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Authors	Carton, Fergal;Sammon, David;Adam, Frédéric
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Benefit Realisation Through ERP: The Re-Emergence of Data Warehousing

David Sammon, Frederic Adam and Fergal Carton
University College Cork, Ireland
dsammon@afis.ucc.ie
fadam@afis.ucc.ie
fcarton@afis.ucc.ie

Abstract: The need for an integrated enterprise-wide set of management information pronounced Data Warehousing the 'hot topic' of the early-to-mid 1990's, however, it became unfashionable through the mid-to-late 1990s, with the approach of Y2K and with it the widespread implementation of ERP systems. However, in recent times, the re-emergence of Data Warehousing, to address the limitations and unrealised benefits of ERP systems implementation, provides researchers with a new challenge in understanding the '*double learning curve*' for an organisation, undertaking in quick succession both an ERP systems project and a Data Warehousing project, in an attempt to finally achieve the benefits expected but never realised.

Keywords: ERP Systems, Data Warehousing, Benefit Realisation, Post-Implementation

1. Introduction

There is no doubt that the introduction of a new Information System into an organisation should deliver multiple benefits and achieve the desired Return On Investment (ROI), in that it meets a business need or solves a business problem. Therefore, an organisation's ability to identify the need for the introduction of an Information System is extremely critical to ensure success and realised benefits. In relation to ERP systems, benefits have not been realised due to the lack of understanding by managers of what these systems entail (Sammon *et al.*, 2003) both in terms of implementation and use. Therefore, it seems that there is an inherent danger in the way that ERP systems, were and are currently being, adopted by organisations. As ERP systems are being introduced, the specific needs of the organisations and the specific features that make them different may be lost or eroded in a way that is not controlled or understood by managers. In certain cases the enormity of the system leads the business rather than the business leading the system. Brown and Vessey (2003) comment on improving the understanding on how to leverage, what they call, the 'enterprise system maturity curve' in an effort to reduce the high risks and costs of implementing 'the next wave of complex enterprise systems'.

Based on these observations, we propose that organisations need to dictate the ERP systems agenda, now and in the future, to a much greater extent, therefore, strengthening their *needs* discourse and thereby improving their chances of realising all of the benefits expected from integrated enterprise-wide systems. However, while strengthening their *needs* discourse, organisations are now being subjected to successive waves of post-ERP hype. To date, researchers have looked at the ERP market as the place where organisational needs, in terms of integrated enterprise-wide systems, were met by the packages proposed by ERP vendors. However, current research in ERP (e.g. Hossain and Shakir, 2001; Wood and Caldas, 2001 and Sammon and Adam, 2002) has found that the ERP market is characterised by a strong vendor and consultant push whereby organisations appear to have little choice but to *jump on the bandwagon* (as described for Activity-Based Costing by Jones and Dugdale, 2002; and IT outsourcing by Michell and Fitzgerald, 1997; and to some extent for e-commerce development by Howcroft, 2001). The strong vendor push that characterises the ERP movement inherently favours the *sales* discourse (that which is proposed by ERP vendors and ERP consultants) and replaces the *needs* discourse (that of the implementing organisation). According to Westrup and Knight (2000)

> the deployment of ERP systems takes place in a marketplace of ERP vendors generally mediated by ERP consultants. Their aims, though never publicly formulated, are to sell ERP systems and consultancy services respectively (p.641).

This contention can prove increasingly problematic for the implementing organisation, leading to what we term a '*double learning curve*' for organisations, who are now undertaking both ERP and Data Warehousing

initiatives. Furthermore, ERP vendors and ERP consultants are extending their range of products and services to provide these Data Warehousing functionalities (Watson and Schneider, 1999; Inmon, 2000). This further strengthens the *sales* discourse and in effect reduces the implementing organisations chances of successfully implementing either ERP or Data Warehousing. However, for the most part, Data Warehousing is a complete culture shock to the ERP vendors. For instance, Inmon (1999) poses the question "why would any company want to have the same data warehouse as any other company in the same industry?" Data Warehousing is about gaining a competitive advantage and differentiation from the competition. However, "SAP seems to think that data warehouses can be turned out like cookies, which is just one more sign of their applications' 'get the data in' mentality" (Inmon, 1999). This trend further heightens our contention that the implementing organisation needs to be empowered and made aware of the complexities of the ERP market and needs to internally assess, if not their readiness for ERP and Data Warehousing, their ability to manage the external parties (the ERP consultant and the ERP vendor) within the ERP community (Sammon and Adam, 2002).

2.   ERP: Understanding a complex phenomenon

In examining the theoretical underpinning of the ERP concept, it is useful to go back to the first classification of systems and the most referenced framework for the implementation of management information systems, that of Gorry and Scott Morton (1971; 1989). In their seminal 1971 article, they developed a framework that has become the foundation stone for much of the research work in Decision Support Systems (Hamilton *et al*., 1982; Kirs *et al*., 1989). The framework allows an organisation to gain a perspective on the field of Information Systems and focuses on understanding the 'evolution of MIS activities within organisations', and recognises some of the potential problems and benefits resulting from 'new technology'. This framework has been criticised, most notably by Keen (1987) and Alter (1992), but it remains that

> *The Gorry and Scott Morton framework is perhaps the best known, most durable and most frequently cited in the IS field* (Kirs et al., 1989, p. 184)*.*

Gorry and Scott Morton (1971) report on their general observations about the different categories of management activity (strategic planning, management control, operational control) and also highlight differences in the information requirements to support these activities*.*

This suggests the reason why many organisations have found it increasingly difficult to realise some of their long-range plans for information systems. Many of these plans are based on the "total systems approach". Some of the proponents of this approach advocate that systems throughout the organisation be tightly linked, with the output of one becoming the direct input of another, and that the whole structure be built on the detailed data used for controlling operations. In doing so, they are suggesting an approach to systems design that is at best uneconomic and at worst based on a serious misconception. To say that management information systems activity must wait "until we get our operational control systems in hand" is to say that efforts to assist management with systems support will be deferred indefinitely.

On further examining the implications of the framework to system design differences Gorry and Scott Morton (1971) noted that because the information requirements 'differ sharply' among the three areas of managerial activity there are 'few occasions in which it makes sense to connect systems directly across boundaries'. Therefore, as an implication of the decision classification (structured, semi-structured, unstructured) of the framework, Gorry and Scott Morton (1971) state that

> totally-integrated-management-information-systems *ideas so popular in the literature are a poor design concept. More particularly, the* integrated *or* company-wide *database is a misleading 'notion', and even if it could be achieved would be exorbitantly expensive*

However, this old *notion* is in fact a new reality for all organisations experiencing ERP systems implementations. An ERP system is built on an enterprise data model and the ERP systems are expensive. Another old *notion* which is in fact a further new reality is that expressed by Dearden (1972) who stated

> *The notion that a company can and ought to have an expert (or a group of experts) create for it a single, completely integrated supersystem - an MIS - to help it*

> *govern every aspect of its acitivy is absurd*

Overall, despite the strong push towards ERP, there is, in relation to ERP implementations, a lack of understanding of the difficulties that can arise when the business models used by organisations clash with the business models underlying the ERP packages implemented by these organisations. There seems to be a subtle but profound danger that the logic of the software package supplants the organising logic of the organisation as a whole. There is also significant evidence that the disruption to everyday business while ERP systems are implemented are putting unduepressure on organisations, regardless of their size and financial means. For example, Dell Computers, after months of delay and cost over-runs, abandoned their ERP project because they found that the new system was not appropriate for its decentralised management model (Stefanou, 2000).

Thus, Wood and Caldas (2001) have commented that, in practice, the reality of ERP implementation for many organisations implementing this type of software is one in which 'a golden dream has turned into a nightmare'. The important question of course is: where did this 'golden dream' come from? The answer, as we see it when talking to managers in organisations where ERP is being implemented or debated is: business media, software vendors, consulting firms, academics and their collective *discourses*. This highlights the existence of the *sales* discourse, on the push side of the ERP market, which *sells the dream* as opposed to *selling the reality* (Carlton Collins 2000). Facing this overpowering push, we contend that the pull side of the ERP market has not developed, which puts organisations at risk of spending large resources to acquire applications that do not truly serve their *needs*.

3.   The enterprise systems era

For more than a decade, organisations have adopted a number of different approaches to IS integration; from Data Warehousing in the early-to-mid 1990s, striving to achieve informational integration, through to ERP in the mid-to-late 1990s, focusing on operational integration. Although Data Warehousing and ERP represent two alternate approaches to IS integration in organisations, a number of common defining factors exist between these two types of IS project implementation, as illustrated in Table 1. Due to the constant regeneration and redefinition of the Data Warehousing concept, there is yet to evolve an 'inclusive' definition of Data Warehousing. However, proposed definitions identify the goal of Data Warehousing as enabling the provision of better corporate information to support an organisation. As a result, the main objective of a Data Warehousing solution is to turn data into information. Therefore, by design, Data Warehousing is informational, analysis and decision support oriented, rather than oriented towards transaction processing (Babcock, 1995). However, there is also no agreed upon definition for ERP systems, although their characteristics position these systems as integrated, all-encompassing (Markus and Tanis, 2000), complex mega-packages (Gable *et al.*, 1997) designed to support the key functional areas of an organisation. Therefore, by design, an ERP is an operational-level system.

Table 1: Defining Characteristics of Data Warehousing and ERP

Characteristics of IS Approach	ERP (operational)	DW (informational)
Focus/Origin	Operational	Informational
Benefit	Efficiency	Effectiveness
Design	Implement Best Practice	Create Best Practice
Development System	Software Package	Evolving Concept
Data Model	Abstract	Concrete
Characteristics of IS Project Implementation	ERP (operational)	DW (informational)
Project Complexity	High	High
Project Failure Rate	High	High
Clarity and Understanding of Project Initiative by Organisation	Low	Low

Reflecting on the early-to-mid 1990s Data Warehousing can be described as an informational solution to an operational problem in terms of data integration, as illustrated in Figure 1. The emergence of the Data Warehousing concept can be viewed as an evolution of Management Information Systems (Wu and Buchmann, 1997). The limitations of the traditional Management Information Systems (MIS), perceived as being unable to maintain a consistent view of an organisation's reconciled data, was identified as the potential benefit of a Data Warehousing system. To overcome the problems with traditional approaches of accessing large amounts of data in heterogeneous, autonomous distributed systems, the emergence of Data Warehousing introduced

the concept of a 'logically centralised data repository'. Therefore, the concept of Data Warehousing emerged due to the evolution of IS objectives within organisations (emerging from concerns with operational efficiency to considerations of market competitiveness), and

further due to the growing demand within organisations to analyse (internal and external) business information. As a result, Data Warehousing was 'thought to be merely a counterpoint to transaction processing applications' (Inmon, 1999).
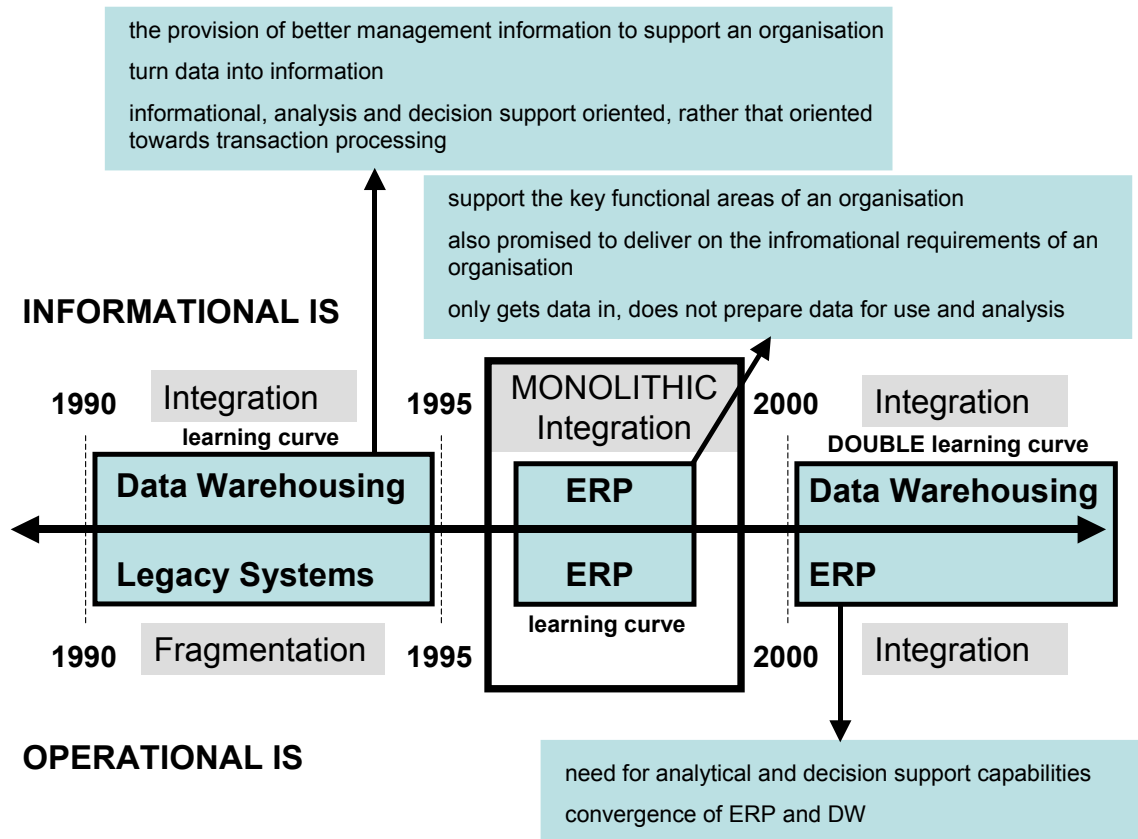
Figure 1: IS Integration Approaches and Learning Curves

However, by the mid-to-late 1990s ERP systems (e.g. JBOPS) provided an alternate operational solution to the operational integration problem, with one of the most significant factors for ERP adoption being Y2K preparation (Brown *et al.*, 2000; Kalakota and Robinson, 2001; Themistocleous et al., 2001; Hayler, 2003). Furthermore, ERP systems also promised to deliver on the informational requirements of an organisation, such is its scope, therefore, the perceived need and along with it, the rate of Data Warehousing project implementations, was reduced. Due to the fact that an ERP systems implementation replaced many of the legacy systems throughout the organisation, it can be perceived as the 'base line application', containing integrated application data, generated as a 'by-product of transaction processing', or as an 'ODS' (Operational Data Store), a 'hybrid structure' that contains some aspects of a data warehouse and other aspects of a transaction processing environment (Inmon, 1999). As further

illustrated in Figure 1, and referencing the insights of Wood and Caldas (2001), ERP can be described as:

> *… a comprehensive information technology package built on the promise that all critical information should be totally integrated in one single information database (p.387)*

Unfortunately, as organisations moved toward the post-implementation phase of ERP project implementations, post Y2K for the vast majority of organisations, the real issue of benefit realisation emerged and with it came the re-emergence of the need for Data Warehousing, as illustrated in Figure 1. Due to the monolithic style integration of the mid-to-late 1990s, many organisations are now discovering that the solution to leveraging investment decisions in, and retrieving useful data from, an ERP system is to undertake a Data Warehousing initiative in conjunction with the implemented

ERP system (Sims, 2001; Raden, 1999; Inmon, 2000; Radding, 2000; Riggle, 2000; Hewlett-Packard, 2002; Hayler, 2003; Sammon *et al*., 2003). The harsh reality of ERP systems implementation, to the expense of those organisations that invested resources in the initiative, is that ERP only gets data into the system, it does not prepare data for use and analysis (Inmon, 2000). ERP systems provide mission-critical operational workflow but do not support decision support systems (DSS) directly, therefore, the need to source a data warehouse from the ERP system is obvious (Riggle, 2000). This is due to the fact that ERP systems lack certain functionality and reporting capabilities (Adam and Doyle, 2001). However, it bears thinking that as long as organisations can analyse data, supporting different business processes, even across differing data structures that change with the diversity of systems, there is no need to force a rigid standardisation of business processes (a straightjacket) across the organisation (Hayler, 2003). For example, organisations that expected ERP systems to solve their Information Systems problems have found that ERP systems solved some, but hardly all, of these problems. Many organisations experience frustration when they attempt to use their ERP system to access information and knowledge (Radding 2000). It has been quickly realised that ERP systems are good for storing, accessing and executing data used in daily transactions, but it is not good at providing the information needed for long term planning and decision making (Radding, 2000; Adam and Doyle, 2001) as ERP systems are not designed to know how the data is to be used once it is gathered (Inmon, 1999). Consequently, in the post-implementation phase organisations are often dismayed to find that they haven't improved their analytical and decision support capabilities (Raden, 1999; Inmon, 1999; 2000; Radding, 2000) as ERP systems do not provide an environment for decision support activities such as analysing historical trends, drawing conclusions, scenario building and planning (Raden, 1999).

To our way of thinking this creates a '*double learning curve*' for an organisation, undertaking in quick succession both an ERP project and a DW project, in an attempt to finally achieve the benefits expected but never realised. This has been referred to as a 'dilemma' by Inmon (1999). As a result, the significance of generating a benefits classification for both ERP and Data Warehousing maybe greater than previously considered in our approach to research in this area. Therefore, the focus and

goal of this research paper is in highlighting the need for a benefits classification to understand the impact of unrealised benefits (from ERP projects) and the re-emergence of Data Warehousing type developments to address the issue of realisation of these benefits.

4.   Benefit realisation through ERP

It is argued that an ERP system, one that is properly implemented, can achieve unprecedented benefits for business computing (Watson and Schneider 1999). However, some companies have difficulty identifying any measurable benefits or business process improvements (James and Wolf 2000; Donovan 2001). It is further reported that a large number of ERP implementations fail to meet expectations (Stefanou 2000) as many adopters have not yet realised the benefits they had anticipated. Therefore, are ERP systems living up to their expectations? For example, Pallatto (2002) comments on the fact that some vendors and consultants are presently 'soft-peddling' the term ERP due to bad experiences and management frustration, when original business goals and benefits were not achieved, with their ERP implementations. In a recent product brochure titled 'Optimise your ERP Investment' by Cap Gemini Ernst & Young (CGEY), CGEY reveal that "most companies have high expectations of their ERP implementations but some of these fail to deliver on all the benefits that were promised. In fact, these ERP implementations experience high dissatisfaction levels, which is evidenced by many operational glitches and limitations". Furthermore, they state that "in effect, the ERP implementation gives you sight of business potential – but may not deliver much of the expected value". Pallatto (2002) adds that concessions and compromises in the design of these rushed Y2K upgrade projects (ERP) had negative impacts on systems performance and benefits which were not promptly and fully communicated to the implementing organisation. While Hendrickson (2002) supports this argument, stating that "organisations that have future designs developed from a clear understanding of [business] requirements will gain more vision and value from their ERP implementation".

A study conducted by Sammon and Lawlor (2004) reiterates this argument, highlighting that a failure to carry out an analysis of the mandatory and desirable features required in a system with an open mind will lead to the blind acceptance of the models underlying the ERP

packages currently on sale on the market, with detrimental effects on the organisation and its operations. Furthermore, Sammon and Lawlor (2004) comment on the short-term and long-term benefits realised in the case studied. The underlying rationale of the organisation in selecting the ERP system was that of *global single instance*, however, only short-term benefits (on a site-by-site basis) had been realised when the research was undertaken. "Even though the initial implementation of SAP began in 1998, the organisation will not know if the benefits of having global integration and a SAP global single instance will materialise, until 2002" (Sammon and Lawlor 2004). However, business circumstances may change over such an extended period of time, causing some of the possible benefits not to be realised, a problem existing with all ERP systems, offering a single instance (Sammon and Lawlor 2004). Therefore, one needs to question if the rationale and justification for implementing an ERP system will ever in fact realise the desired benefits.

Rutherford (2001) observed that only around 10% to 15% of ERP implementations deliver the anticipated benefits. According to James and Wolf (2000) companies that *were* able to identify benefits, thought they could have been realised without the implemented ERP system. "80 percent of the benefit that we get from our ERP system comes from changes, such as inventory optimisation, which we could have achieved without making the IT investment" (James and Wolf 2000). However, in addition, according to James and Wolf (2000), reporting on an instance of an ERP implementation, "many of the benefits that we are able to achieve today could not have been predicted at the time that we started work on ERP. In fact, in hindsight it appears that much of the value of these large systems lay in the infrastructure foundation they created for future growth based on Information Technology".

5. Towards a benefits classification

Bonerjee (2001) pose a question regarding the reality of how many organisations actually 'reaped the benefits' of an ERP implementation, concluding that 'the answer is far less than most might think'. Furthermore, Shang and Seddon (2003) pose the question that if organisations around the world spent US$100bn. or more on ERP in 1999 "*what sort of benefits did they* [the organisation]*, or can they, achieve?"* In answering this question, they present a comprehensive framework of business benefits that organisations might be able to achieve from their use of ERP systems. They present 25 ERP benefits consolidated across five benefit dimensions (Operational, Managerial, Strategic, IT Infrastructure, Organisational). Shang and Seddon (2003) analysed the features of ERP systems, literature on IT benefits, web-based data on 233 ERP-vendor success stories, and interviews with 34 ERP cases to provide a comprehensive foundation for planning, justifying and managing the ERP system. They focus on the benefits of an ERP system in use and comment that there are few details of ERP-specific benefits in academic literature and further noted that 'trade-press articles' and 'vendor-published success stories' were the major sources of data. However, Shang and Seddon (2003) point out that, "cases provided by vendors may exaggerate product strength and business benefits, and omit shortcomings of the products" (p.1007). Furthermore, Adam and Sammon (2004) examine a number of related issues, in their examination of the 'ERP Community' and the *sales* and *needs* discourse that exists to define it. This discourse is also identified by Bonerjee (2001) who comments that the ERP market is all about 'marketing' and all about 'hype'.

As a result, in proposing our benefits classification for this research study we use the five categories of the Shang and Seddon (2003) framework. An ERP system and Data Warehousing clearly has a multitude of different benefits, however, we provide an explanation for the ERP benefit categories in our proposed classification, as illustrated in Table 2. When we examine the short explanation for each of the ERP benefits we can question if ERP systems actually deliver on these benefit categories. Although every organisation implements an ERP system or Data Warehousing for its own unique requirement, there are numerous similarities across the rationales and benefits within organisations. However, the degree of realisation of these benefits can vary dramatically. According the Shang and Seddon (2003) it is not expected that every ERP system will produce all the benefits in each of the 5 categories. Therefore, the adoption rationale and post-implementation realised benefits associated with the deployment approaches need to be analysed and presented in a format which facilitates the foundation of a framework for understanding why organisations embark upon their ERP and Data Warehousing implementation.

Table 2: Developing a Benefits Classification

ERP Benefit Dimension	Explanation
Operational	Since ERP systems automate business processes and enable process changes, one would expect ERP systems to offer all of this type of benefit
Managerial	With centralised database and built-in data analysis capabilities it seems likely that ERP systems will provide informational benefits to management
Strategic	ERP systems, with their large scale of business involvement and internal/external integration capabilities, could assist in achieving these strategic benefits
IT Infrastructure	ERP systems with their integrated and standard application architecture provide an infrastructure that could support this dimension
Organisational	The integrated information processing capabilities of ERP systems could affect the establishment of the organisational capabilities

The justification for adopting ERP centres around the benefits that can be realised, however, Donovan (1998) believes that to receive benefit from implementing ERP there must be no misunderstanding of what it is about, or underestimation of what is involved in implementing it effectively, and even more important, organisational decision makers must have the background and temperament for this type of decision making (Donovan 2001). All too often the argument emerges that the costs of ERP implementation are meagre when compared to the potential benefits offered by a successfully implemented system. However, the majority of ERP implementations are not entirely successful as organisations experience varying degrees of success for a variety of reasons. Therefore, there is an obvious need to structure the potential benefits that organisations might expect to gain from the implementation and use of ERP systems. At this point it is worth re-emphasising that, for the most part, organisations only realise operational and IT infrastructure benefits from ERP systems (Shang and Seddon, 2003) whereas Data Warehousing facilitates the realisation of informational benefits, which could be understood as managerial, strategic and organisational from the Shang and Seddon (2003) framework. These informational benefits emerge from the successful use of integrated organisational information. If we consider that ERP is about data consistency, while Data Warehousing is about data accessibility, we can understand these benefits. Data Warehousing is concerned with providing an optimised environment for data manipulation and reporting, therefore, providing an integrated set of management information. Furthermore, Data Warehousing is an enabler of business strategies and strategic decision making based on turning data into information, therefore, not only understanding but influencing customer behaviour, and competitive position of the organisation.

6. Concluding Remarks

Based on our initial observations, it appears that further investment of resources is required for an organisation to realise the initial benefits promised from their ERP system investments. However, the worrying issue here seems to be ERP vendors and ERP consultants admittance of not addressing critical implementation issues, or fulfilling the organisational requirements, in the previous ERP implementations. Some of our early observations in studying the emergence of DW in the ERP post-implementation phase have proved worrying. From a synthesis of existing literature on ERP project implementation, one noticeable area of omission is that of the focus on data specific critical success factors, highlighting the lack of focus being placed on the importance of data for the implementation of an ERP project. In no small part, this is one of the main reasons in many organisations to legitimise undertaking a Data Warehousing project. However, in the case of Data Warehousing, data related issues would be considered one of the most important and critical areas of research focus (Sammon and Adam, 2000). With ERP, unlike Data Warehousing, an in-depth knowledge of the organisational data is not perceived as being important, due to the fact that [a] the positioning of an ERP system requires an understanding and examination of an organisations business processes, and [b] the organisation adopts the business model and data model of the ERP package and therefore, does not have to invest in the establishment of a sound enterprise-wide data model. For example, ERP offers enterprise-wide data consistency, however, ERP systems make the task of creating accessible data much more difficult "because of their overall complexity and the higher level of abstraction in their data models" (Riggle, 2000). Inmon (1999) reiterates the importance of this point stating

that a clear definition of the required data models needs to exist for the 'base line applications', and/or 'ODS', (an ERP can be perceived as both), and therefore, a major concern when introducing an ERP into an organisation is whether a distinction has been made, between 'base line applications' and 'ODS', by the vendor.

There is no doubt in the researchers minds that initially, when organisations commenced the implementation of ERP systems they did not expect to have to invest in future Data Warehousing solutions to leverage their ERP investments. As a result of this, the early lessons learned by organisations, in relation to Data Warehousing, should not be dismissed. This new era of enterprise-wide systems integration projects introduces an increased level of complexity to an already complicated organisational initiative. In the past, in relation to ERP systems, organisations have been too accepting of the promises of the *sales* discourse. Nowadays, in the enterprise systems market, managers, for the most part, want "assurances that the system will deliver the performance and business benefits that were promised when they agreed to sign on the dotted line". That is because they know from bitter experience that "keeping such promises is easier said that done" (Pallatto, 2002). Therefore, an implementing organisation needs to be empowered and made aware of the increasing complexities of the ERP market and strengthen their *needs* discourse in relation to enterprise-wide systems project requirements, in an effort to realise the benefits of implementation.

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