%) |
| * Changes have been calculated based on the differentiation between the change in average source usage and source role change. Any average use change over 10%, consistence low and high average have been considered. | | | | | | | |

Table 7-24 lists their positive quality dimensions which could have caused this increase in usage over time. On the other hand "doctors" are the only source showing a dramatic fall in its usage over time. Table 7-25 is indicating its negative quality dimensions.

**Table 7-24: Positive IQ dimensions indicated by parents to use information sources showing increased usage**

| | Empathy | Experience | Networking | Amount of relevant info | Accessibility | Informative | Reliability | Practical |
|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 2 | 2 | | 2 | 4 | 4 |
| **WWW (10)** | | | | 4 | 6 | | | |
| **Social Networks (8)** | 2 | | 5 | | | 2 | | |
| **Sum** | 12 | 11 | 7 | 6 | 6 | 4 | 4 | 4 |
| **T.N. of sources** | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 1 |

**Table 7-25: Positive IQ dimensions indicated by parents to use information sources showing decreased usage**

| | Financially Biased | Interaction with child | Reliability | Caring | Speciality | Detailed |
|---|---|---|---|---|---|---|
| **Doctors (16)** | 7 | 7 | 6 | 5 | 5 | 4 |

#### 7.3.5.2 Quality dimensions definitions

Table 7-26 sorts the quality dimensions based on the number of times they have been indicated by parents and provides their definitions. This table defines the first 23 quality dimensions which are mentioned at least by one third of interviewees.

**Table 7-26: Quality dimensions definition**

| Quality dimension | Number of parents indicating | Definitions |
|---|---|---|
| Reliability | 15 | It is a multi-dimension dimension which means seekers may rely and use the information obtained from a source. This dimension would be better defined through its measurement factors mentioned in section 5.4.1. |
| Personal reasons | 14 | There are many personal and family factors which are impacting source preference behaviour including: Spouse opinions, believes and feelings. This is not a quality dimension but impacts parents behaviour |
| Amount of relevant information | 14 | This dimension is about the volume of information that parents expect from a source. This dimension is in a close relationship with "Completeness". |
| Experience | 13 | It refers to having a long experience in domain of autism, as a parent, therapist, doctor, official or else. Having tried interventions, plans and different professionals in the region are the most important expected outputs from experience. Provided information by parents carries this factor. |
| Practical | 13 | Refers to a type of information which can be implemented in practice (e.g. do and do not list, problems and list of solutions for each, nutrition and therapeutic plans, available services in the region). These plans and options should be in detail (close relationship with "Detailed"). Practical information should avoid being very general. |
| Scientific | 12 | Refers to a piece of information written by an author with academic degree and academic information, who has publications and/or works at university. Information itself should not be an everyday kind of news should include statistics and academic references. |
| Empathy | 12 | This dimension is available in a source when parents know that the source also has experienced the same or similar problems as they do. Other parents of children with autism carry this factor better than others. |
| Diversity | 11 | It refers to the differentiation between children with autism and wide spectrum of problems which change over time. These criteria make it hard for parent to use successful experience for their problems as very few similar cases may have the very same problem as theirs. |
| Speciality | 11 | Information source knows about the problem in question and how to deal with it, do not do trial and error, passed relevant trainings, experienced in the subject and carries relevant academic degree. Specialty is in a close relationship with "amount of information". A person/source carrying high amount of relevant information will be considered a specialist. |
| Caring | 11 | This dimension refers to human sources. A caring source should show signs of caring about parents. The mentioned signs are: spending time, being kind, being patient, listening well, do not focusing only on fulfilling the duty and being passionate about their |

| | | |
|---|---|---|
| | | job. |
| Interaction with child | 11 | This dimension is in close relationship with "Diversity". As children with autism symptoms are very diverse, parents have the feeling that only people who have a long interaction with their children and know them well are able to help them with their problems as they exactly know their child's specific problems and potentials. |
| Accessibility | 9 | Refers to the availability of information source and convenient of access to information by it. |
| Reputation | 9 | It is earned from recommendations of trusted individuals or other parents dealing with the same problem. Also strong CV of the author will cause the reputation. |
| Timeliness | 9 | Be up to dated. |
| Detailed | 8 | Information should be specific, complete and includes all the details. |
| Informative | 8 | Refers to sources which have the ability to add to parents' knowledge (even small pieces). |
| Financially biased | 8 | By financially benefitting from the advices that the information source gives, or if source earns more by the increase in number of patients it advices/visits, parents may become suspicious about the source to be financially biased. |
| Language | 8 | To be presented in reader's mother tongue |
| Time | 7 | Refers to time related problems in using a source. Often it is time consuming and sometimes managing the time for example to visit a doctor or attend to a workshop is the case |
| Networking | 7 | Provides parent with the ability to contact other parents or professionals. |
| Hope | 7 | Parents look for information to provide ***realistic*** hope about what can be done. Keeps a balance between positive and negative information. Tries not to explain only worst cases |
| Completeness | 6 | This dimension is in a close relationship with amount of relevant information. It requires that source has answers to all questions that seeker may have in his/her mind |
| Biased information | 6 | Biased information may reflect personal opinions, interpretations and preference of the source about truth. This kind of information may be magnified, selective and does not necessarily reflect the truth |

Table 7-27 categorises the quality dimensions based on the ways through which they are measured.

**Table 7-27: Source versus information specific IQ dimensions**

| Source/Media specific dimension | Information specific dimension | Mixed dimension |
|---|---|---|
| Accessibility | Diversity | Reliability |
| Experience | Detailed | Empathy |
| Interaction with child | Language | Financially biased |
| Speciality | Practical | Amount of relevant info (inc. completeness) |
| Caring | Timeliness | Scientific |
| Reputation | Hope | Biased information |
| Time | Completeness | |
| Networking | | |

### 7.3.5.3 Quality dimensions measurement factors

Many of quality dimensions defined at Table 7-26 cannot be used directly as measurement factors in the field as they are broad, vague and cannot be simply evaluated and/or implemented (e.g. reliability, practicality, completeness). To address this concern at the end of each interview parents have been asked to define the quality dimensions they have used and explain how they evaluate each dimension. Table 7-28 and Table 7-29 list the factors parents have measured these complex quality dimensions with. Two set of data has used to fill these tables including the codes shaping each dimension and the definitions parents provided for each dimension. Table 7-28 lists the source specific measurement factors and Table 7-29 lists the information specific factors. This categorisation may help professionals to better understand where each factor should be implemented.

Table 7-28 and Table 7-29 does not include all quality dimensions at Table 7-26 as some of them were simple enough to be measured directly (e.g. language) and/or their definition did not include any code-able measurement factor (e.g. hope). At these tables only factors which are mentioned at least by two interviewees are listed.

**Table 7-28: Source specific quality dimensions' measurement factors**

| | Published info | Experience with source | Number of source | Amount of relev. Info | Reputation | Caring | Not Financially biased | Trial and error | Speciality | Academic degree or ties | Personally know the source | Source is a parent | Source had other cases |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reliability (15)** | 2 | 3 | | | 8T | 5T | 5T | | | 4 | 10 | | |
| **Amount of relevant information (14)** | | | 3 | | | | | | 4T | | | | |
| **Experience (13)** | | | | | | | | | | | | 5 | 2 |
| **Scientific (12)** | | | | | 2T | | | | | 8 | | | |
| **Speciality (11)** | | | | 7 | | | | 2 | | 3 | | | |
| **Reputation (9)** | | | | | | | | | | 2 | | 2 | |

T: interconnected dimensions

**Table 7-29: Information specific quality dimensions' measurement factors**

| | Referencing (more=better) | International | Multi dimension (completenes | Offer solution options | Reliability | Author CV | No contradiction | Evaluated experi/info | Accuracy | Detailed | Experience | Scientific | Timeliness | No pure opinion (evidence) | Statistics and diagrams |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Reliability (15p)** | 2 | | | | | 3 | 5 | 4 | 5 | | | 9T | 2T | 2 | |
| **Amount of relevant information (14p)** | | 3 | 10T | | 2 T | | | | | | | | | | |
| **Practical (13)** | 2T | | | 5 | | | | | | 3T | 2T | 2T | | | |
| **Scientific (12)** | 3T | 2T | | | | | | | | | | | 2T | | 3 |
| **Speciality (11)** | | | | | | | | | | | | 2T | | | |
| **Timeliness (9)** | | | | | | | | | | | | 3T | | | |
| **Completeness (6)** | 2 | | 2 | | | | | | | 2 | 2T | 2T | | | |

T: interconnected dimensions

To provide a comprehensive definition of each quality dimension, here quality dimensions' measurement factors are defined based of parents' statements.

**Table 7-30: Source and information specific measurement factors**

| Measurement factor | Type* | Definition |
|---|---|---|
| Referencing | I | Refers to other studies to justify that its recommendations are valid |
| Author CV | M | Seekers need to know more about the speaker (Author) and his/her previous works |
| Contradicting information | I | No contradiction should exist in speakers' information nor to tangible facts. Contradictions between different sources information (e.g. doctors with each other also with parents) make the information hard to rely on. |
| Evaluated experience/information | I | Only successfully tested experience should be tried not interventions which are only based on hypothesis. The successful examples should be provided. |
| Accuracy | I | Information should be proved right and be written well. |
| No pure opinion (evidence required) | I | The provided information should be supported by evidences and does not be only speaker's opinion which could be motivated emotionally by the subject. |
| Multi dimension information (completeness) | I | Source should have covered all types of information including, general information, therapies, medicines, nutrition and educational information. It should cover all types of problems and have answers for all questions. Source should be able to guess what seekers have in mind. |
| International | I | Information has produced from several sources placed in different countries. |
| Offer solution options | I | Refers to type of information which can be implemented in practice (e.g. do and do not list, problems and list of solutions for each, nutrition and therapeutic plans, available services in the region). These plans and options should be in detail (close relationship with Detailed). |
| Other cases | M | Information/source indicates that the Author has worked with many cases with autism. |
| Statistics and diagrams | I | It should not be an everyday kind of news. It should include statistics, references and academic studies |
| Published information | S | Seekers assumes written media (i.e. books and medicine booklets) are reliable |
| Experience with source | S | Receiving useful and working advices from the source previously |
| Academic degree or | S | Doctoral degree and relevant speciality and experience. Refers to |

| | | |
|---|---|---|
| ties | | authors with relevant academic degree (relevant speciality), providing academic information and has publications and/or works at university. Being published in academic journals is another factor. |
| Personally know the source | S | This factor is used often for human information sources. Only the information from known parents (speaker) or friends can be tried as parents may not be realistic or maybe depressed. |
| Number of available sources | S | Many number of sources and answers are available for each question |
| Trial and error | S | Offered interventions should not do trial and error on my case |

* I: Information specific factor, S: Source specific factor, M: Mix factor

### 7.3.5.4 IQ requirements specific to categories of information needs

#### 7.3.5.4.1 Domain information quality requirements

##### *7.3.5.4.1.1 Frequently indicated quality dimensions for top four sources*

The factors considered by experienced seekers to use the four most commonly used sources for domain information seeking are listed here at Table 7-31 and Table 7-32.

**Table 7-31: Positive IQ dimensions to use top four sources in the latest ISB for seeking domain information**

| | Average use | Empathy | Experience | Reliability | Amount of relevant info | Networking | Interaction with child | Accessibility | Speciality | Informative | Personal reas. | Scientific | Practical |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 88% | 10 | 11 | 4 | 2 | 2 | | | 2 | 2 | | | 4 |
| **Doctors (16)** | 38% | 3 | | 4 | 3 | | | | 3 | | 2 | 4 | |
| **Personal experience (14)** | 38% | | | 2 | | | 6 | | | | 2 | | |
| **WWW (10)** | 38% | | | | 4 | | | 6 | | | | | |
| **Social Networks (8)** | 38% | 2 | | | | 5 | | | | 2 | | | |
| Sum | | 15 | 11 | 10 | 9 | 7 | 6 | 6 | 5 | 4 | 4 | 4 | 4 |
| T.N. of sources | | 3 | 1 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 1 |

**Table 7-32: Negative IQ dimensions to use top four sources in the latest ISB for seeking domain information**

| | Average use | Reliability | Diversity | Amount of relevant info | Financially Biased | Interaction with child | Language | Technical issue | Practical | Caring | Speciality | Personal reason | Detailed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 88% | 10 | 11 | 3 | | | | | | | | | |
| **Doctors (16)** | 38% | 6 | | 3 | 7 | 7 | | | 2 | 5 | 5 | | 4 |
| **Personal experience (14)** | 38% | 2 | | | | | | | | | | 2 | |
| **WWW (16)** | 38% | 6 | | 4 | | | 6 | 3 | 3 | | | 2 | |
| **Social Networks (8)** | 38% | 2 | 2 | | | | | 2 | | | | | |
| Sum | | 26 | 13 | 10 | 7 | 7 | 6 | 5 | 5 | 5 | 5 | 4 | 4 |
| T.N. of sources | | 5 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 |

#### 7.3.5.4.1.2 IQ dimensions causing sources' average use change over time

For domain information three sources are showing a growth in their average usage (See Table 7-22). The positive criteria of these sources are indicated at Table 7-33. On the other hand Table 7-34 goes through the negative factors of "therapist/trainers" and "books" as they are the two sources displaying a decreased usage for domain information seeking.

**Table 7-33: Positive IQ dimensions of sources with increased usage (domain information)**

| | Empathy | Experience | Interaction with child | Reliability | Networking | Practical |
|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | | 4 | 2 | 4 |
| **Personal experience (14)** | | | 6 | 2 | | |
| **Social Networks (8)** | 2 | | | | 5 | |
| **Sum** | 12 | 11 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | 2 | 1 | 1 | 2 | 1 | 1 |

**Table 7-34: Negative IQ dimensions of sources with decreased usage (domain information)**

| | Reliability | Practical | Detailed |
|---|---|---|---|
| **Therapist/Trainer (14)** | 7 | 2 | 2 |
| **Books (9)** | 4 | 3 | 2 |
| **Sum** | 11 | 5 | 4 |
| **T.N. of sources** | 2 | 2 | 2 |

#### 7.3.5.4.1.3 Domain information conclusion

Five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25.

**Table 7-35: Positive IQ dimensions indicated by parents to use domain information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Empathy | Empathy | Empathy 2 |
| Experience | Experience | Experience 2 |
| Reliability | Interaction with child | Reliability 2 |
| Amount of relevant information | Reliability | Networking 2 |
| Networking | Networking | Interaction with child 1+.5 |
| Interaction with child | Practical | Amount of relevant information 1 |
| Accessibility | | Practical .75 |
| Speciality | | Accessibility .5 |
| Informative | | Speciality .5 |
| Personal reasons | | Informative .5 |
| Scientific | | Personal reasons .5 |
| Practical | | Scientific .25 |

**Table 7-36: Negative IQ dimensions indicated by parents to use domain information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Diversity | Practical | Practical 1+.5 |
| Amount of relevant information | Detailed | Detailed 1+.25 |
| Financially biased | | Diversity 1 |
| Interaction with child | | Amount of relevant information 1 |
| Language | | Financially biased 1 |
| Technical issues | | Interaction with child 1 |
| Practical | | Language .5 |
| Caring | | Technical issues .5 |
| Speciality | | Caring .5 |
| Personal reasons | | Speciality .5 |
| Detailed | | Personal reasons .25 |

#### 7.3.5.4.2 Problem information quality conditions

##### *7.3.5.4.2.1 Frequently indicated quality dimensions for top four sources*

The quality dimensions considered by experienced seekers to use the top three[57] most commonly used sources for problem information are listed here at Table 7-37 and Table 7-38.

**Table 7-37: Positive IQ dimensions to use top three sources in the latest ISB for seeking problem information**

| | Average use | Interaction with child | Amount of relevant info | Accessibility | Reliability | Experience |
|---|---|---|---|---|---|---|
| **Personal experience (14)** | 64% | 6 | | | 2 | |
| **Therapist/Trainer (14)** | 55% | 2 | 2 | | 3 | 4 |
| **WWW (10)** | 55% | | 4 | 6 | | |
| Sum | | 8 | 6 | 6 | 5 | 4 |
| T.N. of sources | | 2 | 2 | 1 | 2 | 1 |

**Table 7-38: Negative IQ dimensions to use top three sources in the latest ISB for seeking problem information**

| | Average use | Reliability | Personal reason | Language | Practical | Amount of relevant info |
|---|---|---|---|---|---|---|
| **Personal experience (14)** | 64% | 2 | 2 | | | |
| **Therapist/Trainer (14)** | 55% | 7 | 2 | | 2 | |
| **WWW (16)** | 55% | 6 | 2 | 6 | 3 | 4 |
| **Sum** | | 15 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | | 3 | 3 | 1 | 2 | 1 |

[57] As there are three sources with the same popularity following the third popular source, researchers study three top popular sources for problem information instead of four otherwise they had do consider six sources which would spoil the results.

#### 7.3.5.4.2.2 IQ dimensions causing sources' average use change over time

For problem information two sources are showing a growth in their average usage and "personal experience" keeps its high usage (See Table 7-22). The positive quality dimensions of these sources are indicated at Table 7-39 but unfortunately "books" did not have any positive factor in common with others or to be mentioned by at least four users. On the other hand Table 7-40 goes through the negative factors of "other parents" and "doctors" as a result of their decreased usage and "social networks" because of its steady low usage for problem information seeking.

**Table 7-39: Positive IQ dimensions to use sources with increased usage (problem information)**

| | Accessibility | Interaction with child | Amount of relevant info |
|---|---|---|---|
| **Personal experience (14)** | | 6 | |
| **WWW (10)** | 6 | | 4 |
| **Books (9)** | | | |
| **Sum** | 6 | 6 | 4 |
| **T.N. of sources** | 1 | 1 | 1 |

**Table 7-40: Negative IQ dimensions to use sources with decreased usage (problem information)**

| | Reliability | Diversity | Financially Biased | Interaction with child | Amount of relevant info | Caring | Speciality | Biased info | Detailed |
|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | | | 3 | | | 4 | |
| **Doctors (16)** | 6 | | 7 | 7 | 3 | 5 | 5 | | 4 |
| **Social networks (8)** | 2 | 2 | | | | | | | |
| **Sum** | 18 | 13 | 7 | 7 | 6 | 5 | 5 | 4 | 4 |
| **T.N. of sources** | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 |

#### 7.3.5.4.2.3 Problem information conclusion

Five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25.

**Table 7-41: Positive IQ dimensions indicated by parents to use problem information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Interaction with child | Accessibility | Accessibility 2 |
| Amount of relevant information | Interaction with child | Amount of relevant information 2 |
| Accessibility | Amount of relevant information | Interaction with child 2 |
| Reliability | | Reliability 1 |
| Experience | | Experience 1 |

**Table 7-42: Negative IQ dimensions indicated by parents to use problem information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Personal reasons | Diversity | Amount of relevant information 2 |
| Language | Financially biased | Diversity 1 |
| Practical | Interaction with child | Financially biased 1 |
| Amount of relevant information | Amount of relevant information | Interaction with child 1 |
| | Caring | Personal reasons 1 |
| | Speciality | Language 1 |
| | Biased information | Practical 1 |
| | Detailed | Caring .5 |
| | | Speciality .5 |
| | | Biased information .5 |
| | | Detailed .5 |

#### 7.3.5.4.3 Problem solving information quality conditions

##### *7.3.5.4.3.1 Frequently indicated quality dimensions for top four sources*

The factors considered by experienced seekers to use the four most commonly used sources for problem solving information seeking are listed here at Table 7-43 and Table 7-44.

**Table 7-43: Positive IQ dimensions to use top four sources in the latest ISB for problem solving information**

| | Average use | Experience | Empathy | Amount of relevant info | Reliability | Scientific | Accessibility | Reputation | Speciality | Informative | Practical |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 71% | 11 | 10 | 2 | 4 | | | | 2 | 2 | 4 |
| **Doctors (16)** | 50% | | 3 | 3 | 4 | 4 | | 2 | 3 | | |
| **Therapist/Trainer (14)** | 43% | 4 | | 2 | 3 | 2 | | 3 | | 2 | |
| **WWW (10)** | 43% | | | 4 | | | 6 | | | | |
| **Sum** | | 15 | 13 | 11 | 11 | 6 | 6 | 5 | 5 | 4 | 4 |
| **T.N. of sources** | | 2 | 2 | 4 | 3 | 2 | 1 | 2 | 2 | 2 | 1 |

**Table 7-44: Negative IQ dimensions to use top four sources in the latest ISB for problem solving information**

| | Average use | Reliability | Diversity | Amount of relevant info | Biased | Financially | Interaction with child | Caring | Practical | Detailed | Language | Speciality | Hope | Personal reason |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 71% | 10 | 11 | 3 | | | | | | | | | | |
| **Doctors (16)** | 50% | 6 | | 3 | 7 | 7 | 5 | 2 | 4 | | 5 | 2 | | |
| **Therapist/Trainer (14)** | 43% | 7 | | | 3 | 2 | 3 | 2 | 2 | | | 2 | 2 | |
| **WWW (16)** | 43% | 6 | | 4 | | | | 3 | | 6 | | | 2 | |
| **Sum** | | 29 | 11 | 10 | 10 | 9 | 8 | 7 | 6 | 6 | 5 | 4 | 4 | |
| **T.N. of sources** | | 4 | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | |

#### 7.3.5.4.3.2 IQ dimensions causing sources' average use change over time

For problem solving information "social networks" and "books" are showing a growth in their average usage and other parents keep their high usage consistently. The positive criteria of these sources are indicated at Table 7-45. On the other hand

Table 7-46 goes through the negative factors of "personal experience" and "doctors" as a result of their decreased usage for problem solving information seeking.

**Table 7-45: Positive IQ dimensions to use sources with increased usage (problem solving information)**

| | Empathy | Experience | Networking | Practical | Informative | Reliability |
|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 2 | 4 | 2 | 4 |
| **Books (9)** | | | | 2 | | |
| **Social Networks (8)** | 2 | | 5 | | 2 | |
| **Sum** | 12 | 11 | 7 | 6 | 4 | 4 |
| **T.N. of sources** | 2 | 1 | 2 | 2 | 2 | 1 |

**Table 7-46: Negative IQ dimensions to use sources with decreased usage (problem solving information)**

| | Reliability | Biased | Financially | Interaction with child | Caring | Speciality | Detailed |
|---|---|---|---|---|---|---|---|
| **Doctors (16)** | 6 | 7 | 7 | 5 | 5 | 4 | |
| **Personal experience (14)** | 2 | | | | | | |
| **Sum** | 8 | 7 | 7 | 5 | 5 | 4 | |
| **T.N. of sources** | 2 | 1 | 1 | 1 | 1 | 1 | |

#### 7.3.5.4.3.3 Problem solving conclusion

Five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25.

**Table 7-47: Positive IQ dimensions indicated by parents to use problem information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Experience | Empathy | Experience 2 |
| Empathy | Experience | Empathy 2 |
| Amount of relevant information | Networking | Reliability 1+.5 |
| Reliability | Practical | Informative 1+.5 |
| Scientific | Informative | Practical 1 +.5 |
| Accessibility | Reliability | Amount of relevant information 1 |
| Reputation | | Networking 1 |
| Speciality | | Scientific 1 |
| Informative | | Accessibility .5 |
| Practical | | Reputation .5 |
| | | Speciality .5 |

**Table 7-48: Negative IQ dimensions indicated by parents to use problem information sources**

| Type 3 (Top 4 sources) | Type 4 (time change) | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Diversity | Financially biased | Financially biased 2 |
| Amount of relevant information | Interaction with child | Interaction with child 2 |
| Financially biased | Caring | Caring 1.5 |
| Interaction with child | Speciality | Speciality 1.5 |
| Caring | Detailed | Detailed 1 |
| Practical | | Diversity 1 |
| Detailed | | Amount of relevant information 1 |
| Language | | Practical .5 |
| Speciality | | Language .5 |
| Hope | | Speciality .5 |
| Personal reasons | | Hope .25 |
| | | Personal reasons .25 |

#### 7.3.5.5 Role specific IQ requirements

Analysing parents' ISB indicates that each source play a different role when providing varied types of information. The role information sources play within the information system also can be used as a way to categorise them. This section compares the quality dimensions parents considered to use each category of information sources through two perspectives as follows:

- Quality dimensions considered for sources playing the same role
- Quality dimensions considered for top four sources playing the same role

Table 7-49 is leveraged for identifying the information sources which play the similar roles in parents' information horizons.

**Table 7-49: Experienced seekers' information horizon categorised by source role and information type**

| | **Recommending** | **Balanced** | **Focusing** |
|---|---|---|---|
| **Domain** | Doctors 2th<br>WWW 2th<br>Therapist/trainer 7th | Personal experience 2nd<br>Books 6th | Other parents 1st<br>Social media 2nd |
| **Problem** | Doctors 4st<br>Personal experience 1st | Other parents 4th<br>WWW 2th<br>Books 4th (discarded as the other two books are 6th) | Therapist/trainer 2nd |
| **Problem solving** | Doctors 2nd | WWW 3th<br>Other parents 1st<br>Therapist/trainer 3th<br>Social media 6th<br>Books 6th | Personal experience 5th |

#### 7.3.5.5.1 Recommending sources

##### *7.3.5.5.1.1 IQ dimensions for using recommending sources (latest ISB)*

Table 7-49 categorises the information horizon based on the role each source plays. Based in Table 7-49, in Table 7-50 and Table 7-51 the positive and negative quality dimensions used for evaluating recommending sources are listed.

**Table 7-50: Positive IQ dimensions to use recommending sources**

| | Reliability | Amount of relevant info | Interaction with child | Scientific | Accessibility | Reputation | Personal reas. | Experience |
|---|---|---|---|---|---|---|---|---|
| **Doctors (16)** | 4 | 3 | | 4 | | 2 | 2 | |
| **Personal experience (14)** | 2 | | 6 | | | | 2 | |
| **Therapist/Trainer (14)** | 3 | 2 | 2 | 2 | | 3 | | 4 |
| **WWW (10)** | | 4 | | | 6 | | | |
| **Sum** | 9 | 9 | 8 | 6 | 6 | 5 | 4 | 4 |
| **T.N. of sources** | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 |

**Table 7-51: Negative IQ dimensions to use recommending sources**

| | Reliability | Financially Biased | Interaction with child | Caring | Practical | Amount of relevant info | Personal reason | Detailed | Language | Speciality | Hope |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Doctors (16)** | 6 | 7 | 7 | 5 | 2 | 3 | | 4 | | 5 | 2 |
| **Personal experience (14)** | 2 | | | | | | 2 | | | | |
| **Therapist/Trainer (14)** | 7 | 3 | 2 | 3 | 2 | | 2 | 2 | | | 2 |
| **WWW (16)** | 6 | | | | 3 | 4 | 2 | | 6 | | |
| **Sum** | 21 | 10 | 9 | 8 | 7 | 7 | 6 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | 4 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 2 |

##### *7.3.5.5.1.2 IQ dimensions for using recommending sources amongst the top four (latest ISB)*

In Table 7-52 and Table 7-53 the positive and negative quality dimensions used for evaluating recommending sources which are amongst the top four mostly used sources are listed.

**Table 7-52: Positive IQ dimensions to use the recommending sources amongst the top four**

| | Amount of relevant info | Interaction with child | Accessibility | Reliability | Personal reas. | Scientific |
|---|---|---|---|---|---|---|
| **Doctors (16)** | 3 | | | 4 | 2 | 4 |
| **Personal experience (14)** | | 6 | | 2 | 2 | |
| **WWW (10)** | 4 | | 6 | | | |
| **Sum** | 7 | 6 | 6 | 6 | 4 | 4 |
| **T.N. of sources** | 2 | 1 | 1 | 2 | 2 | 1 |

**Table 7-53: Negative IQ dimensions to use the recommending sources amongst the top four**

| | Reliability | Amount of relevant info | Financially Biased | Interaction with child | Language | Practical | Caring | Speciality | Personal reason | Detailed |
|---|---|---|---|---|---|---|---|---|---|---|
| **Doctors (16)** | 6 | 3 | 7 | 7 | | 2 | 5 | 5 | | 4 |
| **Personal experience (14)** | 2 | | | | | | | | 2 | |
| **WWW (16)** | 6 | 4 | | | 6 | 3 | | | 2 | |
| **Sum** | 14 | 7 | 7 | 7 | 6 | 5 | 5 | 5 | 4 | 4 |
| **T.N. of sources** | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |

#### *7.3.5.5.1.3 Recommending sources conclusion*

To calculate the importance of each dimension five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25

**Table 7-54: Positive IQ dimensions indicated by parents to use recommending sources**

| **Appearance (all sources)** | **Top four** | **Total** |
|---|---|---|
| Reliability | Amount of relevant info | Reliability 2 |
| Amount of relevant info | Interaction with child | Amount of relevant info 2 |
| Interaction with child | Accessibility | Interaction with child 2 |
| Scientific | Reliability | Accessibility 2 |
| Accessibility | Personal reasons | Scientific 1.5 |
| Reputation | Scientific | Personal reasons 1.5 |
| Personal reasons | | Reputation 0.5 |
| Experience | | Experience 0.5 |
| | | |

**Table 7-55: Negative IQ dimensions indicated by parents to use recommending sources**

| Appearance (all sources) | Top four | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Financially biased | Amount of relevant info | Financially biased 2 |
| Interaction with child | Financially biased | Interaction with child 2 |
| Caring | Interaction with child | Caring 1.5 |
| Practical | Language | Practical 1.5 |
| Amount of relevant info | Practical | Amount of relevant info 1.5 |
| Personal reasons | Caring | Language 1.5 |
| Detailed | Speciality | Personal reasons 1 |
| Language | Personal reasons | Detailed 1 |
| Speciality | Detailed | Speciality 1 |
| Hope | | Hope 0.5 |
| | | |

#### 7.3.5.5.2 Balanced sources

##### *7.3.5.5.2.1 IQ dimensions considered for balanced sources (latest ISB)*

Table 7-49 categorises the information horizon based on the role each source plays. Based in Table 7-49, in Table 7-56 and Table 7-57 the positive and negative quality dimensions used for evaluating balanced sources are listed.

**Table 7-56: Positive IQ dimensions to use balanced sources**

| | Experience | Empathy | Reliability | Amount of relevant info | Interaction with child | Networking | Informative | Practical | Accessibility | Reputation | Scientific |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 11 | 10 | 4 | 2 | | 2 | 2 | 4 | | | |
| **Personal experience (14)** | | | 2 | | 6 | | | | | | |
| **Therapist/Trainer (14)** | 4 | | 3 | 2 | 2 | | 2 | | | 3 | 2 |
| **WWW (10)** | | | | 4 | | | | | 6 | | |
| **Books (9)** | | | | | | | | 2 | | 2 | 2 |
| **Social Networks (8)** | | 2 | | | | 5 | 2 | | | | |
| **Sum** | 15 | 12 | 9 | 8 | 8 | 7 | 6 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 2 |

**Table 7-57: Negative IQ dimensions to use balanced sources**

| | Reliability | Diversity | Amount of relevant info | Practical | Language | Personal reason | Technical issue | Detailed | Biased info |
|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 3 | | | | | | 4 |
| **Personal experience (14)** | 2 | | | | | 2 | | | |
| **Therapist/Trainer (14)** | 7 | | | 2 | | 2 | | 2 | |
| **WWW (16)** | 6 | | 4 | 3 | 6 | 2 | 3 | | |
| **Books (9)** | 4 | | 3 | 3 | 2 | | | 2 | |
| **Social Networks (8)** | 2 | 2 | | | | | 2 | | |
| **Sum** | 31 | 13 | 10 | 8 | 8 | 6 | 5 | 4 | 4 |
| **T.N. of sources** | 6 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |

#### 7.3.5.5.2.2 IQ dimensions considered for balanced sources amongst the top four (latest ISB)

In Table 7-58 and Table 7-59 the positive and negative quality dimensions used for evaluating balanced sources which are amongst the top four mostly used sources are listed.

**Table 7-58: Positive IQ dimensions to use the balanced sources amongst the top four**

| | Experience | Empathy | Reliability | Amount of relevant info | Interaction with child | Accessibility | Informative | Practical |
|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 11 | 10 | 4 | 2 | | | 2 | 4 |
| **Personal experience (14)** | | | 2 | | 6 | | | |
| **Therapist/Trainer (14)** | 4 | | 3 | 2 | 2 | | 2 | |
| **WWW (10)** | | | | 4 | | 6 | | |
| **Sum** | 15 | 10 | 9 | 8 | 8 | 6 | 4 | 4 |
| **T.N. of sources** | 2 | 1 | 3 | 3 | 2 | 1 | 2 | 1 |

**Table 7-59: Negative IQ dimensions to use the balanced sources amongst the top four**

| | Reliability | Diversity | Amount of relevant info | Personal reason | Language | Practical | Biased info |
|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 3 | | | | 4 |
| **Personal experience (14)** | 2 | | | 2 | | | |
| **Therapist/Trainer (14)** | 7 | | | 2 | | 2 | |
| **WWW (16)** | 6 | | 4 | 2 | 6 | 3 | |
| **Sum** | 25 | 11 | 7 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | 4 | 1 | 2 | 3 | 1 | 2 | 1 |

#### 7.3.5.5.2.3 Balanced sources conclusion

To calculate the importance of each dimension five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25

**Table 7-60: Positive IQ dimensions indicated by parents to use balanced sources**

| **Appearance (all sources)** | **Top four** | **Total** |
|---|---|---|
| Experience | Experience | Experience 2 |
| Empathy | Empathy | Empathy 2 |
| Reliability | Reliability | Reliability 2 |
| Amount of relevant info | Amount of relevant info | Amount of relevant info 2 |
| Interaction with child | Interaction with child | Interaction with child 2 |
| Networking | Accessibility | Informative 1 |
| Informative | Informative | Practical 1 |
| Practical | Practical | Accessibility 1 |
| Accessibility | | Networking 0.5 |
| Reputation | | Reputation 0.5 |
| Scientific | | Scientific 0.5 |

**Table 7-61: Negative IQ dimensions indicated by parents to use balanced sources**

| Appearance (all sources) | Top four | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Diversity | Diversity | Diversity 2 |
| Amount of relevant info | Amount of relevant info | Amount of relevant info 2 |
| Practical | Personal reasons | Language 2 |
| Language | Language | Practical 1.5 |
| Personal reasons | Practical | Personal reasons 1.5 |
| Technical issues | Biased info | Biased info 1 |
| Detailed | | Technical issues 0.5 |
| Biased info | | Detailed 0.5 |
| | | |

### 7.3.5.5.3 Focusing sources

#### *7.3.5.5.3.1 Quality dimensions considered for focusing sources (latest ISB)*

Table 7-49 categorises the information horizon based on the role each source plays. Based in Table 7-49, in Table 7-62 and Table 7-63 the positive and negative quality dimensions used for evaluating focusing sources are listed.

**Table 7-62: Positive IQ dimensions to use focusing sources**

| | Experience | Empathy | Reliability | Interaction with child | Networking | Informative | Amount of relevant info | Practical |
|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 11 | 10 | 4 | | 2 | 2 | 2 | 4 |
| **Personal experience (14)** | | | 2 | 6 | | | | |
| **Therapist/Trainer (14)** | 4 | | 3 | 2 | | 2 | 2 | |
| **Social Networks (8)** | | 2 | | | 5 | 2 | | |
| **Sum** | 15 | 12 | 9 | 8 | 7 | 6 | 4 | 4 |
| **T.N. of sources** | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 |

**Table 7-63: Negative IQ dimensions to use focusing sources**

| | Reliability | Diversity | Personal reason | Biased info |
|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | | 4 |
| **Personal experience (14)** | 2 | | 2 | |
| **Therapist/Trainer (14)** | 7 | | 2 | |
| **Social Networks (8)** | 2 | 2 | | |
| **Sum** | 21 | 13 | 4 | 4 |
| **T.N. of sources** | 4 | 2 | 2 | 1 |

#### 7.3.5.5.3.2 Quality dimensions considered for focusing sources amongst the top four (latest ISB)

In Table 7-64 and Table 7-65 the positive and negative quality dimensions used for evaluating focusing sources which are amongst the top four mostly used sources are listed.

**Table 7-64: Positive IQ dimensions to use the focusing sources amongst the top four**

| | Experience | Empathy | Reliability | Networking | Informative | Amount of relevant info | Practical |
|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 11 | 10 | 4 | 2 | 2 | 2 | 4 |
| **Therapist/Trainer (14)** | 4 | | 3 | | 2 | 2 | |
| **Social Networks (8)** | | 2 | | 5 | 2 | | |
| **Sum** | 15 | 12 | 7 | 7 | 6 | 4 | 4 |
| **T.N. of sources** | 2 | 2 | 2 | 2 | 3 | 2 | 1 |

**Table 7-65: Negative IQ dimensions to use the focusing sources amongst the top four**

| | Reliability | Diversity | Biased info |
|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 4 |
| **Therapist/Trainer (14)** | 7 | | |
| **Social Networks (8)** | 2 | 2 | |
| **Sum** | 19 | 13 | 4 |
| **T.N. of sources** | 3 | 2 | 1 |

#### 7.3.5.5.3.3 Focusing sources conclusion

To calculate the importance of each dimension five top dimensions are rated by 1, second five by 0.5 and the rest by 0.25

**Table 7-66: Positive IQ dimensions indicated by parents to use focusing sources**

| **Appearance (all sources)** | **Top four** | **Total** |
|---|---|---|
| Experience | Experience | Experience 2 |
| Empathy | Empathy | Empathy 2 |
| Reliability | Reliability | Reliability 2 |
| Interaction with child | Networking | Networking 2 |
| Networking | Informative | Informative 1.5 |
| Informative | Amount of relevant info | Interaction with child 1 |
| Amount of relevant info | Practical | Practical 1 |
| Practical | | Amount of relevant info 1 |
| | | |

**Table 7-67: Negative IQ dimensions indicated by parents to use focusing sources**

| Appearance (all sources) | Top four | Total |
|---|---|---|
| Reliability | Reliability | Reliability 2 |
| Diversity | Diversity | Diversity 2 |
| Personal reasons | Biased info | Biased info 2 |
| Biased info | | Personal reasons 1 |
| | | |
| | | |
| | | |

## 7.4 Interview guide: Phase one (parents)

| | |
|---|---|
| Introducing interviewer | Hello, my name is _____, and I have been asked to _____.<br>During the interview, I would like to discuss an information seeking incident in which you were looking for a proper treatment for your child. I will ask you to provide details.<br>You have been chosen as an interviewee because your child has been diagnosed with autism few years ago so you have experience in information seeking for your child's needs which are very beneficial to this study.<br>The objective of this study is to create a solution which helps providing quality information sources in area of caring children with autism. Quality information then will reduce the ambiguity in decision making by parents. Findings of this study will be sent on to you at the end of it for your consideration.<br>I was wondering is it alright if I record the interview for later transcribing and analysis, also I would like to assure you that what we discuss here remains confidential<br>May I ask you to read and sign the consent form please? |

| Main Questions | Additional questions | Clarification questions<br>Probing questions |
|---|---|---|
| Demographics | What is your<br>• Both parents occupation?<br>• What is your latest qualification?<br>• How long your child has been diagnosed with autism?<br>• Did you have any experience about autism before your child was diagnosed with it?<br>• Who in your family is the main planner for the interventions that your child with autism should receive? | |

| | | |
|---|---|---|
| | • Is he/she your first child? number of children? Their age?<br>• Do you have e-mail address?<br>• Do you have a broadband internet connection at home?<br>• Do you use social media? | |
| Introducing question<br>I want to ask you to remember the last time you needed information to plan for a treatment/therapy your child should receive to help him/her with a specific problem.<br>May I ask you what therapy or treatment you were seeking information for last time and to help with what problem? | | |
| Why did you need information about this particular treatment (mentioned by parent)? | • Can you mention any particular reason that caused you start seeking?<br>• Can you name a specific incident which triggered the information seeking? | • Any other reason you sough information for this treatment?<br>• Could you explain further please?<br>• Any other incident you can name? |
| What kind of information were you seeking for in that particular incident? | • What specific questions did you have which you wanted to be answered?(problem solving?)<br>• What specific questions you had in mind the problem-solving (mentioned treatment/therapy)?<br>• Did you look for information about the problem before?<br>• What specific questions did you have about the problem? (no queries of this type this time?)<br>• Did you look for general information about the area of problem and solution before? | • Any other query you can remember?<br>Categorise queries into **domain, problem** and **problem solving** information during the interview |

| | | |
|---|---|---|
| | • Do you remember any general questions you had about whole subject? (no queries of this type this time?)<br>• Do you remember when you were looking for general information and problem information? | |
| Here I want to ask you to remember the sources you used to find answer for your queries and I want to ask you to please draw them on paper for me? (information horizon instrument)<br><br>USE SAMPLES OF THEIR COMMENTS TO REMEMBER WHAT YOU MEAN | Explain them how to draw the diagram and to draw more important sources closer and less important ones farther<br>You mentioned these queries being sought by you about **domain**<br>• Could you draw the information sources on the paper?<br>You mentioned these queries being sought by you about **problem**<br>• Could you draw the information sources on the paper?<br>You mentioned these queries being sought by you about **problem solving**<br>• Could you draw the information sources on the paper? | • Any other sources you remember?<br>• Previously you mentioned this source, wouldn't you include it in your information horizon for this query type?<br>Some hints learnt from previews interviews can help informant to remember things (Laforest & Bouchard, 2009) |
| In which order have you used the sources? (pathway) | • Can you remember the sequence through which you used sources for each group of queries?<br>Three diagrams should be numbered | • It is okay if you have used one source in more than one step |
| You mentioned these sources in the diagrams you drew, here I want to ask you about the reasons you used each source. | • Can you remember any specific source you have used? (e.g. specific book, website)<br>• In this diagram why each source is where it is already in the diagram (source preference criteria)? (go through sources one by one) | • Can you expand a little more on this?<br>• Can you tell me anything else?<br>• Can you give me some examples?<br>• Can you think of any other factor?<br>Make a list of factors to |

| | | |
|---|---|---|
| | • What benefits you can name for each source?<br>• What problem you can name for each source?<br>• Internet has not been among your sources, why?<br>• Internet has not been among your main sources, why?<br>• | ask their meanings at next steps |
| Now I want to discuss your reasons for using information sources a bit more? | • You mentioned X for using /not using source Y, could you explain what do you mean of that? (your opinion) (e.g. You mentioned "understandibility" for using doctors as a source, could you explain what do you mean of that?) | • Can you expand a little more on this?<br>• Can you tell me anything else?<br>• Can you give me some examples? |
| Did you behave the same while your child recently had diagnosed with autism? | • Could you redraw the diagrams you have drawn with the black pen to show the differences?<br>• Why did you behave differently? | • |
| Interviewers channel of interest will be focused here (here it is internet)<br>During the interview you mentioned few factors which positively or negatively impacted your decision to include or exclude a source; I was wondering how a web source could pass those factors? | Should go through next question for all factors mentioned for internet<br>• You mentioned XX factor for using internet. How a web source will/will not pass that factor?<br>Should go through following question for the rest of factors one by one<br>• You mentioned XX factor for including YY source, how could you say a web source does/does not pass it? | • Anything else you can add?<br>• Can you expand a little more on this?<br>• Can you tell me anything else?<br>• Can you give me some examples? |
| What do you recommend that an | • How do you recommend information | • Can you expand a little more on this? |

| | | |
|---|---|---|
| information source should be look like? | within an information sources should be looked like?<br>• What information they should include?<br>• How do you understand a source pass it? | • Can you tell me anything else?<br>• Can you give me some examples? |

| |
|---|
| After interview is done:<br>Do you have anything else to add? Or recommend?<br>Thank you for your help, it is much appreciated<br>Here is my contact details printed on this paper, please contact me if you think you want to add something else.<br>Would you like to receive a copy of the transcript and/or findings? |

## 7.5 Interview guide (IS practitioners)

| | |
|---|---|
| Introducing interviewer | Hello, my name is Amin Mousavinejad and I am a PhD student in Business information systems. You have been chosen because you have been involved in the process of an/a few information system development(s).<br>During the interview, I would like to present an information requirement determination technique and discuss its potential applicability in your projects.<br>This technique has been tested to determine parents' of children with autism information requirements for developing an information system. And the anonymous data has been presented here as the sample data.<br>Is it alright if I record the focus group for later transcribing and analysis? Also I would like to assure you that what we discuss here remains confidential.<br>May I ask you to read and sign the consent form please? |

| Main Questions | Additional questions | Clarification questions<br>Probing questions |
|---|---|---|
| Demographics | What is your<br>• Occupation?<br>• What is your latest qualification?<br>• Experience in IS developments? How many? Which domains?<br>• Your role in system development? (Analysts, content developer, system developer, manager?) | |

The focus of this interview is on evaluating the practical use of the developed IRD technique and there is only one open question to be discussed.

> How each part of the matrix and analysed data could be operationalised in the projects you already have been involved in?

To begin with here is the presentation matrix filled by the data collected from parents of children with autism.

1 2

| **Type of information** | **Equivocality resolution** | **Confirming** | **Uncertainty resolution** | **Positive quality dimensions** | **Negative quality dimensions** |
|---|---|---|---|---|---|
| Domain<br>Focus of unexperienced parents | Doctors (0+0)=0<br>Internet (0+0)=0<br>Therapist/trainer (-1-1)=-2 | Personal experience (+1+1)=2<br>Books (-1-1)=-2 | Other parents (0+1)=1<br>Social media (-1+1)=0 | Empathy<br>Experience<br>Reliability<br>Networking<br>Interaction with child | Reliability<br>Practical<br>Detailed<br>Diversity<br>Amount of rel. info. |
| Problem | Doctors (-1-1)=-2<br>Personal experience (1+1)=2 | Other parents (1-1)=0<br>Internet (-1+1)=0<br>Books (1+1)=2 | Therapist/trainer (-1+0)=-1 | Accessibility<br>Amount of rel. info.<br>Interaction with child<br>Reliability<br>Experience | Reliability<br>Amount of rel. info.<br>Diversity<br>Financially biased<br>Interaction with child |
| Problem solving<br>Focus of experienced parents | Doctors (1-1)=0 | Internet (0+0)=0<br>Other parents (-1+1)=0<br>Therapist/trainer (-1+0)=-1<br>Social media (--+1)=1<br>Books (1+1)=2 | Personal experience (1-1)=0 | Experience<br>Empathy<br>Reliability<br>Informative<br>Practical | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Speciality |
| Role specific quality dimensions<br>3 | Reliability<br>Amount of rel. info<br>Scientific<br>Interaction with child<br>Accessibility | Experience<br>Empathy<br>Reliability<br>Amount of rel. info<br>Interaction with child | Experience<br>Empathy<br>Reliability<br>Interaction with child<br>Practical<br>Networking | | |
| | Reliability<br>Financially biased<br>Interaction with child<br>Caring<br>Practical | Reliability<br>Diversity<br>Amount of rel. info<br>Language<br>Practical | Reliability<br>Personal reasons<br>Diversity<br>Biased info<br>Practical | | |
| The entire information horizon quality requirements | | | | | |

| **Source specific factors:** | **Information specific factors**: |
|---|---|
| - Empathy, Experience<br>* Use parents provided information<br>- Reliability, 2-Scientific, 3-Speciality<br>* Reputation#(2)(3)<br>* Has academic ties/degree (2)(3)<br>* Knowing the Author/Speaker/Parent<br>* Not being financially biased (source does not benefits from provided information)#<br>* Caring<br>* User has previous experience with source<br>* Information be in a written or face to face format<br>- Amount of relevant info.<br>*Alternative information sources be available<br>*Does not practice trial and error<br>*Has academic ties<br>- Considers the diversity of children<br>- To be simple to access<br>- Knows child well and has interactions with him/her<br>- Practical information<br>*Recommends solution options<br>- Caring<br>*Represents sympathy and care<br>- Provide the opportunity to meet other parents/professionals<br>- Explains in details | - Reliability, 2-Scientific, 3-Speciality<br>* Timeliness (2)<br>* Referencing (2)<br>* Has international Authors (2)<br>* Includes statistics and diagrams (2)<br>* No contradicting information<br>* Accuracy<br>* Author CV (Has related/specific academic degree(s), has experience in similar cases)<br>* Evaluated/tested information (no pure opinion)<br>- Amount of relevant information<br>* Multidimensional information (cover all the aspects)<br>* Has international Authors<br>- Considers the diversity of children<br>- Practical<br>* Recommends solution options<br>* Referencing<br>* Explains in details#<br>- Empathy, Experience<br>* Use parents information<br>- Language<br>* To be written in user's mother tongue |
| Measurement factors for few quality dimensions are similar with few other and in some cases to avoid repetition they have not been repeated (Words coming after "-" are dimensions, after "*" are factors) | |

4

| | |
|---|---|
| | We used a technique to determine parents' information requirements. Here I will explain what we have done. |
| | 17 parents have been interviewed using this technique.<br>Interviewees first were asked to talk about two incidents in which they were seeking for information to make a decision regarding their child care. They were asked about queries they had in their minds in recent incident and also for an incident close to child's diagnosis. Their queries categorised into three groups of "Domain", "Problem" and "Problem solving" information during the interview.<br>Domain: general facts<br>Problem: Information about what is wrong<br>Problem solving: Information about how to solve the problem |

Four sections are included in the matrix.

## Section 1

It is the main part. It maps the information sources and media used by parents based on the type of information they provide and the role they play within information system.

The presented matrix categorises information sources/media used by seekers based the **type of information** each source provides (domain information, problem information and problem solving information) and the **role it plays**. One type of source resolves the equivocality when seekers' queries are still vague and general (equivocality resolution). The second type responses to uncertainties by providing answers to specific queries (Uncertainty resolution) and third type provides complementary information for the two other types (confirming).

This matrix has been tested by mapping parents of children with autism information behaviour. 17 parents have been interviewed for two incidents in which they were seeking information to make a decision regarding their child care. They were asked about queries they had in their minds for a recent incident and also for an incident close to child's diagnosis. Their queries categorised into three groups of "Domain", "Problem" and "Problem solving" queries. (Domain: general facts, Problem: Information about what is wrong, Problem solving: Information about how to solve the problem). Parents' information behaviour then were collected separately for each type of queues (Early queries: 42 domain, 7 problem, 3 problem solving - Current queries: 21 domain, 35 problem, 40 problem solving)

**Sample of current queries**

| Domain query | Problem query | Problems solving query |
|---|---|---|
| Can these children go to school? Do they have the ability to get educated? | What are repetitive behaviour? | Which doctor is the best to be visited for this problem? |

**Success evaluation**

The success and failure of categorised information sources within seekers' information horizon has been rated in a 4 point grading scale (-2 to 2) based on change in seekers' behaviour over time. Each source has been rated based on its

***importance average change and usage average change*** over time. Finally the reasons for placing information sources in their category has been justified by quality dimensions seekers indicate for their source preference behaviour.

## Section 2

Lists quality dimensions required for each type of information

## Section 3

Lists quality dimensions required for de-equivocality and finalising sources. And finally

## Section 4

Categorises the source specific and information specific quality requirements of the entire information horizon. These dimensions are accompanied with factors parents used to measure them. Four tables are used to feed this matrix which all are presented at Table 7-70. These tables illustrate the positive and negative quality criteria of the top seven sources and also the definitions and evaluation factors identified for each quality dimension.

### Quality dimensions used for source evaluation

**Table 7-68: Most important positive dimensions to use seven most popular sources**

| | Empathy | Experience | Reliability | Amount of relevant info | Scientific | Interaction with child | Reputation | Networking | Informative | Practical | Accessibility | Speciality | Personal reas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 11 | 4 | 2 | | | | 2 | 2 | 4 | | 2 | |
| **Doctors (16)** | 3 | | 4 | 3 | 4 | | 2 | | | | | 3 | 2 |
| **Personal experience (14)** | | | 2 | | | 6 | | | | | | | 2 |
| **Therapist/Trainer (14)** | | 4 | 3 | 2 | 2 | 2 | 3 | | 2 | | | | |
| **Internet (10)** | | | | 4 | | | | | | | 6 | | |
| **Books (9)** | | | | | 2 | | 2 | | | 2 | | | |
| **Social Networks (8)** | 2 | | | | | | | 5 | 2 | | | | |
| **Sum** | 15 | 15 | 13 | 11 | 8 | 8 | 7 | 7 | 6 | 6 | 6 | 5 | 4 |
| **T.N. of sources** | 3 | 2 | 4 | 4 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 |

**Table 7-69: Most important negative dimensions to use seven most popular sources**

| | Reliability | Amount of relevant info | Diversity | Practical | Financially Biased | Interaction with child | Detailed | Language | Caring | Personal reason | Technical issue | Speciality | Hope |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Other parents (17)** | 10 | 3 | 11 | | | | | | | | | | |
| **Doctors (16)** | 6 | 3 | | 2 | 7 | 7 | 4 | | 5 | | | 5 | 2 |
| **Personal experience (14)** | 2 | | | | | | | | | 2 | | | |
| **Therapist/Trainer (14)** | 7 | | | 2 | 3 | 2 | 2 | | 3 | 2 | | | 2 |
| **Internet (16)** | 6 | 4 | | 3 | | | | 6 | | 2 | 3 | | |
| **Books (9)** | 4 | 3 | | 3 | | | 2 | 2 | | | | | |
| **Social Networks (8)** | 2 | | 2 | | | | | | | | 2 | | |
| **Sum** | 37 | 13 | 13 | 10 | 10 | 9 | 8 | 8 | 8 | 6 | 5 | 5 | 4 |
| **T.N. of sources** | 7 | 4 | 2 | 4 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 2 |

**Most frequently mentioned quality dimensions and their measurement factors**

| **Dimension (Positive/Negative)** | **Definition** | **Source specific Measurement factors** | **Information specific Measurement factors** |
|---|---|---|---|
| **Empathy P** | This factor holds when parents know that information source also has experienced the same or similar problems as they do. Other parents of children with autism may hold this factor better than others. | | |
| **Reliability P-N*** | It is a multi-dimension factor which means seekers may rely and use the information obtained from a source. This factor would be better defined through its measurement factors. | Type of source (published or face to face sources are more reliable), positive experience with the source, reputation, caring, not being financially biased, having academic degree or ties, knowing the speaker personally/be a parent | Referencing, availability of author's CV, no contradiction in given info, providing evaluated info/experience, accuracy, scientific, timeliness, evidence based info (no pure opinion) |
| **Amount of relevant information P-N** | This factor is more about the volume of information that seekers expect from a source. | Many number of available sources, speciality | International team, multi dimension info (completeness), reliability |
| **Experience P** | It refers to having a long experience in domain of autism, as a parent, therapist, doctor, official or else. Having tried interventions, plans and different professionals in the region are the most important expected outputs from experience. Provided information by parents would hold this factor. | Source has other similar cases, parents as information source | - |

| | | | |
|---|---|---|---|
| **Scientific P** | Refers to information written by an author with academic degree and academic information, who has publications and/or works at university. Information itself should not be an everyday kind of news and includes statistics and academic references. | Reputation, source's academic ties or degree | Referencing, international, timeliness, statistics and diagrams |
| **Networking P** | Providing the ability to contact other parents or professionals | | |
| **Interaction with child P-N** | This factor is in close relationship with "Diversity". As children with autism symptoms are very diverse, parents have the feeling that only people who have a long interaction with their children and know them well are able to help them with their problems as they exactly know their child's specific problems and potentials. | | |
| **Accessibility P** | Refers to the availability of information source and convenient of access to information through it. | | |
| **Practical P-N*** | Refers to a type of information which can be implemented in practice (e.g. do and do not list, problems and list of solutions for each, nutrition and therapeutic plans, available services in the region). These plans and options should be in detail (close relationship with Detailed). Practical information should avoid being very general. | | Referencing, offers solution options, detailed, experience, scientific |
| **Reputation P** | It is earned from recommendations of trusted individuals or other parents dealing with the same problem. Also strong CV of the Author will bring the reputation. | Academic degree or ties, source is a parent | |
| **Informative P** | Any source that can provide any sort of information (even small pieces) that seeker already does not know is categorized as informative. | | |
| **Financially biased N** | By financially benefitting from the advices source gives, or if source earns more by the increase in number of patients it advices/visits, parents may become suspicious about the source to be financially biased. | | |
| **Diversity N*** | It refers to the differentiation between children with autism and wide spectrum of problems which change over time. These criteria make it hard for using successful experience for your problems as very few similar cases may have the very same problem as yours. | | |
| **Detailed N*** | Information should be specific, complete and includes all the details | | |
| **Caring N** | This factor refers to human sources. | | |

| | | | |
|---|---|---|---|
| | A caring source should show signs of caring about parents. The mentioned signs are: Spending time, being kind, being patient, listening well, do not focusing only on fulfilling the duty and being passionate about their job. | | |
| **Speciality N** | Information source knows about the problem in question and how to deal with it, do not do trial and error, passed relevant trainings, experienced in the subject and carries relevant academic degree. Specialty is in a close relationship with amount of information. A person/source holding high amount of relevant information will be considered a specialist. | Amount of relevant info, not doing trial and error, academic degree or ties | Scientific |

# Explanation sheets (IS practitioners)

## Data collection and analysis

Early queries:

42 domain, 7 problem, 3 problem solving

Current queries:

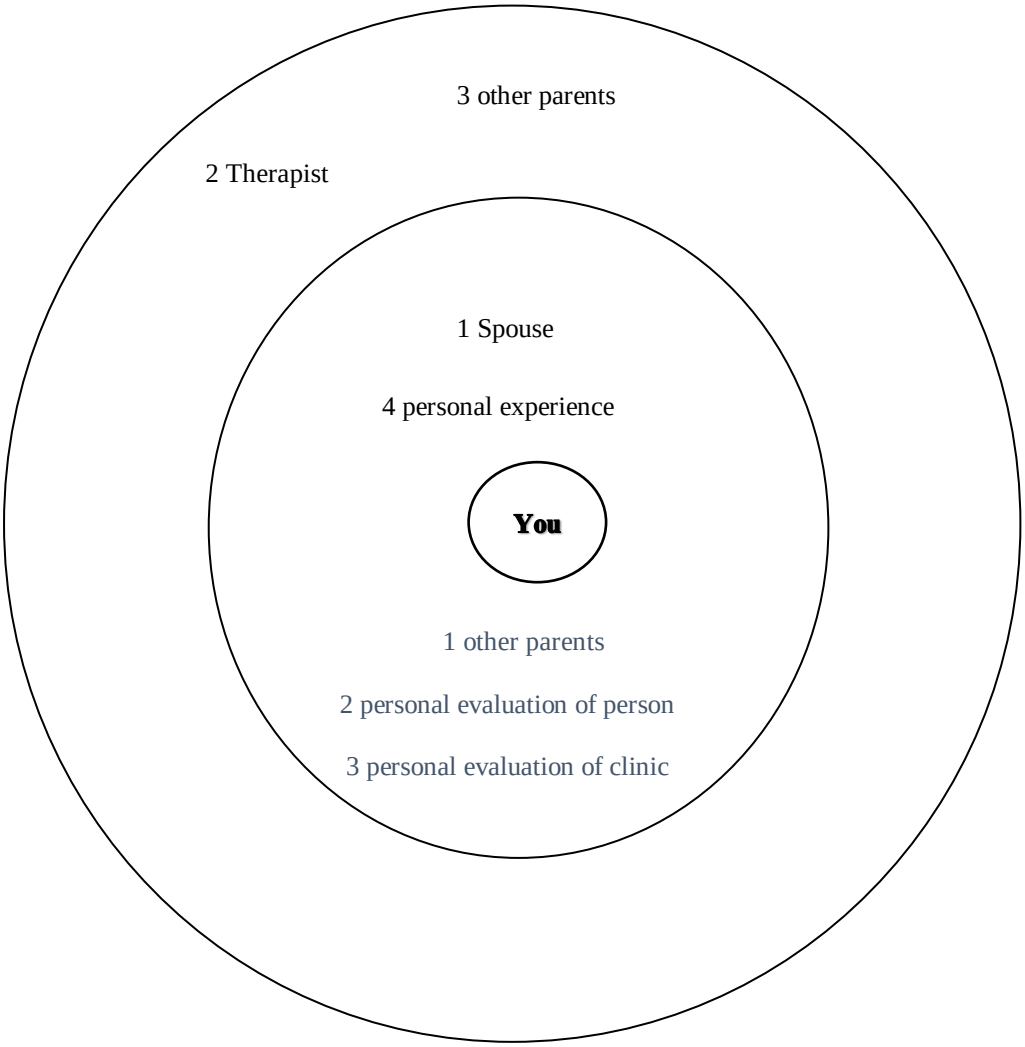
| Domain query | Problem query | Problems solving query |
|---|---|---|
| Can these children go to school? Do they have the ability to get educated? | What are repetitive behaviours? | Which doctor is the best to be visited for this problem? |

21 domain, 35 problem, 40 problem solving

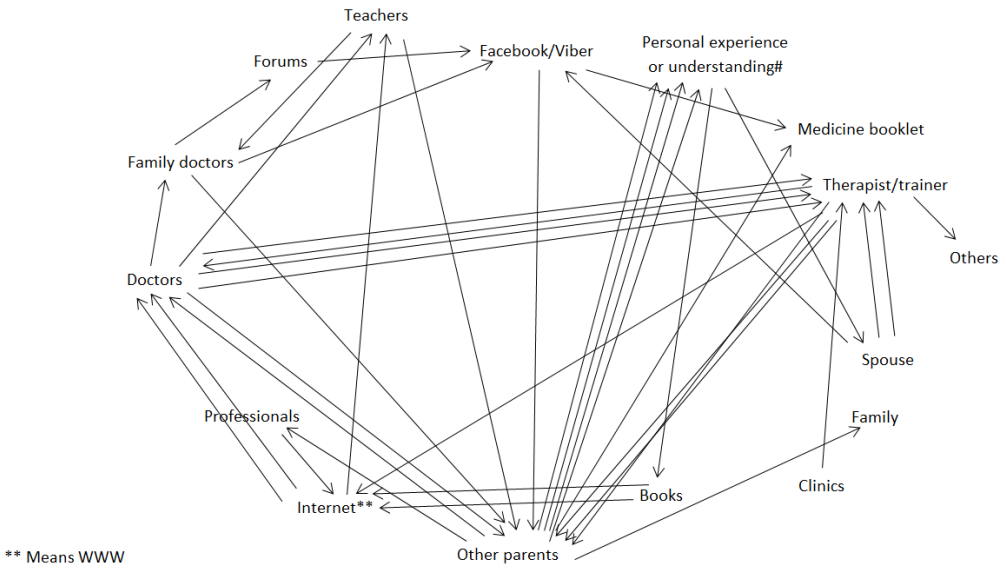
Problem solving seeking behaviour diagram: present behaviour

Past behaviour Case ID:12

Type of problem: Therapeutic (choosing the right therapist)



## Analysis and categorising




**Problem solving seeking pathways for experienced seekers**

**Type of information sources used by experienced parents for problem solving information**

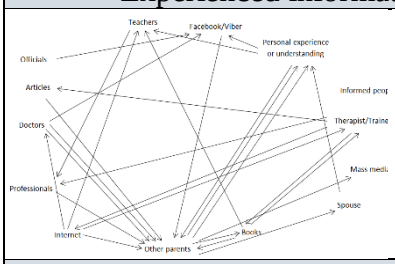
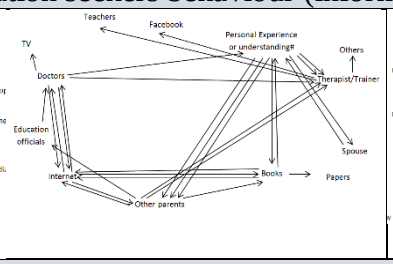
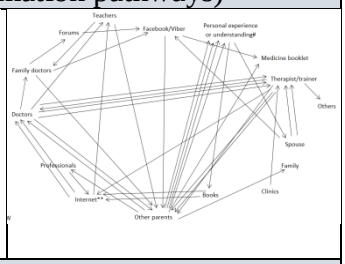
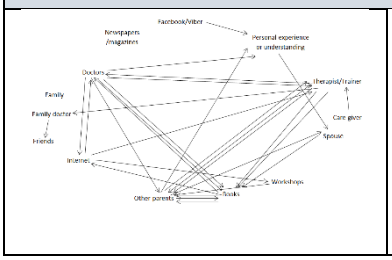
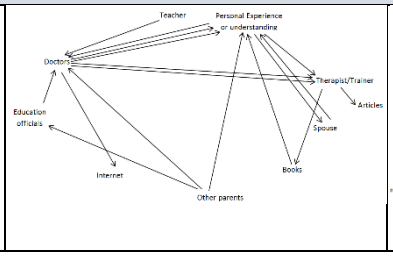
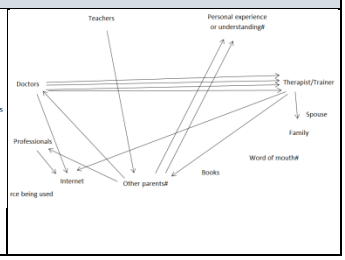
| Source | Incoming | Outgoing | Total | Type |
|---|---|---|---|---|
| Other parents | 7 | 8 | 15 | Balanced |
| Therapist/trainer | 6 | 6 | 12 | Balanced |
| Doctors | 4 | 6 | 10 | Recommending |
| www | 4 | 3 | 7 | Balanced |
| Personal experience | 5 | 2 | 7 | Focused |
| Books | 1 | 2 | 3 | Balanced |

7 most popular information sources (used by more than 20% of interviewees) then categorised based on the type of information they provide and the role they play

**Table 7-70: Information horizon categorised based on source role and information type (experienced seekers)**

| | Recommending | Balanced | Focusing |
|---|---|---|---|
| **Domain** | Doctors<br>Internet<br>Therapist/trainer | Personal experience<br>Books | Other parents<br>Social media |
| **Problem** | Doctors<br>Personal experience | Other parents<br>Internet<br>Books | Therapist/trainer |
| **Problem solving** | Doctors | Internet<br>Other parents<br>Therapist/trainer<br>Social media<br>Books | Personal experience |

## Success rating

| Domain | Problem | Problem solving |
|---|---|---|
| Experienced information seekers behaviour (information pathways) | | |
|  |  |  |
| Unexperienced information seekers' behaviour (information pathways) | | |
|  |  |  |

**Change of source importance over time**

| Source | Average use | Domain * | Problem * | Problem solving * |
|---|---|---|---|---|
| **Other parents** | 67% | 2.25—2.29 | 3—2.6 | 2.83—2.4 |
| **Doctors** | 45% | 2.43—2.33 | 2.67—2 | 2.67—2.71 |
| **Internet (WWW)** | 45% | 2.2—1.67 | 3—2.5 | 1.67—2.17 |
| **Personal experience** | 45% | 2.25—3 | 2.33—3 | 2.8—3 |
| **Therapist/trainer** | 39% | 2.8—1 | 3—2 | 3—2.5 |
| **Books** | 30% | 2.57—1.5 | 3—2.6 | 3—2.67 |
| **Social networks** | 21% | 3—2.33 | -- —2 | -- —2.23 |

* Past importance average – Present importance average

**Change in average use and roles of information sources in seeking pathways**

| Source | Popularity in information horizon | Average use | Change of use (%) | domain | problem | Problem solving |
|---|---|---|---|---|---|---|
| **Doctors** | 94% (2nd) | 54% | 18 ↓ 63->45<br>24↓Anticipation<br>p- Recommending<br>Recommending | 26 ↓ 64->38<br>9↓Anticipation<br>p- Recommending<br>Recommending | 41 ↓ 86->45<br>55↓Anticipation<br>p- Balanced<br>Recommending | 0 50->50<br>18↓Anticipation<br>p- Recommending<br>Recommending |
| **Social networks** | 47% (7th) | 12% | 18 ↑ 3 -> 21<br>18↑Anticipation<br>p- -----<br>Focusing | 29 ↑ 9 ->38<br>31↑Anticipation<br>p- -----<br>Focusing | 9 ↑ 0->9<br>9↑Anticipation<br>p- -----<br>------- | 21 ↑ 0->21<br>21↑Anticipation<br>p- -----<br>Balanced |
| **Internet (WWW)** | 59% (5th) | 38% | 15 ↑ 30->45<br>10↑Anticipation<br>p- Focusing<br>Balanced | 7 ↓ 45->38<br>5↑Anticipation<br>p- Balanced<br>Recommending | 41 ↑ 14->55<br>37↑Anticipation<br>p- ------<br>Balanced | 18 ↑ 25->43<br>9↑Anticipation<br>p- Ending<br>Balanced |
| **Other parents** | 100% (1st) | 62% | 10 ↑ 57->67<br>5↑Anticipation<br>p- Recommending<br>Balanced | 15 ↑ 73->88<br>35↑Anticipation<br>p- Focusing<br>Focusing | 2 ↑ 43->45<br>10↓Anticipation<br>p- Starting<br>Balanced | 21 ↑ 50->71<br>3↑Anticipation<br>p- Balanced<br>Balanced |
| **Personal experience** | 82% (3rd) | 43% | 5 ↑ 40->45<br>1↑Anticipation<br>p- Focusing<br>Balanced | 2 ↑ 36->38<br>12↑Anticipation<br>p- Focusing<br>Balanced | 21 ↑ 43->64<br>9↑Anticipation<br>p- Focusing<br>Recommending | 6 ↓ 42->36<br>21↓Anticipation<br>p- Ending<br>Focusing |
| **Therapist/trainer** | 82% (3rd) | 38% | 2 ↑ 37->39<br>1↓Anticipation<br>p- Balanced<br>Balanced | 33 ↓ 45->12<br>21↓Anticipation<br>p- Recommending<br>Recommending | 12 ↑ 43->55<br>0↑Anticipation<br>p- Balanced<br>Focusing | 18 ↑ 25->43<br>9↑Anticipation<br>p- Balanced<br>Balanced |
| **Books** | 53% (6th) | 30% | 0 30->30<br>3↓Anticipation<br>p- Focusing<br>Recommending | 39 ↓ 64->25<br>22↓Anticipation<br>p- Focusing<br>Balanced | 31 ↑ 14->45<br>27↑Anticipation<br>p- Balanced<br>Balanced | 13 ↑ 8->21<br>10↑Anticipation<br>p- -----<br>Balanced |
| **Average number of sources used** (total filled diagrams) | | | p- 3.4<br>3.73<br>9 ↑ | p- 4.64 (11)<br>3.38 (8)<br>27* ↓ | p- 3 (7)<br>3.82 (11)<br>27* ↑ | p- 2.5 (12)<br>3.86 (14)<br>35* ↑ |

* For domain information, anticipated average change in use is -27%. It means that if the initial average use is 45% it is anticipated to decrease to 33% (45-(45*27%)). Any changes more or less than that has been considered as **above or under anticipation.** Unit of analysis is number of filled diagrams.

## IQ evaluation

1 Frequently indicated quality dimensions (all information system)**

2 Quality dimension popularity **

3 Frequently indicated quality dimensions for the top four sources (most important information zone)*

4 Quality dimensions causing sources' average use change over time*

* Categorised based on information use

** Can be used only for determining the entire information horizon IQ needs

4/5 these manners are used to rate the most important dimensions to be met by system and 2 for the rest

**IQ dimensions needed by different parts of information system**

| | Entire system | Domain info. | Problem info. | Problem solving info. | Recommending sources | Focusing sources |
|---|---|---|---|---|---|---|
| **Positive** | Empathy 4 | Empathy 2 | Accessibility 2 | Experience 2 | Scientific | Networking |
| | Reliability 3+.5 | Experience 2 | Amount of relevant information 2 | Empathy 2 | Reputation | |
| | Amount of rel. info 3+.25 | Reliability 2 | Interaction with child 2 | Reliability 1+.5 | Reliability | |
| | Experience 3 | Networking 2 | Reliability 1 | Informative 1+.5 | | |
| | Scientific 2+.5 | Interaction with child 1+.5 | Experience 1 | Practical 1 +.5 | | |
| **Negative** | Reliability 4 | Reliability 2 | Reliability 2 | Reliability 2 | Reliability | |
| | Financially biased 3+.5 | Practical 1+.5 | Amount of relevant information 2 | Financially biased 2 | Financially Biased | |
| | Interaction with child 2+1 | Detailed 1+.5 | Diversity 1 | Interaction with child 2 | Interaction with child | |
| | Diversity 3 | Diversity 1 | Financially biased 1 | Caring 1.5 | Amount of relevant information | |
| | Amount of rel. info. 3 | Amount of relevant information 1 | Interaction with child 1 | Speciality 1.5 | Detailed | |

## 7.6 Challenges of parenting children with autism (concept matrix)

**Table 7-71: Challenges facing parents' of children with autism (concept matrix)**

| Parent's Task/ Child's need (USE for info.) | Task/info category | Problems associated with task* | Objective/ Title | Information/ required task | Info. Source USED for info. portion | Problems/ Opportunities for each source | Info. Satisfaction (IQ) factors/ source | Author/ ref. quality |
|---|---|---|---|---|---|---|---|---|
| **New treatment (CN)**<br><br>**Dietary programs (CN)**<br><br>**Medication (CN)**<br><br>**Educational intervention(CN)**<br><br>**Strategies to access services**<br><br>**Manage difficult behaviors** | Five complexity category for tasks<br><br>problem information, domain information, and problem-solving information. (Byström & Järvelin, 1995) | | Sources of information and support used by parents of children with autism spectrum disorders | | Academic papers<br><br>Television, newspaper, magazine articles, book<br><br>Other parents<br><br>Internet websites<br><br>Conference, workshops<br><br>Physicians<br><br>Pediatrician | Feel flooded in the process of information seeking,<br><br>Seek for accurate and most helpful<br><br>Lower income have a negative effect | | (Mackintosh et al., 2005) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Adjust to child disability**<br><br>**Services available/not available**<br><br>**Stay up with updates** | | | | | | | | |
| **Coping and having control of child's disability** | | | | Having good and complete information about the subject | | Time consuming | | |
| | | Less income/used fewer source | | Find how to best meet child's needs (listed in task list) | Academic papers | | Academic papers are not accessible, hard to understand. Information overload | |
| | | | | | Television, newspaper, magazine articles, book | | reliability | |
| | | | | | Other parents | | | |
| | | | | | Internet websites | Many sites, hard to sort them out | Reliability, sorting a lot of information | |
| | | | | | Conference, workshops | Recent information, meet up other parents, not everyone able to attend, lower income parents cannot afford it, lower incomes cannot afford time | recent | |
| | | | | | Physicians | | | |
| | | | | | Pediatrician | Vary in their knowledge | | |
| **Feeding child** | | | Describing autism meal plan ("a behaviorally based parent-training curriculum to address feeding problems associated with" ASD | autism Meal Plan (to prevent nutritional and possible medical issues) | Parent training by researchers | | | (Sharp, Burrell, & Jaquess, 2013) |
| **Vaccines MMR (all children)** | | | | Vaccine side effects, detailed information | | Inadequate, biased, inaccurate, not enough detail | | (Wallace, Leask, & Trevena, 2006) |
| **Delivering care to children** | | | | | | | | (Case-Smith & Bryan, 1999; Escalona, Field, Singer-Strunck, Cullen, & Hartshorn, 2001; Wood et al., 2009) |
| **coordinating care process** | | | | | | | | (Kogan et al., 2008; Liptak et al., 2006) |
| **controlling the quality of care** | | | | | | | | (Kogan et al., 2008) |
| **Visiting professionals** | | Time consuming, needs two carers to drive and accompany the person with autism | | | | | | (R Oberleitner, Laxminarayan, Suri, Harrington, & Bradstreet, |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2004) |
| **Therapeutic oriented education (CN)** | | Accessing professionals in the region | | | | | | (Lovaas, 1987) |
| **Asses progression, Pursue new therapeutic strategies.** | | Deal with ever increasing number of professionals | | List of professionals | | | | (Ron Oberleitner, Ball, & Gillette, 2006) |
| **Communicate with practitioners on child's issues** | | Communicatio n is not effective | | | | | | |
| **Recreate and convey child's history** | | It is a challenge to recreate and convey medical and behavioral history | | | | | | |
| **Health scares of MMR vaccines (All children)**<br><br>**Key point for all sources is believability of info** | | Increases parents information needs | The impact of health scares on parents' information needs and preferred information sources: a case study of the MMR vaccine scare | | Mass Media (first source) | Trustworthiness is an important factors to choose a source,<br>- Media is the source because of not trusting official information | Mass media (NOT trustworthy) , Found the others as untrustwort hy, parents think they can judge true info. | (Guillaume & Bath, 2004) |
| | | | | | Newspaper | | More balanced info., untrustwort hy | |
| | | | | | Official information | Mistrust to government | Not enough | |
| | | | | General information, specific info about MMR | | | Large amount, clearly presented, independent (trusted), medically rich, | |
| | | | | | GPs, practice nurses or health visitors | Some have no info.,<br>Some not up to date, biased, no free willing, not willing to discuss alternatives | Enough info., being up to date | |
| | | | | | | Conflicted info. and lack of balanced info. has named as the barrier for decision making | balanced amount (aiming the problem only) | (Bond & Nolan, 1998; Brazy & Anderson, 2001) |
| **Finding all school options** | | | | | | | | |
| **Nutrition, handling mentally retarded children** | | | Patterns of childcare information seeking by families | Child care info. | Magazines, books, government and other organisation's pamphlets, Television, workshop, expert persons, family, friends, spouse | Time for workshop | | (Jr & Durio, 1983) |
| Parent's Task/ Child's need (USE for info.) | **Task category** | **Problems associated with task*** | **Objective/Titl e** | **Info. required/task** | **Info. Source USED for info. portion** | **Problems/ Opportunities for source** | **Info. Satisfaction (IQ) factors/sou rce** | **Author/ ref. quality** |

**Table 7-72: Requirements/problems of stakeholders in the context of caring children with autism**

| | General problem(s) (sources of uncertainty) | | | Requirements | | | Recommended solution(s) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Stakeholder(s) deal with care/problem** | **Problem(s)** | **Effective on problem** | **Affected by problem** | **Information** | **Coordination (relationship)** | **Others** | **Solution/ help** | **Reason for solution** | **Author(s)** |
| Parents | Anxiety/Stress/ Depression | - Child status *<br>- Earning power<br>- Social Support<br>- Hope for new treatments **<br>- Isolation<br>- Expectations | - Parental functioning<br>-Professional advancement | - Learning skills to cope<br>- Strategy of action<br>- gathering information to formulate action | | - Coping with autism<br>- Battling with autism | Internet | - Contents are useful<br>- Media to build virtual support groups<br>- Surfed for learning<br>- Makes ties with others and takes them out of isolation<br>- A tool enables parents to help others | (Fleischmann, 2005) |
| | - Struggling with educators | - Exposing child with all the possible solutions (therapies) (or protect him all the time) | | | | | | | |
| | - did not know what to do after they realise their child's problem | - Other parents' help | Stress | | | | | | |
| General Practitioner | - GP does not put families in touch with each other<br>- GP does not understand the impact of children with autism on family<br>- GP cannot answer the questions about child's condition<br>- GP cannot provide information and guidance for prevention<br>- GP knowledge about complementary and alternative medicines is low<br>- GPs qualifications to manage special needs is low<br>- GP does not provide help in coordinating care | | | - GP knows about new aspect of care<br>- GP knows the Sensitivity of care to these children | | | | | (Liptak et al., 2006) |
| Parents | - Families dissatisfaction with healthcare<br>- Voice unmet needs<br>- Dissatisfaction with conventional care | - Patient involvement in decisions<br>-getting feedbacks about care<br>- Uncertainty and doubt about child's disability<br>-Service delivery structure | | - Requested information about complementary and alternative medicines and therapies<br>- Prefer to accept responsibility, investigate | - Promoting parents-professionals partnership in care<br>- Parents should coordinate the care for their children | - More support in the community<br>- Children have complex medical needs<br>- Family Centred care<br>- Usually put a nurse or non-physician person as a primary source of care | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | for all options instead of relying on doctors<br>- Complete and unbiased information about various treatment options | | | | | |
| | - Stress<br>- Anxious about getting proper service | | | | | | | | |
| Parents - Professionals | - Differences between parental perception and professional assessments of the child's cognitive level<br>- Quality of care | | - Discord between these parents and professionals | | - Simplifying the links between professionals, caregivers, doctors and etc. | | -Self management for parents<br>-Decision support for providers<br>- Enhancing clinical IS<br>- Enhancing service delivery<br>- Strengthen link between professionals | | |
| Physicians dealing with special needs children | - EDS should be available 24/7 | | | - Available medical needs for emergency/ pre-hospital physicians (Emergency Data Set)<br>- One/all physician(s) responsible for keeping EDS up to date | | | | | (Sacchetti et al., 1996) |
| Families | (Among families with special need children)<br>- Are more likely to have financial problem | - Medical home | - Almost everything | | | | - System reforms<br>- Quality improvement initiatives<br>- Innovative financing reform<br>- Improving healthcare and related services for children with ASD and their families | | (Kogan et al., 2008) |
| | - Are more likely to have unmet needs<br>- Stopped working because of child<br>- Spent 10+ h/week providing or coordinating care<br>- Paid more than 1000$/Year providing care<br>- Difficulties accessing services | | | | | - Have more hospital and physician needs<br>- More frequent surveillance<br>- More aggressive educational intervention | | | |
| Mothers | - Stress/anxiety<br>- Risk of depression | - Lack of social support * (informal support is more effective)<br>- Child's improvement<br>- Less involvement in social activities | | Solutions to successfully (support groups wasn't that successful)<br>- Increase factual knowledge of autism | | -Parents need option to choose education or social support | #Formal social support to:<br>- Increase family's knowledge about autism<br>- Knowledge | - Reduce stress<br>#Satisfaction with social support causes<br>- Better personal well-being<br>- More positive attitude about child | (Boyd, 2002) |

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| | | than mother of normal children (Caused by Child's behaviour)<br>- Worry of long term dependency<br>- Time consuming care (leaves no time for stress reduction activities) | | - Increase knowledge of stress and solutions to cope with it<br><br>- Training is needed to help families cope with child's characteristics | | | of stress and how to cope it<br>- Awareness of advocacy issues<br>#Informal social support – Parents' support group- (Speaking about their concerns in groups)* | - More positive child-parents interactions<br>- Higher scores in child's development test | |
| | - Inclination to seek social support | - Child's cognitive limitations<br>- Child's behaviour problems<br>- Difficult management problems<br>- Dependency on caregivers<br>- Need assistance on self-help skills<br>- Spousal support | | | | | | | |
| Mothers | - Stress | - Worrying of permanency of condition<br>- Acceptance of child's behaviour in society<br>- Low level of social support | | | | | | | (Sharpley, Bitsika, & Efremidis, 1997) |
| Families | | | | - Need information about child's condition<br>- Needed information about how to obtain services for the child<br>- How to cope with child's behaviour | | | | | (D. B. Bailey et al., 1999) |
| Parents | - Ambiguity<br>- Information Overload | | | | | | | | (Mackintosh et al., 2005) |

## Definitions

Understanding the following definitions are necessary to comprehend this research properly. Some of the definitions may look very obvious but during the research knowing these definitions help to understand arguments

**Information:** "relevant, accurate, timely and concise" data. In which data is "raw number of facts" (Alavi & Leidner, 2001; Mackay, 1969; Tushman & Nadler, 1978).

“As information must effect a change in knowledge, data may or may not be information” (Tushman & Nadler, 1978, p. 614).

**Task:** “A piece of work to be done or undertaken” (“task: definition of task in Oxford dictionary (British & World English),” n.d.). In this study it implies to a piece of work conducted by stakeholders to fulfil their responsibilities.

**“Information Behavior** is the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use. Thus, it includes face- to-face communication with others, as well as the passive reception of information as in, for example, watching TV advertisements, without any intention to act on the information given.

**Information Seeking Behavior** is the purposive seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems (such as a newspaper or a library), or with computer based systems (such as the World Wide Web).

**Information Searching Behavior** is the ‘micro-level’ of behavior employed by the searcher in interacting with information systems of all kinds. It consists of all the interactions with the system, whether at the level of human computer interaction (for example, use of the mouse and clicks on links) or at the intellectual level (for example, adopting a Boolean search strategy or determining the criteria for deciding which of two books selected from adjacent places on a library shelf is most useful), which will also involve mental acts, such as judging the relevance of data or information retrieved

**Information Use Behavior** consists of the physical and mental acts involved in incorporating the information found into the person's existing knowledge base. It may involve, therefore, physical acts such as marking sections in a text to note their importance or significance, as well as mental acts that involve, for example, comparison of new information with existing knowledge” (Wilson, 2000, pp. 49–50).

**Processed Information:** information being “incorporated into the users' framework of knowledge, beliefs or values” (Wilson, 1997, p. 657).

**Information Used:** “lead[s] to changes in the user's state of knowledge, behaviour, values or beliefs” (Wilson, 1997, p. 657).

**IQ:** “Quality information allows a decision maker to justify the basis of the decision to others [or themselves], arguing that if the information used is timely, accurate, and reliable, then any decision made is likely to be a good one” (O’Reilly, 1982, p. 757).

**Autism:** Autism Spectrum Disorder (ASD) is a group of disorders which are marked by significant qualitative limitations in social interactions, verbal and nonverbal communication, and restricted repetitive and stereotyped patterns of behaviour, interests, and activities (Kogan et al., 2008).

**Uncertainty:** “The difference between information possessed and information required to a complete a task” (Tushman and Nadler 1978 p. 617). An issue that several aspects like task complexity and task environment affect it.

**Information Source horizon:** In the study she proposed that “within a context and situation there is an “information horizon” in which we can act” (Sonnenwald, 1999, p. 8). An information horizon may include a variety of sources from human resources to websites. Shaping information horizons is the consequence of complex judgments concerning information and source quality and accessibility.

**Problem specific information seeking:** To find information about a specific problem individuals perform problem-specific information seeking. On the other hand problem specific information seeking holds the majority of information seeking behaviours in areas like online health information seeking (Fox & Raine, 2002). In definition *problem specific information seeking is an ISB to obtain information needed to solve individual’s problems* (Savolainen, 2007).

**Health information seeking:** Search to receipt information to help for reducing the uncertainty regarding health status and to build a personal and social sense of health (Cotten & Gupta, 2004)

**Perceived use for information:** it is the kind of use information seeker perceived for the information he/she is looking for in a period of his/her seeking behaviour.

This information is to answer the information needs raised from different stages of getting to certainty from uncertainty.