AN AUTOETHNOGRAPHY OF TRUSTED DATA GOVERNANCE WITH A FOCUS ON FOOD DATA

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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 the 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.

ABSTRACT

Trusted data is today as topical as it is elusive. Data governance is, or should be the guide to trusted data. However, as the world of data grows at an unprecedented rate, the clarity on its accuracy, appropriateness and authority remains a constant challenge for most users. Research suggests that just 3% of firms have confidence that their data meets basic quality standards. Some frameworks exist for data governance but this study expands beyond the boundaries of those models to include the data community, the data governance processes and the evolving technology governance. It then presents a novel and comprehensive framework for trusted data governance emerging from a food sector research case.

Irish produced food, mainly dairy products, beef and lamb and its related consumer products, is amongst the premium food brands in the world and is growing every year to meet the demands of a global population which continues to grow and demand safe and quality food. Ours was a sunset industry from the darkest days of the famine era in the 19th century when our farmers could not produce what our population needed to survive, to a supplier to Europe at war in the early 20th century and primitive production and food chain systems in post independent Ireland from the 1920's to the 1970's when Ireland joined the European Union. Now Ireland produces over twelve times what our population needs. The industry is worth over €25 billion annually to the economy, we export €11 billion and the industry employs 230,000 people on the approximately 140,000 farms and the related service industries around it. The average farm size is just 32.5 hectares but it is now a modern food eco-system with some of the

leading practices in the world and a leader in sustainable grass based production systems providing high quality, sustainable and tasty produce. At the heart of this great growth story is a well-run and managed industry that depends on data to promote and protect the industry. I ran the company, SWS that helped to build many of these data systems over the last twenty years.

This thesis presents an autoethnography of my experience in SWS focusing on how these trusted data systems evolved over the twenty-year period. The research method is underpinned by a strong methods paper in Chapter 2. Chapters 3, 4 and 5 take us through a people, process and technology perspective on the evolution of these systems as Chapter 3 examines the community governance, Chapter 4 researches the data governance and Chapter 5 studies the technology evolution over the programme. Each of these chapters presents a number of significant research contributions. To conclude, Chapter 6 brings the research together and proposes a "New Framework for Trusted Data Governance".

1. CHAPTER 1 - INTRODUCTION

1.1. Introduction to this study

I started my research study, a study of the governance for trusted data systems, in 2015. My research methodology is autoethnography as I research how the food traceability systems were built in Ireland from 1995 to 2015. This study of the data systems evolution provides new contributions to the development of food systems and to the development of data governance in general. This is a thesis by publication and is structured as this introduction chapter, a collection of four completed research papers, and a discussion and conclusion chapter. In this chapter, I will provide an overview of the research objective and approach, information about myself - the autoethnographer and a practitioner in the field, a full discussion on the methodology and why it was chosen, a summary of each of the four completed research papers and an insight into the key conclusions from my study. In the final part of the chapter, I will detail the trusted data case scene, a national food traceability programme, which this autoethnography is based on.

1.2. Research overview and the main contributions

An overview of the research is shown in Figure 1-1:

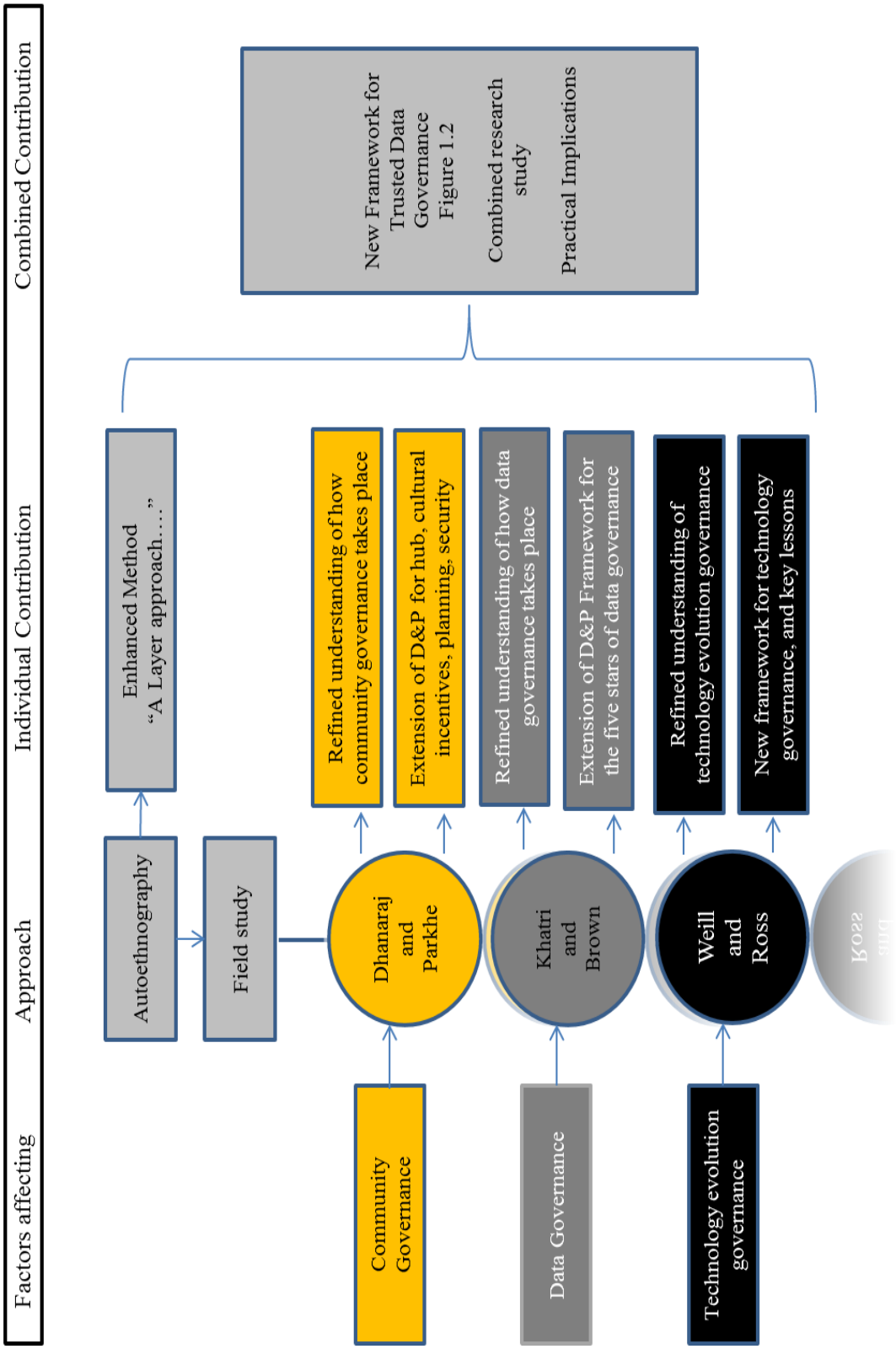

Figure 1-1 Overview of the research

As shown in Figure 1-1, the research starts with an examination of the data in a field study from a perspective of factors affecting the domains of community governance, data governance and technology evolution governance. The data is provided by the author who was the CEO of the company around which the case study is centred, and who therefore brings unique insight, original data and access to the full community network involved in the case. Each paper examines those domains using my layer framework approach to autoethnography which builds upon existing analytic and introspective styles of autoethnography. This robust "layer" framework and how it is developed from those existing styles, is described in Chapter 2. Each paper makes new contributions to theory in each domain area as follows:

1) The method paper in Chapter 2 tells the story of doing autoethnography from a practitioner's perspective and gives insight to the challenges and opportunities that the method presents. A more general background on autoethnography is included in this chapter (Chapter 1) also. The paper is now published as a chapter in a book by Nova Publishing on autoethnography. (Costello et al 2018)
2) In my "Community Governance" research paper in Chapter 3, I present new data on the experience of community governance in a national trusted data programme over a twenty-year period. I examine it through the analytic lens of innovation networks (see Dhanaraj and Parkhe 2006) as well as other reflective and triangulated layers of analysis. This analysis presents new contributions in the areas of community behaviours, actions, culture and leadership that extend our understanding of community governance.

3) In Chapter 4, our completed research paper on “Data Governance” provides new data through this unique insight into the data governance process in this large national case study. The new contributions of the “5 Stars of Data Governance” offer new perspectives on effective governance for trusted data.
4) The evolution of technology over the twenty-year period of the case is presented in Chapter 5, and this paper offers new insight into how a major data system must evolve to keep pace with changing data needs. It offers new contributions in the area of technology evolution design and a proposed decision matrix for technology evolution is presented.

1.2.1. Completed research paper summaries

A summary of each of these research papers is shown in Table 1-1:

Chapter/ Domain	Paper Title	Peer review	Analysis Method	Key Data	Key contribution
2. Method	A Layer Framework for a Precise, Consistent and Contributive Autoethnography	Syrjälä Henna & Norrgrann, Anu (Eds.). (2018, forthcoming) Nova Publishing book.	Autoethnography of autoethnography triangulated to literature review	Story of a practitioner writing research, the review process, challenges and benefits	New model for delivery of autoethnography for practitioners
3. Community Governance	On the road to trusted data: an autoethnography of community governance and decision-making	IFIP conference 2016 Journal of Decision systems 2016	Autoethnography and analysis through the lens of Dhanaraj and Parkhe (2006)	Insight into the collaboration within the data community to deliver and use data	Industry and cultural knowledge and skills Cultural behaviours Leadership in hub role
4. Data Governance	Building Trusted Data in Food Traceability Systems: An Autoethnography of Data Governance	In review with Journal of decision systems since May 2017	Autoethnography with vignettes, other case data through the lens of Khatri and Brown 2010	1st hand account of Data Governance in action with working examples in defining, implementing and monitoring data	Five stars of Data Governance process including strategy, Roles, Standards, Technology and actionable output
5. Technology Evolution Governanc	How IT Governance evolved in a National Food Traceability System: An Autoethnography of Technology Governance	In 2nd stage review with MIS Quarterly Executive (11/17)	Autoethnography with use of other data including interviews through the lens of Weill and Ross' (2005) technology governance framework	Detail account of the evolution of data systems over 20 year programme as data needs grew and changed	Four mantras of data technology evolution and a new decision matrix for technology evolution decision making

Table 1-1 Research papers summary, detail in chapters 2, 3, 4 & 5

Finally, Chapter 6 combines the analysis from each of the papers in Chapters, 3, 4 and 5 and presents a new analysis supported by further autoethnographic vignettes. Two new contributions emerge in Chapter 6, including an understanding of "The Road to Trusted Data", however, the main contribution from this research is a "New Framework for Trusted Data Governance", as shown in Figure 1-2 below.

Figure 1-2 The New Framework for Trusted Data Governance

1.3. My Story- Autoethnographer

The research methodology is autoethnography and I am the autoethnographer. In my life I have been at farmer, a carpenter, an accountant, a CEO, a father and a scholar. My life story is shown on a page in Figure 1-3 below. This is my life story in text:

- **Farmer**

I was born in 1962 and raised on a farm in Kilkenny, Ireland. I am the twelfth of thirteen children. It was a mixed farm, with crops, beef, dairy, sheep, pigs, chickens, horses, vegetables and, indeed, just about everything else. My mother's weekly shopping was very much different than that of todays. Almost all the food came from the farm, with just condiments and treats occasionally bought in the local shops. We also had some workmen on the farm and there were often traders who came to the farm, to buy or trade livestock, machinery or services. Everyone who visited the farm either got a cup of tea, or a good dinner, because they would have travelled a distance. So there were often twenty or so people, including family, in the house to be fed. That was never a problem and the work to do this was always seen as part of the daily chore and routine of farming in Ireland in those times. Of course as time went on, (and because I was the twelfth child), there was not much chance of me staying on the farm as a career. I had to go and get educated, or so I was told! As I did that, I remained involved on the farm, helping my mother when Dad died, feeding calves, riding out the horses, milking cows, herding or whatever had to be done. I finished school in 1981 and studied accountancy in the local technical college. During college summer months, I

would sometimes visit my brother in Texas; and I would work there using the handy skills developed on the farm doing labouring or light carpentry work. A farm taught you a lot of things!

- **Carpenter**

After three years of learning how to be an accountant, I ran away with my girlfriend to New York for a while. I was a wild one, my mother would say. I got some carpentry work in non-union jobs and got to know the New York construction scene of the 1980s. It was a tough business. I even started my own business, when I set up a company to renovate houses in Brooklyn. But the owner of one of the houses was betrayed by another tradesperson who, unfortunately, had recommended me. As a result the owner refused to pay my bill for a large, fixed price job - and I went bankrupt! I was broke. Then I got a job in the Local 608 New York Carpenters Union. The union supported the re-election of Mayor Ed Koch for Mayor of New York and we had to campaign for him. It was a wild time and I enjoyed it. However, my fair lady left me and, after I recovered and made a few bucks again, I decided to return to my studies.

- **Accountant**

I was already part-qualified with the Chartered Institute of Management Accountants but I needed to do my final exams while working. I worked in industry and soon qualified in all my exams which led to becoming a Chartered Management Accountant. Soon after - in 1987 - I was lucky to join Unisys Corporation, a Global IT data centre company and still one of the major providers of data centre and cloud technology around the world. I worked for this company in London in their UK subsidiary and later in the European Headquarters. In

1994, I became Finance Director for Europe for their computer services and outsourcing division. Then in 1998 I left the world of finance, and became Managing Director of the outsourcing business for Unisys in Paris, France.

- **CEO**

In 1999 I moved with Unisys to the global headquarters in Philadelphia, where I was Managing Director of the Unisys/Dell global partnership for managed I.T. services. This was a $40m joint venture (JV) company between Dell and Unisys. I ran this JV through the use of business insight using data analytics of supply chain from the Unisys and Dell systems.

The JV was responsible for servicing Dell data centres and end-user computers all over the world. As many of these data centres operated large businesses such as, airlines, banks, government operations and other critical activities, service standards and requirements were critical. These organisations had to trust their systems and the service provider that supported them. We built trust with these clients all over the world and over the following three years, I grew the JV to almost $150m in annual sales. I made ground-breaking contracts through the building of trusted partnerships including one of the largest of these kinds of deals ever signed with Boeing Corporation. It was an exciting model, but it was dependent on 100% accuracy of data and trust with clients, contractors and staff to achieve service levels. At this time, I had been working for Unisys for fifteen years, with assignments either in finance or general management while living in the UK, Holland, France and the United States. I was, by now, an experienced executive from the Information Systems sector.

Around this time, I joined SWS. The CEO of SWS at that time was a man called Mr Kieran Calnan. I had heard about the work he had done developing SWS (later called SouthWestern) and the relatively recent data services contracts he had won with the Department of Agriculture and another similar one with the Department of Transport. I wrote to him and complimented him on his work and I told him of my experience in the Information Systems sector globally. He interviewed me and I told him my story. I am sure he did good background checks through the national co-op movement and the agriculture community network in Ireland, through the GAA and other trusted circles. It all checked out and I got the job - at a low pay to start with but an entrepreneurial way of participating in shares and growing the company.

The company went on to achieve great success; one of its divisions built the largest windfarm portfolio in the country and it was sold to an Irish national utility provider. I developed and ran the Data Services business, or as it was to become over time, and we became a leading Business Process Outsourcing company in Ireland and the UK. At the early stages - in 2002/2003 - we had a staff of around 30 people in the company. As CEO, I built this into an international organisation of over 1,000 employees delivering services, in Ireland, the UK and also with global contracts. I also developed my education while doing this, completing a Masters in Science with Ulster University as well as completing a one-year executive programme with Stanford University in California. The company became a great success story and our case study was published at the World Economic Forum in Davos in 2014, as one of the examples of how rural regional organisations can grow and create jobs. We were “Cork Company of the Year” on two occasions and won many accolades in the industry. In 2014, we were bought

by the leading global outsourcing company, Capita Plc, and we are now integrated into Capita.

- **Husband and Father**

While I lived in London and worked for Unisys I met my wife Judy. Judy was a nurse and originally from Cork, Ireland. We had children in some of the countries we lived in. Oliver was born in France, Vicky in England and James in the United States in 2001. We were grateful for our work and our family - and lived a happy life. When we returned to Ireland it was a happy time for us and our family grew up close to Judy's family in Cork. But in 2014, we had a terrible family tragedy when Judy died very suddenly from sudden death syndrome, a loosely defined name for a sudden heart failure with uncertain causes. The tragedy propelled my family into great sadness and, of course, the loss of a mother and carer for the family was devastating. It was also around this time that we sold SWS and, as its CEO, I was obviously very engaged in this sales process. I became Managing Director under the new owners. But this life was now unsustainable, as my children were still young and were in distress from our grief. I resigned my role to dedicate my time to my kids for a few years anyway. One of the more difficult challenges during this time for us was to understand sudden death syndrome, the cause of Judy's death. The data on it was poor from either the internet or any of the available medical resources. Doctors were unsure and the advice given to my kids and me was varying, sometimes scary and completely non-trustworthy. It was a big worry to me.

- **Scholar and teacher**

The new owners of SWS offered me some consulting work as a Chairman and this allowed me to provide those services from my home. I knew that after years of being a practitioner, I could not immediately stop engagement with the business networks and so my continued role even as a non-executive would help. A PhD was considered and I wanted to study trusted data because of the poor information on sudden death syndrome. I spoke to a professor at my University and then enrolled in this PhD course. After a while I also took up some tutor work where I was able to share my business experiences with Business Information Systems post-graduate students. I am now also a scholar - and a teacher it seems. Though struck by tragedy, I have wonderful memories of good times too, with a great family. I am grateful for this experience to complete this research, make meaningful contributions and grow from here.

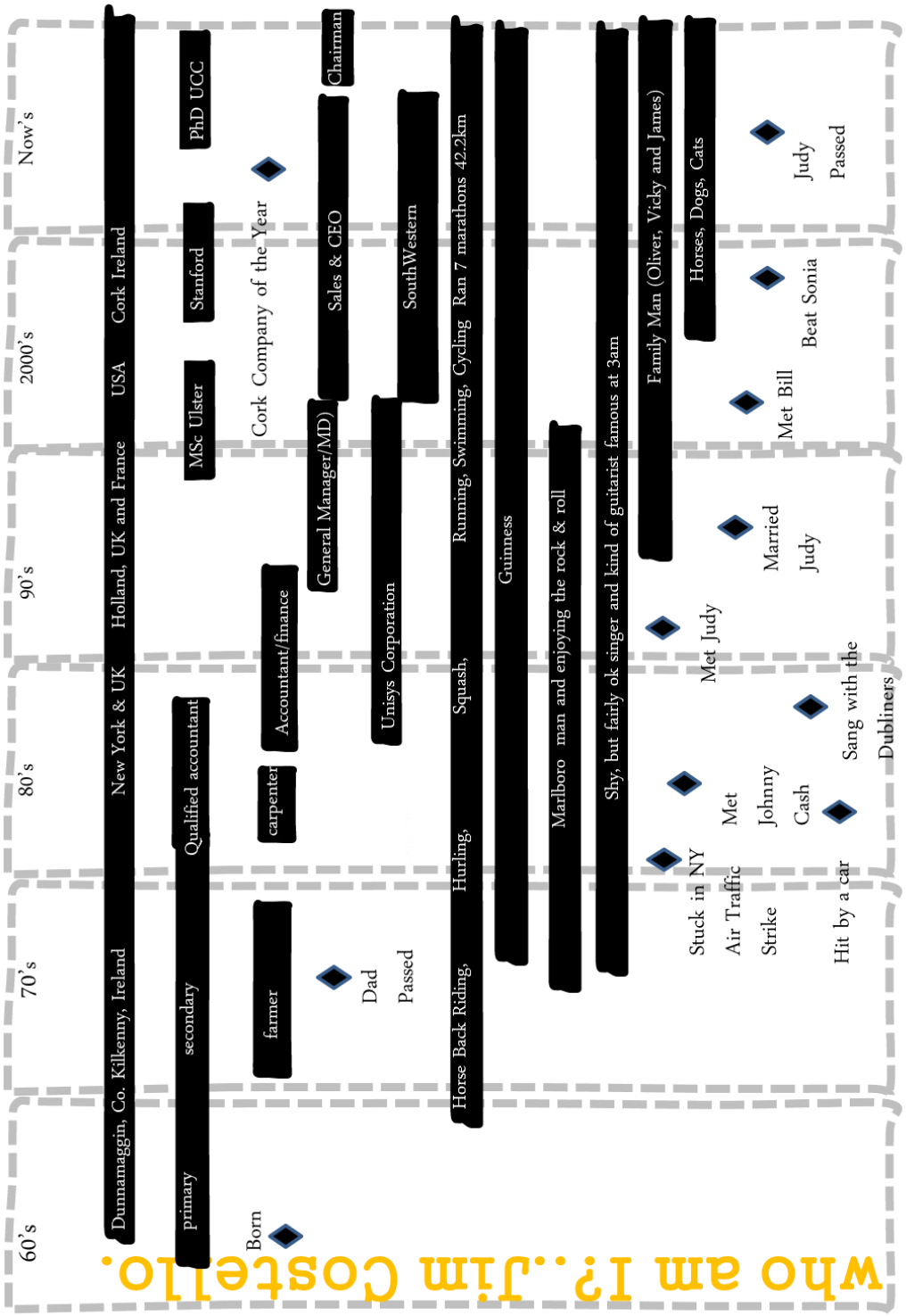

Figure 1-3 My life so far.....

1.4. The research proposal background

Finding a way to trust data more was the main driver for me when starting this research PhD. I was chief executive and now chairman of a large data processing company in the south of Ireland and I came to my University with this research proposal already in my mind. My research topic was motivated by the experience I had with health data after my wife died in 2014. The cause of death was Sudden Adult Death Syndrome (SADS) but the information on SADS was conflicting and contradictory, among doctors and on online sources. My family were obviously destabilised with grief and then, furthermore, with the confusing information. I believed that we could have got better and more accurate information if a strong data governance framework was applied to this data, and so I proposed my research around developing such a data governance framework. The methodology I would use in the research was that of combining my own experience with published literature on the subject of data governance.

I thought of the trusted data experiences I had in my life working as a financial accountant and an executive in business, often building and relying on trusted data. I thought of the food traceability systems that I had built and evolved in my company and decided that this would be a superb model to research on how it achieves trusted status nationally and internationally.

1.4.1. Defining my research objectives and research questions

My research objective was *to develop a new framework for the governance of trusted data that could be used to help the evolution of data systems*.

1.4.2. What is trusted data governance and why do we need it?

Thinking about data strategically is a problem for many organisations, so much so that Gartner predicts that, by 2017, 33% of Fortune 100 organisations "will experience an information crisis due to their inability to effectively value, govern, and trust their enterprise information". Therefore, in this Big Data era, defining a data strategy is a key requirement and this data strategy should see the alignment of "people-process-technology" (c.f. Abbasi, Sarker and Chiang, 2016 p.1) with the capability to "organise, govern and share data to achieve business ends" (Information Builder, 2014 p.1).

By "trusted", I am referring to the characteristics of quality, accuracy, context-appropriate, safe and usable data that I had seen multiple corporations and governments avail of throughout my career. Trusted data is most often discussed in academic literature in the context of data security whether that be cloud or other data security issues (Boebert et al 1994, Zhao et al 2010, Hwang 2010). However, trusted data in the context of this research thesis deals with the credibility of data through governance as set out in Redman (2013) amongst others (c.f. Malka et al 2009, Wang et al 1996).

A review of data governance literature shows that there is a lack of research that explicitly studies activities for governing data. (c.f. Alhassan, Sammon and Daly 2016). Because of this, I will add to this body of knowledge throughout this research. Data governance includes the decision rights and policy making for data, while data management is the tactical execution of those policies. (Dyche and Nevala 2017, Khatri and Brown 2010). There is massive growth in data under management in organisations and business sectors such that, between now and

2025, some industries retained data is doubling every year (Tallon et al 2013). IBM research suggests that the big data market is worth a whopping $136 billion worldwide in 2016 (Redman 2016). While research further suggests that poor data costs US companies $3 Trillion per year! (Redman 2016). Other studies show that workers in large corporations waste up to 50% of their time hunting for data, identifying and correcting errors and seeking confirmation for sources they do not trust (Redman 2013). It is clear that this problem has developed over time, older studies on data accuracy estimated that more than 60 % of medium-size firms have problems with data quality and that the quality issue goes beyond accuracy to include aspects such as completeness and accessibility (Wang and Strong 1996) . In addition, problems exist with defining exactly what data management in organisations needs and so they (organisations) are often overwhelmed with data they cannot use and therefore cannot trust (Rockart 1979). Problems of trust in national data are also well documented, for example, when comparing the scientists' view of the risks of global warming versus the public perception of the same problem (Malka et al 2009). Whereas this study on global warming was in 2007, it is clear because of the United States' withdrawal from the United Nations Framework Convention on Climate Change (UNFCCC) in June 2017, that the same challenges exist with the trust in climate data today. Despite the many proposals of frameworks and models for data governance, (Tallon et al 2013, Dyche et al 2015, Information Builders 2011, Khatri and Brown 2010) the challenge of good data governance persists with most recent studies showing that just 3% of company data meets basic quality standards (Nagle et al 2017).

1.4.3. Food and trusted data

In 1985 a United Nations General Assembly resolution published "guidelines for consumer protection" that identify food as one of the three priority areas of concern to human health. Since then, and because of the outbreak of diseases including Bovine Spongiform Encephalopathy (BSE) and Foot and Mouth disease, the EU legislated for a full traceability data system for bovine products. All countries in the EU have implemented traceability systems though the format for implementation is different depending on the production systems in each country (Regattieri et al 2007). As a result, food traceability regulation in Europe is more advanced than all other regions in the world (Charlebois et al 2014).

Food traceability is defined in European Union legislation (EU directive 198/2002) as "the ability to trace and follow a food, feed or food producing animal or ingredients, through all stages of production and distribution". While agreeing with this definition, the reasons for traceability vary and include regulation, food safety, ability to trace-back and disease control (c.f. Opara 2003, Regattieri et al 2007) while some include economic reasons (reduced costs or legal claims) (c.f.Sparling and Sterling 2004) and food quality (c.f. Regattieri et al 2007).

While food traceability can be done via paper, (c.f. Moe 1998), the complexity of product and activities requires scalable technology to effectively run food traceability. Much of the literature on food traceability address the importance of systems in being able to deliver the trusted data necessary to trace the supply chain. These include software needs such as central databases, integration to all systems in the supply chain, sensor and RFID technology, data capture, tagging

and barcoding, data security and storage needs, etc. (Opara 2003, Regattieri et al 2007, Adams et al 2016, Charlebois, 2014, Sparling and Sterling 2004). It is a complex area with many variables and big data needs.

Studies in the United States (Loureiro and Umberger 2007) and in Europe (Giraud and Halawany 2006) show us the importance of data to the consumers' trust in our food.

There are many different systems of traceability including wholechain and fragmented supply chain systems (Adam et al 2016). A good model of food traceability is provided by Moe (1998) who simply divides the core entities of traceability into type of product and life cycle activity. However, all systems can be tested by the value of their markets and Ireland's success in exporting our produce - and its outstanding reputation - is strong evidence of its trusted value.

1.4.4. Data Governance

It is argued that a lack of trust in data can lead to a wasting of up to 50% of knowledge workers' time "hunting for data" (Redman, 2013 p.4). Whereas when "data is trusted, it gets shared" which can drive higher return on data investments (Information Builders, 2014 p.8). So the question exists, how do we ensure we are building trusted data? Redman (2013, p.4) argues that those creating the data need to know how others will use the data and this is "one of the easiest and most effective ways of improving quality". Furthermore, Khatri and Brown (2010 p.150) argue that "data quality decisions are pivotal in the effective governance of data assets". They also continue that governance is a 'key element' in 'enhancing corporate confidence' in data. Therefore, we contend that building trusted data comes from good data governance.

While data assets can play a critical role in business operations (Tallon, Ramirez and Short, 2013) both in the effective running of the business and access to its markets, data governance is still a developing area within both research and indeed practice(Weber et al 2009, Wende and Otto 2007, Khatri and Brown 2010, Otto 2011, Alhassan et al 2016).. Currently there are a small number of academic papers researching data governance activities and the majority of those (2/3 approx.) focus on 'defining' the governance model as opposed to 'implementing' and 'monitoring' data governance (Alhassan, Sammon and Daly 2016). So perhaps the know-how around implementing and monitoring effective data governance is still only maturing. As a result, the focus of this paper lends itself to adding to the body of knowledge around defining, implementing and monitoring data governance. My research case in this thesis, as a trusted data governance research case, is the Irish food traceability system and its related data governance evolution from 1995 to 2015. The need for trust in food origin data is obvious because of its direct consequences for the health of its consumers. The systems in this research provide the data for the consumption of safely produced Irish food that is exported to 175 countries worldwide and is one of Ireland's largest industries.

1.5. Methodology

The methodology used in this research is autoethnography which uses my own experience and story as a main source of data for the research. My "layer framework" for autoethnography as described in chapter 2, builds upon exiting analytic and introspective styles of autoethnography, optimising the advantages and offsetting the challenges of these styles. Autoethnography is a well-established method in literature and this section will describe its definitions,

strengths and challenges, its evolution in styles and comparison to other methodologies, as well as the strong fit of this methodology to my own research.

1.5.1. Definition and uses of the methodology in literature

"Autoethnography is a qualitative methodology for research and writing that seeks to describe and systematically analyse (Graphy) personal experience in order to understand cultural experience". (Ellis, Adams, Bochner 2011 citing Ellis 2004 and Jones 2005).

My understanding of autoethnography began with the literature. My initial literature review included the 200 most frequently cited documents (metrics: Google Scholar) using autoethnography as a keyword. These were reviewed at abstract level and coded in terms of focus and content (see Table 1-2)

Discipline Year	General	Anthropology	Education	Health	Other	Total
< 2000	7	7	1	1	4	20
>2000	55	24	28	16	57	180
Total %	31%	16%	14%	8%	31%	200

Table 1-2 Research on top 200 documents with keyword "autoethnography"

The analysis shows a breakdown of these 200 top cited papers by discipline where, for example the discipline of "general" includes the published works on the methodology without being specific to any discipline (e.g. Ellis et al 2011) and also for example the "anthropology" discipline included such work as Reed Danahay (1997) where autoethnography is used to research different race or cultures. The analysis shows the relative popularity of the method with most

papers discussing the method in general (31%), 16% in Anthropology/Sociology, 14% in Education and 8% in Health. The other 31% were in many different categories including sport, sexuality, feminism, arts, tourism and business. Just 6 papers from this sample were in my area of business and information systems. In addition, the analysis shows the significant growth in the number of references to autoethnography since the turn of the century (90% of the 200).

From this initial analysis, I followed up with two in-depth reviews of specific papers as follows:

a) A review of the most cited and influential scholarly publications on the methodology.
b) A review of practice oriented papers and analytic methods that are included in those papers.

The review of these papers is used in the analysis of autoethnography that helped me to understand its suitability as my methodology of choice, as shown in the following sections.

1.5.2. Advantages and challenges of using autoethnography

Much of the strengths of autoethnography comes from the unique insight that autoethnography can bring to research because of the source of its data. However, this unique insight in itself may not contribute to scientific research if the researcher cannot analyse and interpret the data. In autoethnography, data collection and data management will underpin a valuable data interpretation and analysis in order to make scientific contribution (Chang 2016).

From our reading of the top researchers on autoethnography, it becomes clear that they don't all agree on the balance of the pure story of self and the rigour of analytic science. Denzin (2006) challenged Anderson's (2006) analytic account of autoethnography very much on the basis of need for complete membership (within the data case). In addition, Ellis (2011) comments on the nature of autoethnography as "socially just acts not preoccupied with accuracy" and this view contrasts somewhat with Chang's (2016) methodical focus on rigor to assure accuracy. However, the consistent opinion of all researchers include the story of self as core to the methodology and the expression of this story through descriptive writing to give unique insight. Perhaps the challenge amongst the most cited writers is to what degree further analytic method can advance this insight, or if in fact an incorrect balance of rigour might perhaps detract from the unique writing method in the first place. This "balance" question is a driving force in the argument to achieve the best scientific outcome using this methodology.

The key benefits of autoethnography of new perspective, greater depth of insight, accessibility and analytic rigour with associated reference are shown in Table 1-3.

Advantage	Arguments to support autoethnography	References
Offers new perspective	• A unique way of thinking and feeling, helping others make sense of themselves. • Analytic aspect of autoethnography is suitable to new forms of enquiry and practice. • Relentless nudging of autoethnography against the world of traditional science holds symbolic and emancipatory promise. • Positivist view of scientific research from quantitative to qualitative.	Ellis, et al 2011 Richardson (1994) Anderson 2006 Wall 2006 Ellis 2011
Greater depth of insight	• Socially just acts not preoccupied with accuracy • Generate introspective- provides rich insights into human, social and organizational. • Natural Reality- focus on Experience. • Practitioners experience in paradox, cross cultural and complex.	Van Maanen(1988) Denzin and Lincoln(1994) Klein and Rowe (2008) Rowe (2012) Simonsen (2009)
Access	• Attracts the interest of practitioners/resonance • Self-identification and full membership as recognised by self and group.	O'Riordan (2014) Reed-Danahay (1997) Chang (2016)
Analytic Rigour	• Post-modernist approaches to autoethnography, the increase in use of method and use in new disciplines has brought new approaches to analytic Rigour.	Anderson (2006) O' Riordan (2014) Duncan (2004)

Table 1-3 Advantages of Autoethnography

Of course there are challenges with autoethnography as shown in **Table 1-4** and having presented a number of papers for peer review I am quite familiar with them. These challenges include how data collection can address such issues as

memory leakage, how outcome bias can be caused by familiarity of data source, and interpretation and analysis being the same person? These challenges all require careful rigour of self-analysis, corroborative data, and reflective analysis to offset risks.

Challenge	Challenges of Autoethnography	References
Ensure Analytic Rigor	• Too artful and not scientific enough. • Memory leakage. • Prevent bias. • Issues of quantification. • Generalizability, validity and reliability.	Ellis et al 2011 Holt 2003 Denzin and Lincoln 1994
Difficult to Evaluate	• Attacks on methodology by reviewers. • Resilience and conviction are required to pursue the methodology. • Limited to social sciences especially topics with limited research done in areas such as business and information systems.	Holt 2003 Ellis 1991 Anderson 2006
Ethical Challenges	• Intruding on the lives of others • Self- Indulgent, narcissist • None of us are interesting enough	Ellis 2007 Delamont (2007)

Table 1-4 Challenges of autoethnographic method

1.5.3. How autoethnography has evolved over time

The methodology has evolved over time to address the challenges and accentuate the benefits of autoethnography. **Table 1-5** shows our selection from the top cited autoethnography publications and an analysis of their focus on analytic method within autoethnography. It was Hayano (1982) who coined the term autoethnography which he used in his book in 1982 on the life of a poker player. His analysis of his story of the poker player comes from his style of writing and description of the life which he lived. The language is evocative, and emotional with colourful description of the smoky nights, the highs and lows of life on the road in California as a poker player over a 40- year period.

Author	Purpose	Analytic method
Hayano 1979	The life of the poker player.	Writing style created the image of the poker player as an active member.
Ellis 1991	Story of death of friend	Self- examination emotions insight/analysis Introspection of emotions.
Denzin and Lincoln 1994	Handbook of Qualitative research	Autoethnography evolution discussion as sub-genre of ethnography.
Richardson 1994	Handbook of Qualitative research	Writing as a method of enquiry. The creative Analytic Process from style of writing.
Reed-Danahay 1997	Book Auto/Ethnography	Analysis of anthropology concepts through autoethnography and ethnography vignettes.
Anderson 2006	Analytic Autoethnography Steps	Complete Member research, analytic reflexivity Visibility as a member, dialogue with informants Commitment to develop theory, self-narrative.
Denzin 2006	Analytic Autoethnography	Challenging the Complete Member scope of Anderson.
Ellis et al 2011	Autoethnography an Overview	Explanation of method. With focus on storytelling, emotional introspection, need for analysis including external.
Rowe 2012	Guidelines for Ethnographers	Need for full member narratives in IS, use of storytelling, use of data.
Chang 2016	Autoethnography as method	Analysis and interpretation balancing from stories.

Table 1-5 Analytic commentary of top cited autoethnography researchers

A major contributor and teacher of the autoethnographic method, Carolyn Ellis, has over time, strengthened the case for autoethnography as a valuable and acceptable research practice. In the Ellis (1991) paper on social introspective, she discusses how social constructionists can use the study of emotions to inform their research. Denzin and Lincoln (1994) develop the thinking on autoethnography in the handbook of qualitative research. In the same book, Richardson (1994) talks about CAP (Creative Analytical Processes) ethnography adding more substance to the creative "writing as a method of enquiry" approach to autobiographical writing for science. In Richardson's (1994) chapter the writer describes how different writing styles can be a method of discovery and analysis of the story, as well as telling the story. She recommends writing courses and similar exercises for researchers in order to improve the evocative writing styles, which leans somewhat toward the artist type skill rather than the scientist, or so it could appear! The focus of analytic rigour continues to develop in Anderson's paper on analytic autoethnography (2006) and it seems to be a contrast to Richardson's "writing as a method". In it Anderson (2006) suggests a sub-genre of autoethnography, with 5 key steps that should be followed. Denzyn (2006) challenged Andersons claim to his "new" genre by re-emphasising that the earlier works on autoethnography by Richardson, Ellis and himself already required this analytical rigour. Once again this argument seems to underpin the required balance/debate on rigour and emotional introspective writing and also challenges the "complete" member assertion of Anderson (2006) as distinct from other forms of active membership. It is true that the emphasis of the earlier autoethnographic method papers was more emotional evocative and introspective writing than

structured analysis, whereas Anderson's (2006) work strengthens the systematic rigour, and perhaps understates the writing style and requires single membership.

Many other writers have gone into greater depth on celebrating the benefits of autoethnography. In the Reed-Danahay (1997) book on autoethnography the author describes the important measure of autoethnography as: "self-identification with the group and full membership as recognised by self and group (p. 100)". Once again this contrasts with the earlier debate where Denzin appears to allow active, versus complete membership of the related research. This is certainly the case in my own research where I was and continue to be a complete member of the research group. In more recent specific research Heewon Chang (2008) gives specific guidelines on how to collect and analyse data for autoethnography to be rich scientific research including how data should be collected, analysed, interpreted and written, both internally (self) and externally (triangulation).

1.5.4. **Comparison to other methodologies and choice**.

As I became enthusiastic about my prospects of writing my research using autoethnography I have also analysed for the purpose of deciding on my own methodology, the comparison to other methodologies and the advantages and disadvantages. I developed the analysis in Table 1-6 of methodology comparison using Susman (1978) as a template for comparison of methodologies.

Points of comparison	Positivist	AR	Autoethnography
Value Proposition	Methods are value neutral	Methods develop the research	Method is story of self
Time perspective	Observation of present	Observation and interpretation of present	Self-observation and interpretation of present and past
Relationship with units	Detached	Active Member	Meaningful member
Treatment of units	Interest only as representative of population	Cases can be sufficient sources of knowledge	Meaningful experience of case is source of knowledge
Language used	Denotative, observational	Conative, metaphorical	Narrative text, subtleties, emotional and evocative
Basis for assuming existence of units	Exist independently of humans	Artefacts for purpose	Self-experience. Culture, other data
Epistemological aims	Prediction of events from propositions arranged hierarchically	Guides for taking action that produce desired outcomes	Experience of culture that produce different outcomes and why
Strategy for growth of knowledge	Induction and deduction	Conjecturing, creating settings for learning and modelling behaviour	Theory building Reflective Analysis
Criteria for confirmation	Logical consistency, prediction and control	Evaluating whether actions produce intended consequences	Other data Writing Reflective analysis Layers (Chapter 2)
Basis for generalisation	Broad, universal and free of content	Narrow, situational and bound by context	Opened through theory building using reflexive analysis and theory building

Table 1-6 Comparison of methodologies to autoethnography

Table 1-6 gives a comparison of positivist methodology, action research and autoethnography using such criteria as the value proposition of each research methodology, its time perspective, the relationship of the researcher to the data, the treatment of data, language used, basis for existence of data, the epistemology

aims, strategy for growth in knowledge, the criteria for confirmation of data and a basis for generalization. I developed this analysis using a similar comparison of action research methodology in Susman (1978). It serves as a useful confirmation of my use of autoethnography for a number of reasons including:

- My experience and meaningful membership of my research made me uniquely qualified to write this research in this way.
- All the criteria for comparison of methodologies as per Table 1-6 seemed to justify my research methodology of autoethnography, including timelines, my relationship with the data, the strategy for knowledge growth and others.
- My understanding of the evolution of autoethnography into new approaches and new sectors and the strengths and weakness of the method allowed me to develop a most robust approach as outlined in Chapter 2 using my "layer" approach.
- The methodology allowed me to research the culture behind the governance of trusted data which I felt from my analysis that other methodologies would not allow me to research.
- My research could be very real and unique to me addressing my personal drive to find a trusted data governance framework using what I knew was a proven model that I had experienced. No other methodology would have allowed for the richness that would emerge from this approach.

My journey and use of autoethnography is the subject of Chapter 2 of this thesis where the story of how I used this method is fully presented. I have

followed a layer framework in developing my autoethnographic research. This layer approach took me through the layers of data gathering and analysis including the story of self, use of my membership of the research case, other data sources which I have because of my position, reflexive analysis of all data and the use of conceptual lens through which to analyse our data.

1.6. Use of concept lens and other data

In this section I focus on the selection of the conceptual lens for analysis and also the use of other data throughout the thesis.

1.6.1. Use of conceptual lens and associated theory

To deliver on the concept lens "layer" of my analysis (see Chapter 2) I selected theories not because I claim that they are the "best" but to, as Miles and Huberman (1984) point out, provide the following context to my data, including:

- Show that our finding has a conceptual analog, which lends more plausibility to the finding and to the concept, which is now empirically grounded in a new context.
- Help explain why patterns occur.
- Throw light on larger issues (e.g., how people cope with uncertainty).
- Finally, the construct can be trained back on our cases to explain related but puzzling phenomena.

The first of these frameworks or lenses of analysis is a framework that I have used throughout my career to understand many practical business and technology issues. It is used extensively in the Information Technology service management method; ITIL (Information Technology Infrastructure Library). The British Government's Central Computer and Telecommunications Agency developed the

ITIL framework during the 1980's (Galup et al 2009) and is also widely used in organisational transformation best practice (Ramakrishnan et al 2009, Chen and Popovich, 2003, Information Builders 2014, Vom Brocke and Roseman 2010). It breaks down the understanding of change management with regard to its implications for the domains of people, processes and technology. As I started to code my case for the research proposal, this approach emerged as a very logical way in order to cluster concepts within my trusted data case. It addressed three questions with my data governance research namely:

- How did the communities co-operate to govern trusted data?
- How did the processes of data governance evolve?
- How did the technology evolve for trusted data governance?

Therefore, People, Process, Technology as conceptual domains provided an initial useful lens to analyse my case and provide a solid roadmap for my research. Because these domains are all part of the same case, the development of the research therefore also provided for a Venn diagram (Venn 1880) representation of how these three areas of research were domains within the same trusted data case study as shown in Figure 1-4. This combined view of how the community operated and the processes and technology developed would allow me to provide unique research on data governance by looking at these three domains and their dependencies on each other. Each domain is researched independently in Chapters 3, 4 and 5 and the combined analysis in Chapter 6 takes us to conclusive contributions from the research.

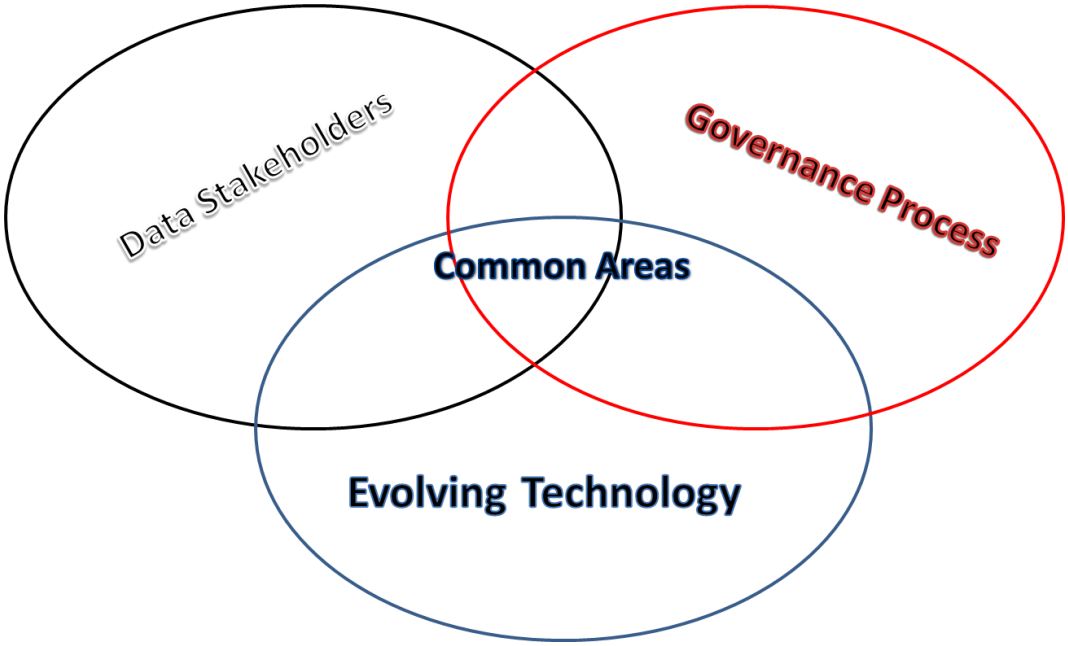

Figure 1-4 The case domains for Venn analysis

This conceptual approach therefore would be my direction for writing; an autoethnography of each domain of community governance, data governance process and data technology evolution that would offer a unique contribution to data governance research. From the literature review there was a lack of research in data governance from this perspective of people, process and technology especially, from design stage through to implementation and monitoring of data governance programmes (c.f. Alhassan et al 2016). Therefore I believe I can make a unique contribution as a practitioner, to the process of data governance for trusted data using this model. This research is structured in this way. The completed thesis therefore can be visualised as in **Figure 1-5**:

<table>
<tr><th>Approach</th><th>Individual Research Papers</th><th>Combined Research</th></tr>
<tr><td rowspan="4">Chapters 1 and 2
Introduction, Method and summaries.
Ireland’s Food Data systems were developed by my company and evolved over a twenty-year period to become the trusted data source for food produced in this country and consumed all over the world</td><td>Chapter 3
How Community Governance contributes to trusted data</td><td rowspan="4">Chapter 6

A New Framework for Trusted Data Governance</td></tr>
<tr><td>Chapter 4
How the Data Governance process evolves to deliver trusted data</td></tr>
<tr><td>Chapter 5
How Technology Evolution Governance assured meeting data needs over time</td></tr>
</table>

Figure 1-5 Research study approach

1.6.2. Selection of appropriate lens for each domain

As stated in 1.6.1, the conceptual theory lens (Miles and Huberman 1984) was one of the layers of analysis used in my research, and this layer method is explained in detail in Chapter 2.

In order to select these lenses for each of the three domains, I researched similar frameworks from published literature according to the concept I was researching

within data governance. I coded this analysis using the Webster and Watson (2002) concept-centric matrix approach to match the lens requirements to the framework. The coding for the matrix used the following criteria:

- Does the research paper provide a clear framework suitable to my research method?
- Do definitions match closely to my data governance study?
- Is the industry/sector/context similar? Is the scale similar?
- Is the paper published and well cited?
- Is it a limiting framework? e.g., full scope of data governance, not just, e.g., quality
- The framework should be relatively simple given that I will combine and generalise contributions at a later stage.

For each of these concepts, I searched for suitable frameworks. The concept centric matrix extracts are shown in Table 1-7, Table 1-8 and Table 1-9

Table 1-7 Conceptual lens selection for community governance

Paper	Name	Yr	Cited	Framework	Comments
Pahl	A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes	2009	1032	Single Double triple loop learning Adaptive governance Improving Reframing Transforming	Focuses on resources not focus on firm. Framework for analysing adaptive capacity
Jones et al	A general theory of network governance: exchange conditions and social mechanisms	1997	1704	Combine Social context into transaction cost economics Culture Sanction Restricted access Reputation	The focus on role of the participant only
Stoker	Governance as theory, five propositions	1998	3717	Simplifying lens Complex set of institutions Recognising blurring lines Identifies power dependencies Autonomous self giving network of actions Capacity to get things done	Not sure if it's a theory or a framework but valuable paper for my work
Henderson et al	Global production networks and the analysis of economic development	2002	1704	Management structures Value Power Embeddedness	Global Corporate
Provan and Kenis	Modes of network governance, structure, management and effectiveness	2008	2205	Structure Lead organisation Participant Admin organisation Trust, Network Goal Efficiency Vs inclusiveness Internal Vs External Flexibility Vs Stability	Overly Public Admin
Dhanaraj and Parkhe	Orchestrating Innovation Networks	2006	1288	Innovation network Mobility Appropriability Stability	Choice because of simplicity and structure

Table 1-7 shows the selection process using a choice of papers with theories or frameworks for network or community governance. The favoured model framework for use in our autoethnographic analysis after this study was that of Dhanaraj and Parkhe (2006). The simplicity of its network design and orchestration process is a close match to the case study and the focus on behaviours matched closely with the strength of the autoethnographic method, including behavioural insight. Other frameworks that were considered such as those of Jones et al (1997) and Stoker (1998), had similar network behaviours considered in these papers also that underpin the strength of the framework of Dhanaraj and Parkhe's (2006). This framework was therefore used as the analytic lens in our first paper on community governance and its process and findings are shown in the paper in Chapter 4.

Paper	Name	Yr	Cited	Framework	Comment
Kristin Wende	A Model for Data Governance – Organising Accountabilities for Data Quality Management	2007	76	Defining roles Decision areas Responsibilities Good corporate governance organisation model	Focus on Organisation structures Poor on process and skill/knowledge requirements
Weber, Otto, Osterle	One Size Does Not Fit All—A Contingency Approach to Data Governance	2009	131	Focus on roles and responsibilities in corporate with RACI framework. Add in a contingency model that allows a not one size fits all approach	Excludes policies, guidelines, routines for governance
Redman	Data's credibility problem	2013	21	Fixing Data: Connecting data creators and users Focus on getting new data right Responsibility	Focused on management Ignores process
Tallon, Ramirez and Short	The Information artefact in IT governance	2013	77	Antecedents (Enablers and Inhibitors) Structural practices Procedural Practices Relational Practices	Incremental model Versus a ground up model
Khatri and Brown	Designing Data Governance	2010	208	Framework designed for researchers Principles Data Quality Metadata Data access Data lifecycle	Choice because of similarity , structure, and relevance

Table 1-8 Conceptual lens for data governance process

Table 1-8 shows the comparison of data governance frameworks from the literature in which Khatri and Brown's was the preferred framework that was adopted because of the similarity in structure to the research case. Other frameworks from literature have been used throughout the research study for reference and to help with triangulation of research analysis.

Paper	Name	Yr	Cited	Framework	Comment
Sambamurthy & Zmud -	Arrangements for information technology governance: A theory of multiple contingencies	1999	1144	3 uses of IT Gov: Infrastructure, Use of IT and Project management 3 structures, central, decentral and federal, 3 contingencies, reinforcing, dominating and conflicting	Firm focused and not community focused
R Peterson -	Crafting information technology governance	2004	493	From Structures of Control, authority and efficiency to competencies of collaboration, competency and flexibility	Corporate focus, Lack of competition within community
Weill and Ross	A matrixed approach to designing IT governance	2005	530	Principles Architecture Infrastructure Business Needs Priority and Investment Monarchy, federal, feudal, duopoly, anarchy	Good breakdown of IT priorities with good fit to public and private sectors Choice

Table 1-9 Conceptual lens for technology evolution governance

Table 1-9 shows a comparison of frameworks analysed for choice of lens for technology evolution. The Weill and Ross (2005) paper selected was a significant influence on the Khatri and Brown (2010) framework developed in 2010. This similarity of structure and completeness of each of the frameworks, spanning the entire scope of the governance process and technology evolution, made selection of these two papers the most sensible and value-add approach from a research perspective.

1.6.3. Case data used in the research

As stated in section 1.4, my methodology is autoethnography. The data used in my research therefore is driven by my analytic approach to autoethnography and this is explained in detailed in Chapter 2. The specific data sources within my approach are as follows:

- A personal account with unique insight as a leader in the Irish food programme, with many short stories within the programme that could inform the culture of the community involved in its decision-making
- A network with the data community which would help with interviews about the data governance process detail for the purpose of supporting this research
- Access to extensive notes including system specifications and designs as they evolved, published catalogues, photographs, official records and other artefacts that could help interpret and illustrate my story.
- A detail table of these sources are shown in Table 1-10 as follows:

Data Sets Used	Nature	Coding and analysis approach	Use in research
Interview of self	Supervisor recorded detail interview.	Open coding , mapping, timelines of timelines, concepts	Timelines and concepts were clear at the research design phase and therefore formed the structure of the thesis
Interview of community members	7 recorded interviews from personal network	Coding for concepts, matching to story of self	Used throughout research for data triangulation
Writing the story	Writing as a form of research including vignettes	Introspection and reflective analytics. Peer review	Part of each chapter
Work notes	25 years of personal and business digital and analog records including email, tender documents.	Organisation of work notes to support research.	Illustrations used in Chapters 4,5, and 6.
Photographs	Private and public documents	Organised according to use in each vignette	Used as illustrations or triangulation of data in research notes
Public information	Web pages detail on industry, organisations, etc	Used when needed and open coded for matching data need	Data triangulation on scope of food industry

Table 1-10 Case data sets used for the research

1.6.4. Research Paper review process

Each of the papers in Chapter 2,3, 4 and 5 has gone through a significant peer-review process. My research paper on autoethnography has been reviewed and following these reviews has been published in a book on autoethnography (Costello et al 2018). My research paper in Chapter 3 on Community Governance (Costello et al 2016) was published in the proceedings of the 2016 open

conference of the IFIP WG 8.3. My completed research paper on data governance was initially proposed for an ICIS conference in 2016, but was not accepted. However, the output from its reviews helped me to rewrite the chapter and now it is proceeding through the review process in the Journal of Decision Systems for publication. My research paper in Chapter 5 on "Technology Evolution Governance" has been submitted and reviewed by MIS Quarterly Executive and after some redrafting has now been submitted for a second round of reviews with that journal.

1.7. Overview and background of autoethnographic field site

In this section, I will explain in more detail my research case including the legislation that started it and using a six-honest-men analysis of the programme asking the *What?, Why?, How?, When?, Who?* And *Where*, presented as follows:

- Introduction to the legislation
- What is the data-driven initiative being reported?
- Why is it an important initiative?
- How was the initiative implemented?
- When did this initiative take place?
- Who has benefited from the initiative?
- Where is the business value being realised from this initiative?

1.7.1. Legislation

The completion of the Single European Market in 1992 required common market conditions to be implemented in all member states. Amongst those common market conditions was the elimination of border controls within the region for all trade including animals. To fulfil these conditions, each member state had to implement an animal identification system. Ireland, just like all other states did comply with this directive and in 1995 the Irish government contracted out the development of the systems, process and services for compliance to a company in West Cork, called the SouthWestern (formerly SWS) Group. SouthWestern had been founded in 1957 and its charter was to provide farming services to the members of local co-ops in the South West of Ireland. Over the next 20 years the Irish government would continually raise the bar on the management of food and animals beyond the requirements of the EU directive - from this basic level of

identification, through to full traceability, disease control, eradication, quality of production and environmental improvement. As a result, today, Ireland's food produce carries a premium brand reputation and price in the major markets in the world and Irish food has access to high-growth markets including in the United States and China that other EU countries do not have. SouthWestern partnered with the Irish government throughout these past 20 years in the implementation of many of these initiatives and today is still a major partner for traceability, data collection, quality inspection and environmental inspection for most of the food produced in this country. This research study is based on the autoethnographic story of how SouthWestern were part of - and in some cases took leadership in - a large community of stakeholders in order to produce the data and analysis so as to achieve this premium brand. The trust in data that was required by international and national markets, by consumers and farmers, by legislators and marketers, by scientists and representative bodies, to create this premium brand has so far been achieved. This is the story of how to achieve that level of trust in data.

The project started with the Irish government's Department of Agriculture in 1995, when they issued a procurement tender inviting companies to bid for a contract to build and deliver the registration for birth, movement and death of animals. This tender was won by our company, SouthWestern, and the systems were delivered and evolved over the following years. We were contracted directly to the department of agriculture to deliver this contract. In 2005 the department of agriculture considered a quality assurance programme to measure the quality method of production on Irish farms. They did a tender and we also decided to participate in it. We proposed a detailed solution outlining data collection, data transfer, quality assurance of data and proposed analysis method. It was

benchmarked against the International Standards Organisation (ISO) standards and it measured cleanliness and quality of production and husbandry on Irish farms. Bord Bia was the delivery agency for the programme on behalf of the department of agriculture and after evaluation of all tenders our proposed solution for Bord Bia was accepted. Following the awarding of the contract, we hired and trained approximately fifty on-farm inspectors throughout the country to collect the data. We trained all the inspectors on our quality assured methodology to collect the data including how they would set up appointments with farmers and report the data. We also had a head office team for collection of the data from the on-farm inspectors and the processing of the data into the government agency systems. The acceptance by the farming community of the data service was very good, which was just as well since our business model was based on the success of the take-up of the programme. As the quality assurance programme progressed, the subject of environmental sustainability became more and more of a concern for the industry. We worked with the carbon trust in the UK to look for ways to measure carbon data on farms and we also worked with Teagasc, the science agency for the department of agriculture in order to try and build a data solution. In 2010, the government agency issued a new tender for the calculation of a carbon data measure inside the farm gate. We had a proposed solution and we won the contract again. These three programmes - traceability to origin, quality of production method and environmental sustainability - have been run by my company, SouthWestern, since they commenced to the present day. Each programme has been continuously improved and upgraded such as today they are an exemplar of measures of food supply chain data, and are trusted internationally.

1.7.2. What is the data driven initiative being reported?

The data-driven initiative underpins food health safety, quality and sustainability and is the first initiative in the world to measure carbon footprint inside the farm gate. The grassland-based system of farming for meat and dairy products is run by thousands of mostly small farmers throughout Ireland. Ireland's food brand has grown in trust since the launch of Kerrygold in 1962, joining the EU in 1972 and since the introduction of legislation from the European Union in the mid-1990s as described above. Since the mid '90's the Irish branding has been built upon a strongly legislated and calibrated food production data system that verifies the source, quality and sustainability of its produce. The data that establishes these brands is collected from the birth of animal and origin of produce, through the farm gate and on through its supply chain. The data allows for approval by government food traceability and disease-free regulations around the world as well as branding as a quality assured product under the Bord Bia Quality assurance program. You may recognise its logo in Figure 1-6. It also provides the data required to be branded as a sustainably produced product under the Origin Green program for food sustainability in Ireland. You might also recognise this logo in Figure 1-6 below.

Figure 1-6 Irish food quality and sustainability logos

1.7.3. Why is it an important initiative?

Irish food is mainly produced in the open air and is considered to be a sustainable food source in terms of its social, economic and environmental impact. It forms the basis of all rural communities in Ireland and, in turn, creates Ireland's largest indigenous business employing over 260,000 people. It is deeply embedded in the landscape, history and personality of the country. Its strategic importance to the Irish economy, its roots in local communities and its strengthening global reach (the industry provides quality, safe and nutritious food to consumers in at least 175 countries around the world) make it an important economic sector unlike any other.

The industry exports some €11 billion (2015) of Irish food annually and this number is projected to grow to €19bn by 2025. In addition, the value add of Irish food is projected to grow by 70% over the same period through the innovative creation of produce that continues to grow the premium nature of Irish food feeding the ethical, gourmet and health appetites of the world. Trust in our produce is based on

- Its traceability.
- The quality of the production system, and

- The sustainable method of production.

The Table 1-11 below outlines how these requirements of trust are measured using data collected at every part of the chain.

Initiative	Animal Identification Systems	Quality	Sustainability
Description	Origin of food including control of all movements, disease management and compliance .	Adherence to best practices of food management from time of breeding through to the table.	Sustainability of farming in its social, economic and environmental methods.
Branding	Department of Agriculture, Food and the Marine An Roinn Talmhaíochta, Bia agus Mara	BORD BIA QUALITY ASSURANCE SCHEME ORIGIN-IRELAND	Origin Green IRELAND Working with nature
Data Analysis	Tag Number Birth, Movement and disposal date Disease control	Record Keeping Remedy/Medicine management Cleanliness Farm safety Housing comfort	Carbon Footprint (KG of Carbon per KG of food) using : Slurry data Nitrogen usage Weight Gain Age of calving Calving rate Grazing season
Key Outcome's	Permission to trade Subsidies for compliance Safe food	Premium price from factory Good farming practice Access to new markets	Premium price in Global markets Access to new markets Regulation of Irish food

Table 1-11 Data analysis for Irish food

1.7.4. How was the initiative implemented?

The evolution from regulatory compliance through to differentiation as a premium brand occurred over a 20 year period and will continue to improve in the future. Below I have divided this twenty year period into four key phases of this evolution. Each phase introduces new data sets.

Phase 1: In what I have called Phase 1, the animal identification national database was set up, and this database produced the datasets of farm and herd numbers, animal tag numbers and other unique data sets that identified animal and animal movements. Every farmer had to comply under government legislation. The data accuracy and completeness improved over time. The I.T. systems that were developed also became sophisticated, including strong analytic capability that was used primarily to track compliance with regulation.

Phase 2: Phase 2 saw the introduction of the Bord Bia Quality assurance scheme. This scheme added in previously unknown data on the quality of animal farming that exists inside a farmer's gate. This required new technologies and a process of sending trained auditors or inspectors onto every participating farm to collect data. This scheme was voluntary to the farmer, but funded by the Irish Department of Agriculture. Over time, the meat markets paid extra for food certified under this programme and participation by farmers is very high.

Phase 3 is the addition of an environment sustainability measure to the previous data sets. The strategic goal is to show how Ireland's food is produced mostly on open grassland and in an environmentally friendly way. Some data could be calculated from previously collected data sets while some data points could be extrapolated by using equations developed by Teagasc, the national food science

agency. Other data still needed to be collected inside the farm gate and these data requirement formats were added to the onsite questionnaire.

Phase 3(a) was the same as phase 3 but added in dairy farms which represented a 100% growth in the size of the programme. This phase was driven by the needs of premium markets for environmentally friendly food sources. The dairy marketing board (Irish Dairy Board) is not governed by the Bord Bia government agency, instead, it is owned directly by the Irish co-ops. It is a co-op of co-op's. As phase 3 was progressing, we worked with the Irish Dairy Board on the concept of introducing this Quality and Sustainability scheme into the Dairy Industry.

1.7.5. When did this initiative take place?

The initiative took place through its four phases from 1995 to the present. There are continuous initiatives to improve and advance the program further. Table 1-12 below outlines the timeline of implementation of each phase of the programme, including its strategic drivers at those times, and the data scope:

Phase	Activity	Scope	Dates	Strategic Driver
1	Identification & Traceability	Bovine first, Followed by all livestock	1995	EU & Irish Government Directive
2	Quality Assurance	All meat types, mainly beef and lamb. Voluntary started with approx. 20000 on farm audits	2005	Government initiative to improve Quality of food production
3	Sustainability	All Meat Types Same as 2 but greater adoption approx. 30000 on farm audits)	2010	Markets driving need for Environmental friendly produce. Competition from emerging markets
3 (a)	Sustainability (dairy	Same as 3 plus 30000 dairy farms i.e. 60000 on farm audits	2014	New Markets China and USA Pride Better price

Table 1-12 Programme timeline

Figure 1-7 below, also shows the timeline with the many internal and external influencing factors. While the programme was being implemented the value of exports rose from approximately € 3 billion to €11 billion per annum.

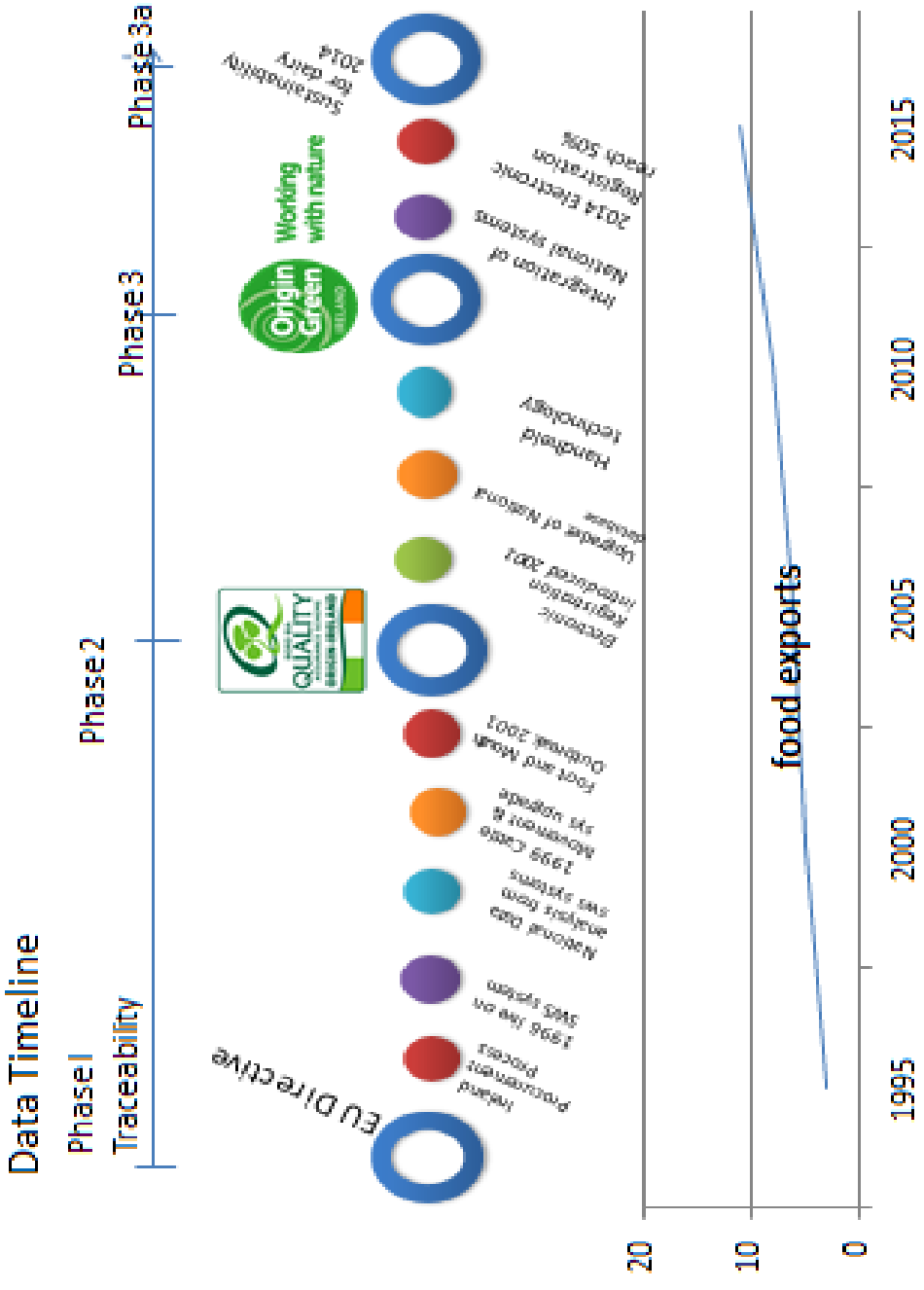

Figure 1-7 Timeline including external and internal changes

1.7.6. Who has benefited from the initiative?

There are six stakeholder groups (see Figure 1-8 Stakeholders in the data) involved in the collection, analytics and marketing of the data - all of whom have benefited from the programme. The priorities and benefits for each stakeholder group are shown in Figure 1-10 below.

Legal and Government: The original legislation for food identification in Phase 1 was developed as an EU directive through the European Parliament. The Department of Agriculture in Ireland is the responsible body for the implementation of EU directives on traceability of food. An agency of the Department An Bord Bia, is responsible for the marketing of Irish food. It is this agency that has led the development of the brands of "Origin Green" and the Bord Bia Quality assurance Mark.

Science and Benchmark: Stakeholders in the programme included science and benchmark expertise as follows: ***Teagas***c is the agriculture and food development authority in Ireland. Its mission is to support science-based innovation in the agri-food sector and the broader bioeconomy that will underpin profitability, competitiveness and sustainability. (www.teagasc.ie). ***The Carbon Trust*** is a globally recognized authority on Carbon management. **The Irish National Accreditation Board** (INAB) is the national body with responsibility for the accreditation of laboratories, certification bodies and inspection bodies.

Farmer: The farmer is the source of the data for every phase of the programme. The farmers in Ireland are represented by a number of co-op movements, representative bodies and unions. The IFA, Irish Farmers' Association, is the largest farmer representation body in the state. In addition to the IFA, there are other important or associations, including the Irish Creamery Milk Suppliers Association representing specific interests of dairy farmers and other similar representative associations.

Service Providers: In data collection for agriculture, my company, Southwestern is now a regional leader with contracts in Ireland, Northern Ireland and the UK. Southwestern have been involved in Agriculture services since 1957, and in data processing of Agriculture information since the mid 1990's. There are other service providers in this sector, but we are by far the largest and most experienced in the field of data processing for Agriculture. As a result Southwestern have been the solution-provider of choice for all phases to date in these programmes.

Industry Suppliers; These are the groups who buy the produce from the farmers. They include dairy-producing companies in Ireland such as Glanbia, Kerry, Dairygold, and international food producers who use Irish Dairy produce such as Danone or Nestle. Etc. They also include the meat producers such as Slaney Meats, Dawn Meats, etc. As an improvement initiative, the meat producers agreed over time to give higher pricing for Quality assured product under the new scheme.

- **Retailers & Consumers**: The major retail chains in the UK and Ireland were big influencers on the way the original programme solution was run. Retail companies such as Sainsbury's, Marks & Spencer, Tesco, Dunne Stores and others all had significant carbon reduction programmes going on in their companies

Figure 1-8 Stakeholders in the data

1.7.7. Where the business value is realised from this initiative?

Figure 1-9 below reminds us of the economic, reputational and quality value-add created by these programmes. All stakeholders listed in Figure 1-8 have benefited from these value-add initiatives.

Initiative	Animal Identification Systems	Quality	Sustainability
Branding			
Value Outcomes	• Permission to trade • Subsidies for compliance • Safe food	• Premium price from factory • Good farming practice • Access to new markets	• Premium price in Global markets • Access to new markets • Regulation of Irish food

Figure 1-9 Business value from data

However Figure 1-10, describes the differing incentives, or value add aspirations required for each stakeholder in the community and the priority within which these might have operated.

Stakeholder	Incentive 1	Incentive 2	Incentive 3
Legal & Government	Statutory Authority	Protect the citizen	Promote Ireland
Science/Benchmark	Civic Duty	Research	Pride in Culture
Farmer	Financial Benefit	Pride in Produce	Better farm Management
Service Provider	Financial Benefit	Effectiveness/efficiency	Sustainability
Industry Suppliers	Market Growth	Competitive Advantage	Innovation
Retail & Consumer	Safer Food	Traceability	Pride in Culture

Figure 1-10 Stakeholder benefit

The programme as outlined above, takes you through a complex system evolution spanning a 20-year period and which is still ongoing. The spotlight on the programme is intensive from the markets, from its competitors like Brazil and Argentina, and from all stakeholders. Up to now, it has not only stood the test of time, but is poised to continue to improve and add further value over the years to come. The value of food exports from Ireland is predicted to reach €19 billion by

2025 and this goal is underpinned by, amongst other things, the initiative outlined in this paper. Therefore, it will continue to innovate.

1.8. Chapter summary and conclusion

My study in this thesis goes back to the learnings in my youth on the farm through to the study of the evolution of Irish food traceability systems today. My immersion in the culture of food data, through to my youth and as CEO of the firm who built these systems, has allowed me to gather the data, analyse it and deliver unique insights into trusted data system development in general and for the food industry in particular.

My study has been completed in a way that has dug deep into myself, my company, our work and its outputs. Through this introspection, I've kicked it, poked it, torn it up a few times and stitched it back together again through peer review and editorial reviews. Two of the four papers are published or to be published and the other two are in the review cycle with peer reviews and rewrites already done. Now it delivers new insights and contributions to the governance for trusted data systems. Its method is robust and scientific, precise and consistent, and it is presented in such a manner as to give many new contributions all along the way.

I hope you learn from, and enjoy, my research and its contributions.

2. CHAPTER 2 - AUTOETHNOGRAPHY: A LAYER FRAMEWORK FOR A PRECISE, CONSISTENT AND CONTRIBUTIVE METHODOLOGY

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Paper Summary **Chapter 2 – Method** **A Layer Framework for a Precise, Consistent and Contributive Autoethnography**			
Peer review	**Analysis Method**	**Key Data**	**Key contribution**
Syrjälä Henna & Norrgrann, Anu (Eds.). (Costello et al 2018) Nova Publishing book.	Autoethnography of autoethnography triangulated to literature review	Story of a practitioner writing research, the review process, challenges and benefits	New model for delivery of autoethnography for practitioners

Table 2-1 Paper summary

ABSTRACT

This chapter discusses a new analytical framework to support autoethnographic methodology using my own experience and some of the leading literature writing on autoethnography. We examine how, by writing in this way, the methodology can be used most effectively in scientific research. I am a person who has worked in the Information and Communications Technology (ICT) field for 30 years and embarked on a PhD research journey two years ago. I am using autoethnography as my methodology of data collection and analysis and have published papers in this way. My research writing examines governance for trusted data systems within the social interplay of ICT. In this chapter, I will describe a layer analytical approach to support my writing of this research, and I give examples of the way I have used it to ensure precision and consistency in, and contribution to, scientific research. I recommend this layer approach as a support to writing autoethnography which will inform new understanding of the methodology and encourage more practitioners and engaged academics into this type of research.

Keywords: Autoethnography, Ethnography, Reflective Practice, Qualitative Research Methods

2.1. Introduction

I entered the world of academic research after being a businessman, a carpenter and a farmer, working around the world and living in Kilkenny, London, Paris, Amsterdam, New York, Philadelphia and Cork. I was a technology hobo engaged in creating, providing and building trusted data systems for customers around the world. Then, after a personally tragic life-changing event, I decided to start a PhD research with my focus on the governance of trusted data. I wanted to understand medical data when my wife died, but the data that was available was very poor; in fact, it was often conflicting between doctors, and online sources were even less trustworthy. I wanted to help fix what I felt was a prevalence of really poor data in health epidemiology which was of concern to me at that time. My wife died suddenly at the young age of 43 for reasons my kids and I didn't understand. I wanted, for my kids and me, "trusted information". By "trusted", I was referring to the characteristics of quality, accurate, context-appropriate, safe and usable data that I had seen multiple corporations and governments avail of throughout my career. These data qualities should also be assured by governance that is visible to the data user. Then, with that assurance, data can be more trustworthy. One of the trusted data initiatives I worked on was the food data systems of Ireland, which traced the food produced, its quality and its sustainability of production. These systems collect and analyse the data of our food chain and are trusted nationally and internationally. I thought that if we can do this for food, then why can't we do it for people. So, I embarked on academic research to find an answer.

My research methodology has thus been autoethnography, which Ellis et al. (2011) define as a qualitative methodology for "research and writing that seeks to describe and systematically analyse (graphy) personal experience (auto) in order

to understand cultural experience (ethno)" (Ellis et al., page 1, 2011). I thought that this could fit as a methodology for me to research data governance from my own extensive experience on this subject from around the world and from Ireland. I had data sources including:

- A personal account with unique insight as a leader in the Irish food programme, with many short stories within the programme that could inform the culture of the community involved in its decision-making
- A network with the data community which would help with interviews about the data governance process detail for the purpose of supporting this research
- Access to extensive notes including system specifications and designs as they evolved, published catalogues, photographs, official records and other artefacts that could help interpret and illustrate my story.

My research has gone deeply into understanding the background and detail behind this methodology so as to be sure I can contribute to my Information Systems (I.S.) practice research area. I have written a number of academic papers, some published and some – hopefully, to be published soon – being peer-reviewed with journals. My practice with the autoethnographic methodology has given me knowledge and experience – through my writing and peer reviews – of what can make up a better use of the autoethnographic methodology, and also what possible pitfalls we can meet along the way. These continuous peer reviews of our papers in the past few years have focused on the importance within my research of the precision of data, the consistency between data and the contribution from the research. So, in this chapter, I aim to construct a novel analytical framework for autoethnography highlighting precision, consistency and scientific contribution as its key features. To this end, I detail in this chapter these features based on my

own research experience in the field of Informtion Systems practice research area as well as on prior literature on autoethnography. The analytical framework objects to serve future researchers entering the field of autoethnography.

This refined framework will show:

- How the analytical layers of autoethnography helped me to be more precise and consistent with my story
- How each "layer" of analysis helped to strengthen and develop my contribution
- How the resulting focus on precision and consistency will reinforce the research and ensure a strong scientific contribution

This analytical framework is shown in Figure 2-1.

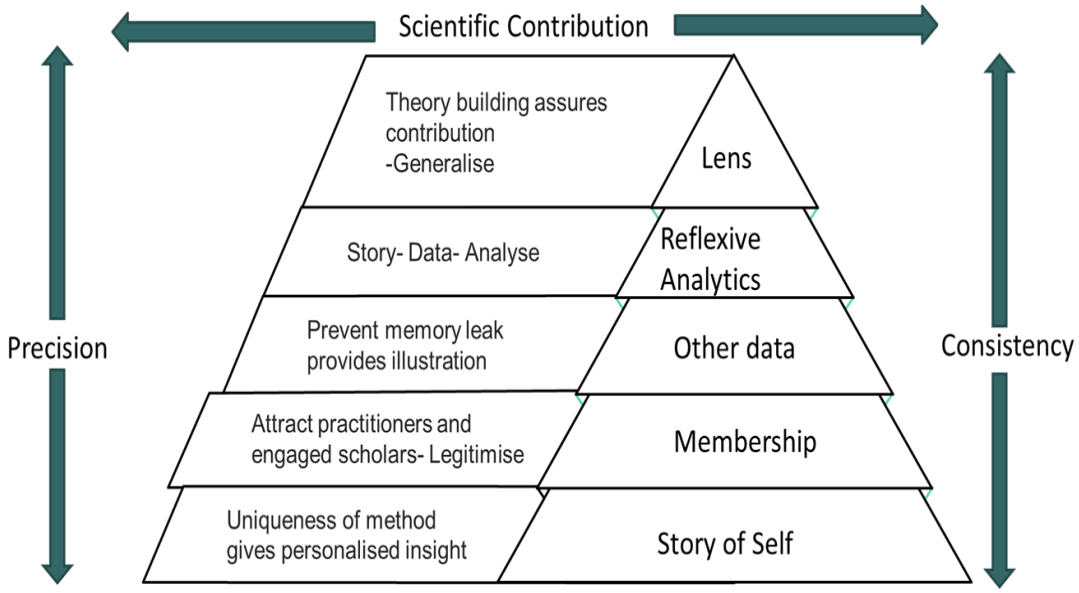

Figure 2-1 Autoethnography: The layer framework

I am a "practitioner" but, as I have studied and learned about autoethnography, I have experienced a process of enrichment of the scientific methodology along the way, which I am sharing with you. In the next part of the chapter, we will analyse

my research story through this layer framework so as to show its application and how I have experienced it. We describe how the trusted attributes of precision, consistency and contribution have been woven into and across the layers of the framework and why these attributes were so important to my research work. I will thereby explain the layers along the way through the lens of my own experience.

2.2. Autoethnography through the layers

The following analysis is my story of how I worked through these layers of autoethnographic research:

2.2.1. Story of self / Into the scene (Ellis et al. 2011)

As in Figure 2-1, the story of self is the foundation of analysis for autoethnography and gives the unique personalized insight to the research area. This is my story that opens up the scene for the research. I was born on a farm in Kilkenny, Ireland. I am one of thirteen children and have six brothers and six sisters. I worked on the farm as a kid, feeding calves from a young age and harvesting the hay, turnips and other animal feeds. As we got a little older, we learned how to use the tools on the farm to help fix-up sheds, fence gaps in the hedgerows, repair machinery, etc. As we grew older, we would progress to help in milking the cows. On days when there was a power cut, we would need to milk them by hand – and there were many power-cuts back then. There was one white cow, a nasty devil, who was a test of skill and bravery for us all as we grew up. If she took a dislike to you, she would give a good kicking – and I got a good kicking many times.

I was lucky enough to go to school and college, but ran away from college with a beautiful mad woman from Kerry. We went to New York. I was a carpenter there for two years, and we lived the life of the wild Irish rover in the immigrant pubs of the Bronx and Woodside, Queens. My training with the tools and repair equipment on the farm meant I was able to do the work of a carpenter in New York in the 1980s and so, I joined the Local 608 Carpenters Union. But my "Fairytale in New York" ended in tears when she ran off with another man! I returned to my studies and soon qualified in London as a financial accountant. I fitted in well and enjoyed my career in finance, in which I was elevated to the position of chief financial officer (CFO) in Europe for a large U.S. multinational company. I was the youngest CFO ever in the business. To produce the accounts for the business, prepare its financial forecasts and advise the management team, the highest level of trust was needed.

In the mid-1990s, I left the world of finance to continue my career in general management. I became general manager of a large subsidiary of the same U.S. multinational based in France and following that role became a global managing director of one of its Information Technology (I.T.) services businesses based in Philadelphia. Then, after a few years there, I returned home to Ireland in the early 2000s and started working for this company who had developed the food traceability systems for the country. When I was interviewed for the role, the then chief executive officer (CEO) asked me about my background. I talked to him about my origins on a farm, my years as an accountant and my time as a general manager and managing director of businesses around the world in I.T. and outsourcing. I also told him about the carpentry in New York. He asked me to work for them and to develop a data services business using the existing food

traceability system as the platform for growth. I did this and soon became the CEO of this firm. It became a very successful business, growing in staff from 30 to over 1,000 with offices in many countries. The story of "trusted data" was my account of how we built the food data business that is the cornerstone of the success of this business and on which we based all of its growth. It is my story of the way in which we networked in the culture of the food community in order to build our experience, of how we established data governance that proved the data and of how we evolved the technology over a 20-year period so as to provide trusted data on the safety, quality and sustainability of Ireland's food system.

Now, many years later, I left this job and entered the world of research when the tragic and sudden death of my wife, Judy, caused me to rethink my life and care for my family. Within my massive grief and trauma, I wanted to understand how I could get trusted information about the cause of death and its genetic implications. We (my kids and I) found many conflicting advices and reports from many different sources; it was confusing and distressing. The great pain of what happened to me could be an autoethnographic research study in itself and, indeed, would be similar to the research done by renowned methodology advocates such as Carolyn Ellis (1991) and others. But I am not an expert in grief or trauma. I am not sure if I could write it, because it would pain me so much to do so. But even if I did, then as I am neither a psychologist nor a medical doctor, I am not sure I could interpret and analyse it so as to contribute to science literature. I am, though, an expert on other things that could contribute to this search for trusted data within my professional life; therefore, I decided to focus my research on governance of data to achieve trusted data, using experience from my professional life.

As shown in Figure 2-1, the story of self is the foundation of autoethnography. The story of self can give unique insight to research, and it can be beautiful, emotional, sad, therapeutic, funny and inspirational. It is highly personalized, and it is real. It is a way of knowing and, because of these traits, it can be more informing in the research of its subjects than other methodologies because only autoethnography can explore behind these emotions. The story of self is the cornerstone of autoethnography. An example of such a story comes from one of its earliest proponents – Hayano (1982) – who, in one of the first studies describing autoethnography, paints a picture of smoke-filled rooms and gives us a unique insight into the life of a professional poker player. Another example comes from Carolyn Ellis (1993) who writes a deep and emotional research into the experience on the death of her brother from an airplane accident in a study that contributes greatly to the sociological understanding of such feelings and events. Van Maanen (2011) brings the analysis of culture of different races of people to life in his ethnographic stories, Tales from the Field. In more recent years, autoethnography has become more sought after as a methodology of bringing practitioner experience into research in areas like business and Information Systems, sport, education and health (Holt 2003; Rowe 2012; Chugtai and Myers 2016; O'Riordan 2014). My story in trusted data governance is based on my own unique experience; accordingly, I firmly believe that I can make a contribution to this field of research.

2.2.2. Membership

But my chosen area of research was not about living with my big family in a small house on a farm with a nasty white cow, nor about running away and living the life of the wild Irish rover in New York, nor the massive pain and experience

since the passing of my dear and beautiful wife, Judy. I wanted to know how governance could make information trustworthy. That was where I needed to focus membership. Leveraging experience can contribute greatly to the precision of my research (Klein and Rowe 2008). So, I dug deeper into my understanding and experience of trusted data consistent with my research purpose. In this deeper analysis, I would search for nuances of behaviour, culture, decisions and action in governance.

As an accountant, trust should be a required attribute. The practice of trust in numbers is supported by the double-entry ledger system that checks and balances all records made. My career progress, once I figured that double-entry bit out, was swift. I was financial controller for a small publishing company where I advised the CEO on the progress and the prospects of the business. Then, still based in London, I went to work for Unisys, a large U.S. multinational technology firm, initially as a financial analyst where my role was to offer advice to their business managers based on the company's financial data. Trust in data was crucial and getting numbers or other data wrong was a big no-no in business and would even in some cases cause people to lose their jobs. After some promotion and experience, I became CFO for Europe for a large part of Unisys' business, and the trusted data experience became bigger with a lot more data on its business throughout Europe, the Middle East and Africa. I had to understand the data within the practices, culture and languages from which it came – and it always needed to be right.

After some years in finance, I became a general manager in the business and my first appointment as a general manager was in Paris, France. My French wasn't great, and I remember that after my second or maybe third meeting I noticed that

my French managers struggled to speak English with me. English was the language of business in this U.S. multinational. I was concerned that the language would interfere with the data I was getting about the business; and so I made a rule that starting from the next similar meeting, the language in all of the meetings would be French only. I got huge payback for this decision from those managers who then provided me with a lot more data because they were more comfortable attending and contributing, I was respectful of their culture, and they trusted me more as a result. My weakness in the language was more than offset by the resulting better communication of data on the business. In another example of building trust, I remember meeting the head of technology of Air France one day, and she was extremely angry with my firm because the on-boarding ticketing machines that we sold to – and supported for – them were giving trouble and which, as a result, had caused delays in a number of flights taking off. She described the problem as "mission critique" which was just as well since I could easily understand those words amidst her anger. I spoke to her, in my best French, about how I would work with my team to give her a realistic resolution timeline for replacement of all the faulty machines. The action would not be immediate because of the custom nature of the equipment, but the dates were realistic. We addressed the mission critical issue, and the client's trust in us grew.

I also recall events in later years as a global general manager in Philadelphia, when I was responsible for I.T. services for Dell equipment in client bases around the world. Every Friday, Dell Corporation would measure my service level attainment. We never focused on the 95% normal compliance level, but we had endless data on the 5% of cases around the world that were non-compliant. The data was critical to training staff, improving product design and delivering great

customer satisfaction. It had to be exact, right down to the smallest percentage point. These experiences and many more taught me about the significance of relationships, processes and technology in building trust with data. The detail, as it was developed in my writing, would give insight to the meaning of trusted data for my research. Through these sub-stories of membership in trusted data governance, I was giving unique insight.

The experiences also gave me the opportunity to join this small company in Ireland where we built the food data systems for Ireland's emerging brand of excellent food. This, too, started off with the need to build relationships with the data creators and link them to the consumers, just like Tom Redman says in his articles about building trusted data (Redman 2013). We needed to have the processes in place, like international standards of quality and sustainability, and we had to build the technology suite. I was CEO for most of this programme that has been going on for 20 years. For years now, I have been running the governance of trusted data in this and in other organisations around the world. I am a member! I should write about and research trusted data because I want to – and I can contribute.

As shown in Figure 2-1, the quality of membership attracts practitioners and engaged scholars into this type of research. However, the degree to which membership (and experience) is a quality criterion in autoethnographic/ethnographic methodology has been debated (Rowe 2012). Full membership of the community is proposed by Anderson (2006) where he adds that the community should also recognise the researcher as its member. In Reed-Danahay's (1997) book on autoethnography, the author describes the important measure of autoethnography as: "self-identification with the group and full

membership as recognised by self and group'' (1997, p. 100). Once again, this contrasts with the earlier debate where Denzin (2006) appears to allow "active", versus "complete" membership in the related research. Chugtai and Myers (2016) also measure the ability to do research based on the existing experience in the community of the researcher, asserting that the ability to interpret the field improves the precision and accuracy of the research. Snow and Anderson's (1993) work on homelessness was undertaken as an active member, rather than as a complete member of this community. Though the degree of membership is debated, the absence of membership of the research community does not give a scientifically qualified attempt for in-depth interpretation of that community in autoethnography. In addition, complete membership gives more scope to the researcher to give nuanced insight and precision to such complex matters as emotions, paradoxes and decision-making reasoning. It was for this reason that we added the layer of membership into the analytic framework of autoethnography as in Figure 2-1, so as to ensure the ability of the researcher to give deep, precise and consistent insight into the social constructs of the data for research. I have this experience and membership of the area of research. As such, I can give a unique insight and, therefore, a contribution that no one else can.

2.2.3. Other Data

As I wrote my story and described my experiences of the community in which I was researching, I collected data associated with my insight. This included other interviews, background data and working documents. I had a wide network in which to access this data.

I applied for my job with the farm data company by sending a letter to the CEO of that time, complimenting him on the work they had already done with food supply chain data. In my letter, I told him that I was an experienced professional in the data outsourcing business and that I was originally from a farm in Kilkenny – and so came from the same culture. He hired me and put me in charge of this division, and when he retired I was made the CEO of the business. His predecessor was a veterinary surgeon and developed the earlier stages of the company. They had both built up great credibility amongst the sector in Ireland, and they introduced me to their network very effectively. I continued the focus on improving the industry through data. As I worked in my role, I continued to build my network and also my expertise and data around the case, which I would now write in my story of self. So, more recently, as I started my research, I decided to conduct interviews with my predecessors in the company, our I.T. leaders and both the I.T. and business leaders in some of the other stakeholder organisations. These interviews were a great opportunity for me to re-live my experiences, to solve conflicts in my understanding and add clarity to my memory.

The third layer in Figure 2-1 is this "other data" or the data from outside my story of self but which is part of my own experience. This sometimes helps to recollect my story or to illustrate my experience sometimes in a visual or representative way. I have access to much of the work material used during the research case. So, I gathered a lot of that "other data" that would help to give precision and consistency in the story of self. For my research, therefore, I have a strong library of external data, including interviews, photography, video or other digital records, written diaries and documentation.

Three photographs come to mind. First of all, there is the cute cow and newborn calf photograph which was sent to us when we had a data query on a newborn animal. The farmer sent the photo to us as proof that the calf was born. But the photo also represents the love which the farmer has for his animal, and this photo has been displayed in our office for perhaps 15 years which shows the love our staff have for the work we do. And each time a visitor comes to see our company, they ask about that calf. A second photo is of the Irish Minister of Agriculture visiting our company when we were launching our trusted food programme in the late 1990s. It is a grainy, black-and-white photo from a newspaper, but it signifies the importance this trusted food programme had in our country. Lastly, there is a photograph of the Chinese Premier when he visited Ireland in about 2010. He is pictured in amongst a herd of cows on one of the farms where we process the food traceability. He was visiting the data source, and he wanted to be sure of the reliability of data about Irish food produce before he agreed a major food import programme. Our staff were on the farm that day and helped the farmer make tea and sandwiches for the important visitors. China is now a major market for our food.

This detail of these "other data" items is now coded to help make my research more precise and consistent across the board. I have not needed to directly use much of this data in my prior publications; however, I have used it when it helps illustrate a particular point. Otherwise, I work from memory interviews (Winkler 2017). This other data approach is consistent with writers like Ellis (1993) whose understanding of social introspection is helped from using diaries, interviews and surveys to jog the memory and give precise detail. Similarly, Snow and Anderson (1993) used other data on understanding homelessness as they became homeless

themselves for the research. In this case, Snow and Anderson used state public data on homelessness to combine with their own experience of living as homeless in order to analyse their research.

2.2.4. Reflexive Analytics

As my story spanned a twenty-year period, reflexive analytics on the complete period and story would take a very long time; however, it was possible to tell short stories or vignettes within the story that would evoke reflective analysis within those stories, just like I have done in this chapter. One such story was when we recently presented at a local university about our company that has progressed from a small agriculture services company to a multinational I.T. services business. My colleague explained the history of our company founded in 1957 in agriculture services that started as a bull station and progressed quickly to artificial insemination (using the acronym AI), to milk recording, to traceability of food and to carbon measurement on farms. One student, obviously very impressed, questioned us about the use of artificial intelligence (also AI) in the 1960's era, much to our amusement. The next question was about how cows emit carbon. "Burping and farting" was the answer. Everyone laughed because the answer was evocative, but – scientifically – it was accurate. But on reflection, we were seen in the universities and nationally as a progressive and innovative company with a reputation for skills in food and agriculture data, and we were often asked to speak at university or business presentations about our story.

In Figure 2-1 above, we have shown how the reflective analysis approach can clarify data analysis within autoethnographic research. This analysis is needed because, sometimes, the external data can contradict the story of self. So, in order

to be precise and consistent, we need to reflect on these contradictions and emerge with clear data for research. In such cases in my own research as a result of this reflective analysis, a paradox may emerge or, in other words, there can be more than one truth. One example of such a paradox within my research case was the challenge of protecting farmer data for security and data protection purposes; however, at the same time there was a need to share this data selectively for the benefit of increasing trust in the data from, for example, the points-of-view of consumers. This learning and illustration is an important contribution from my research that informs how technology needs to evolve. Another outcome of conflicting data in the research is that either the memory or the other data is clarified for the purpose of alignment. This challenge is not a weakness of methodology but an opportunity through reflexive analytics to research the story of self with a deeper introspection within the conflict. Each such conflict within the research is resolved or its paradox understood. Work is coded through analysis and interpretation, balancing of stories, finding recurring topics, cultural themes, exceptions, analysis on inclusion and omission, connecting present and past, analysing self and others, etc. (Chang 2016). This aid to drive deeper introspection and consistency of data provides rich research insight and ensures precision of its data. The purpose behind reflexive analytics is to further help the writing of story of self, add precision and consistency and find new interpretation so as to improve scientific contribution. Anderson (2006) describes the process of reflexive analytics, and Chang (2016) gives detail on the drill down possible in reflective analytics. This is a continuous and deep-searching work-in-progress on my research journey.

2.2.5. Theory Lens

During my research journey, I was introduced to the terminology used in qualitative research, for instance, the conceptual framework or theory lens (Miles and Huberman 1984) which are used as aids in analysis (see sections 1.5.6 and 1.5.7). In business, we use the same types of frameworks in many different domains, including areas of project management, software development or I.T. infrastructure management. A common breakdown that I have used throughout my career to understand business issues is the breakdown of people, processes and technology within the customer value chain (Chen and Popovich 2003) and, as I started to code my own story of self for my research, this also seemed to be a common thread throughout my trusted data story. In business, also, I was a strong user of methodology frameworks in order to implement improvements in business or to maintain standards. Such improvement models included the use of Six Sigma for the improvement of business performance, or the International Standards Organisation (ISO) for establishing and maintaining standards of quality and environment or I.T. security. These frameworks provided much used and tested methods to deliver excellence. For example, when I started my general management role for Unisys in France, I soon invested in the Total Quality Management (Powell 1995) process for improvement of client satisfaction. Total Quality Management was overtaken by ISO 9000 in more recent years, and we used these frameworks throughout the data quality programme.

The methodology of selection of the appropriate lens of analysis for research is just as important as it is for business. The theoretical lens that is chosen should be consistent with my research data and my research aims. Therefore, for my PhD research program, we wanted to find suitable frameworks or theory lens according

to each of the three concepts we were researching within data governance. These concepts for data governance had been identified as being People/Community, Data Process and Technology evolution. We researched theory lens from literature research papers that would best match our case study using the research criteria that would assure consistency with my research:

- Does the literature research paper provide a clear framework or theory lens?
- Are the definitions within the literature research paper similar to the concepts in my data story?
- Is the industry/sector/context similar? Is the scale similar?
- Is the paper published and well cited?
- Do some of the same behaviours and principles emerge?
- Is it a limiting framework, e.g., full scope of data governance, not just, e.g., quality?
- The framework would be relatively simple given that we may need to cross compare, or combine all concepts at a later stage.

We created a matrix (Webster and Watson 2002) using these criteria, and then we chose the most suitable model based on this matrix. An example of one of these matrices is shown in Figure 2-2 below.

Paper	Name	Yr	Cited	Framework	Comments
Pahl et al	A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes	2009	1032	Single Double triple loop learning Adaptive governance Improving Reframing Transforming	Focuses on resources not focus on firm. Framework for analysing adaptive capacity
Jones et al	A general theory of network governance: exchange conditions and social mechanisms	1997	1704	Combine Social context into transaction cost economics Culture Sanction Restricted access Reputation	The focus on role of the participant only
Stoker	Governance as theory, five propositions	1998	3717	Simplifying lens Complex set of institutions Recognising blurring lines Identifies power dependencies Autonomous self giving network of actions Capacity to get things done	Not sure if it's a theory or a framework but valuable paper for my work
Henderson et al	Global production networks and the analysis of economic development	2002	1704	Management structures Value Power Embeddedness	Global Corporate
Provan and Kenis	Modes of network governance, structure, management and effectiveness	2008	2205	Structure Lead organisation Participant Admin organisation Trust, Network Goal Efficiency Vs inclusiveness Internal Vs External Flexibility Vs Stability	Overly Public Admin
Dhanaraj and Parkhe	Orchestrating Innovation Networks	2006	1288	Innovation network Mobility Appropriability Stability	Choice because of simplicity and structure

Figure 2-2 Conceptual lens analysis (Webster and Watson 2002)

Figure 2-2 is the concept centric matrix that I used to choose Dhanaraj and Parkhe (2006) as the analytic lens support for my research on community governance. Use of a conceptual/theory lens to further analyse autoethnography is a well-practiced approach to adding richness to the analysis of qualitative research (Miles and Huberman 1984). It has been used in a number of the autoethnography research papers (Klein and Rowe 2008; O'Riordan 2014; Costello et al. 2016; Chugtai and Myers 2016; Chang 2016). O'Riordan (2014) uses the lens of

established papers on autoethnography to define key output requirements of analysis from autoethnography as being resonance, rich insight, sincerity and contribution. A risk of the use of theoretical lens is, of course, an accurate interpretation of the lens itself. This interpretation must be precise in its elucidation and in its application. The wrong lens or its incorrect interpretation or imprecise explanation will devalue the scientific contribution. As shown in Figure 2-1, at the top layer, the theory lens can help to build on the autoethnographic analysis or create new contributions and, because of the broader context of the theory lens, will allow the research to generalise the theory beyond the case study. In my published paper on community governance, the theory lens helped me to add new contributions to the Dhanaraj and Parkhe (2006) theory lens, including the mobility of the knowledge hub in community governance for data or the importance of cultural behaviour within those communities in order to have effective governance.

As I summarise this part of the chapter, I reflect on how these layers are now woven into autoethnography and how the methodology has evolved over time since its first use to include each layer. When the term 'autoethnography' was first used, Hayano (1982) used his story of self as a professional poker player as his research case. His writing evoked the atmosphere of life in the smokey poker rooms and the hard life on the road. In ethnography, John Van Maanen's Tales of the Field (1988) uses stories of different races of people to give sociological contribution to our understanding of anthropology. As ethnographers, the writers were not members but participated in the research. The stories show the power of storytelling as a contribution to research. Of course, Carolyn Ellis is a major contributor to the methodology since the 1980s, and Ellis (1993), on the death of

her brother, is a strong example of the strength of the emotional introspection and deep insight we can get from reflexive analysis. Ellis uses other data, such as diary notes, surveys and questionnaires, as valid aids in understanding emotional introspection. In Denzin and Lincoln's (1994) Handbook of Qualitative Research, autoethnography is described as using the story of self primarily with the use of other data and, in the same book, Richardson (1994) in "Writing as a Method of Enquiry" discusses how the use of emotional introspection in the words can help give contribution to the research. Snow and Anderson (1993), in their study of homelessness in the United States, used a combination of state statistics and data to complement their own entering into the world of homelessness for periods of time. And so this story builds up over time, when Chugtai and Myers (2016), O'Riordan (2014), Costello et al. (2016), etc., use all layers of analysis to deliver strong research in new sectors. So this analytical analysis methodology is not new, certainly in its separate analytic areas, but its development into a layered framework, as a way to assure precision, consistency and contribution, is new and will encourage new entrants to the research world from practice.

But writing autoethnography is not necessarily obsessed with truth, accuracy or indeed structure, but its focus is on a continuous search for new introspective insight and the refreshing research view through the unique lens of story of self (Ellis et al. 2011). Therefore, it should be understood that the layer framework as shown in Figure 2-1 is woven into this research process of writing, interpreting, analyzing and discovering of the research contributions. Figure 2-3 shows this writing approach where layers of the analytical framework are added during the research process as a continuous development of precision in the research, of checking for consistency between levels of data and of measuring contribution.

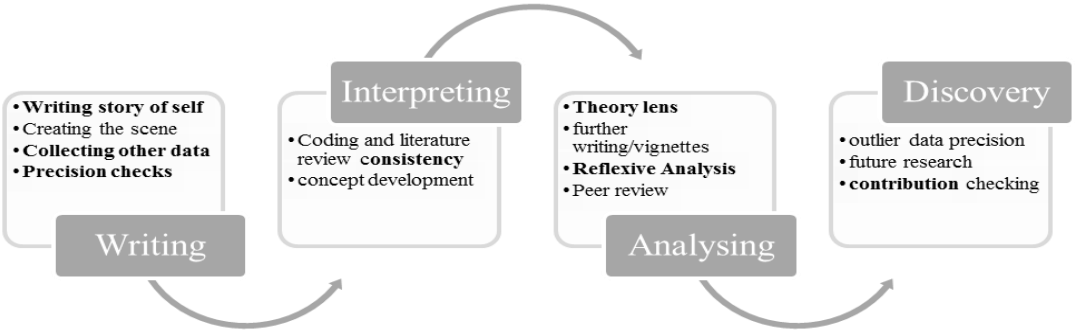

Figure 2-3 The cycle of writing autoethnography using the layer approach

The layer analytical model I have described is drawn across the writing process along with the other research tools such as coding, literature reviews, etc; however, its completeness as a layered approach for autoethnography assures its scientific value. It does not need to be in any sequence of use or stage as long as the foundation of the story of self is primary and the layers can be drawn upon to improve precision and consistency as the research is completed. It is repeated often as new research concepts are discovered in the writing and new data or insights need to be interpreted and analysed. I have used this approach throughout my PhD. In the next part of the chapter, I will explain and show how I have used this iterative process incorporating my layer framework in my writing. This will take you through my data collection stage and my writing of completed research papers.

2.3. My writing story

2.3.1. Starting out with initial data collection

My story of self started with an interview of myself which involved a recorded detail discussion with my research supervisors on the detail behind my experience. It involved a number of deep and long conversations to help me start my research. I transcribed this interview and then started to write my story. I used tools like mind maps and longitudinal mapping to analyse and clarify my reflections. Then, as I developed the writing of my story of self, I could reflect on these analyses and I was able to experience the creative analytic process that Denzin and Lincoln (1994), Richardson (1994) and Ellis (1991) had so described. As I completed vignettes or epiphanies (Ellis et al. 2011) within my story, I realised I needed to have some "refresh" in certain areas of my research data. Many of my stories were situational, descriptive, sometimes serious and sometimes funny. I needed to describe how I, as a research member, related to other members and how we discussed and made decisions. I described the language we spoke. I drew on many experiences throughout my life to understand these, including, for example, the milking of cows (while singing) with my father, and how this helped me speak and understand the community language. As you will see in a later paper, I used some of this language, too, and this can be a challenge.

After some time, I drew on my network within the governance of Irish food and completed a number of recorded interviews, which were transcribed, and I used these interviews to clarify the analysis already completed. I already had access to work notes over the full period of the research study, and so I organised these and

made them ready. These are also analysed, and the data for my research, therefore, can be made more precise and consistent using these reference points. The coding used during this analysis indicated to me that there were three major elements to the governance programme story that I was telling – namely, a) the community in which the food data is collected, b) the processes that were used to build the governance and c) the governance of I.T. decision-making over the life of the research. This simple breakdown of the programme from coding was a common technique both in the businesses that I had worked in and in academic literature, e.g., Chen and Popovich (2003). Therefore, interpretation and analysis of my story was happening at this early stage. Yes, it was basic; yes, it was simple. In my world, interpretive analysis is better that way. It simply pointed the way forward for my research.

My first literature review area was focused on the methodology of autoethnography. We wanted to be sure that autoethnography is an appropriate methodology to use and that it would allow my research to sustain the course of data collection, interpretation, analysis and contribution. Much of what we have written in this chapter came from this initial research, but we have added to it over time as new queries arose from peer reviews or further analysis of our work. We were happy back then that the literature supported our autoethnography research methodology and that it was the best approach to our research.

The great advantage from a researcher's point of view is that we already have much of the data collection work at hand. The great advantage for science was that previous academic research could be enhanced by this first-hand experienced knowledge, and this research methodology was sought out in the I.S. sector (Myers 1997). I was comforted to understand and believe that probably no one

else in the world could bring this perspective on building trusted data by means of the combined practitioner/academic methodology. Also, I had a committed and strong personal relationship to my research purpose and potential outcome which allowed me to think deeply on its constituent concepts and bring new meaning through introspective writing. So, I was self-motivated to work hard as all researchers do, night and day. I had the other data and support to interpret my writing, and we were confident of offering new insight to my research area.

With my story of self, I had developed the concept of breakdown of governance between people, process and technology. My analysis indicated to me that research was needed in these areas of governance, and I felt that by cross analysis of my research at a later stage, I could make a valuable contribution to the science of governance of trusted data. I had an approach, I had the data and I had a research plan.

2.3.2. Writing my first concept published paper

Our first paper was on the community of governance of food traceability, and it was published in a well- known journal – but after rework (Costello et al. 2016). The choice of paper was a direct product of the analysis of our initial interviews and was entitled: ‘‘On the road to trusted data: An autoethnography of community governance and decision-making’’. The analysis from our initial writing continued as we “peeled back the onion” on the analysis of the community governance process that was my story. The analysis included a breakdown of the community into all its stakeholders, and we coded them into seven groups. We then used existing research on community governance from Dhanaraj and Parkhe (2006) as a conceptual lens (Miles et al 1984) since we believed that our research

would add to the Dhanaraj and Parkhe (2006) framework for orchestrating innovative networks and also allow us to add further contribution from our research. The paper achieved strong research results and recommended significant new learning to existing research; and it has now been published after rework from peer review. Key findings of the initial reviews in relation to methodology were valuable lessons on publishing my paper, including recommendations for rework such as:

- We needed to organise the paper to look more scientific.
- We should refrain from personal statements until after the methodology is explained.
- Personal statements should serve a definitive purpose.
- We should evaluate why I held views as I did within the autoethnography.

Our paper was published along with a practitioner paper authored by me in the same journal. But we could see from this feedback the importance within the use of autoethnographic methodology of complete explanation so that personal reflections can be fully interpreted as intended. Also, we faced up to the challenges of sometimes making this research look scientific. This was valuable feedback that allowed me to publish following rework. It also developed my thinking of the analytical layer approach to this methodology as developed in this chapter.

2.3.3. Writing my second paper

In my next article, not yet published, I submitted an initial paper to an international I.S. conference at the early stages of my research – and I got rejected! I had written this paper a bit differently. I added new data by writing

vignettes that highlighted my experience in data process within data governance. The use of vignettes is a useful form of deeper analysis, and it got my data closer to the culture, behaviour, decisions and action of governance. The focus was on the governance of the data process, the second concept from my initial analysis. So, language was important but once again use of language and personal statements were criticized in the peer-review process. I was disappointed because I wrote it in the language of my community, with its slang and sometimes informal vocabulary.

These paragraphs illustrate the type of language I used. I considered: "How could they throw out my experiential rant? I worked hard for that! After all, my methodology was autoethnography – a study of self, born from the qualitative methodology and a sub-genre of ethnography. The value proposition of the methodology is that the research is done from the unique emotional and evocative story of self in relation to the research topic. So, I can use my own way of speaking? Right? After all, an important part of the methodology is the way it is written, close to autobiography as criticised by the "quant"/ "positivists" guys, or journalism as it is sometimes likened to (Denzin and Lincoln 1994). So, in other words, tell your own story in your own way as it really is (Richardson 1994). Of course, it needed rigour, triangulation, work notes and use of vignettes (Anderson 2006; Denzin 2006; Myers 1997; Ellis 2011), and I included all of these in the paper. However, three of the four reviewers rejected it. But why? Well, some of them didn't like my emotional and evocative language. I used expressions from my story like "burping and farting" (in the science context), "it was cool", and I used "post-positivist" words like "should" or "probably". BANG! I got shot down on my use of those words. "He should use more scientific words", the

reviewers stated. Lesson number one from this review: Bad or non-purposeful language is not a method of enquiry (Richardson 1994), though hermeneutics – the art of interpreting texts – is a valid analysis methodology (Denzin and Lincoln 1994).

Some of them didn't like the story of "self". They thought that the history of myself was irrelevant to the research! I guess the relevance was that the author was a 30-year veteran, an expert in the same subject and lived through the governance of the programmes from which the data is collected! Why is that irrelevant? Lesson number two from this review: Don't leave interpretation to chance. The reviewers pointed me in the direction of an action research paper to learn about the rigour of qualitative research. They directed me to "An assessment of the Scientific Merits of Action Research" (Susman and Evered 1978), and I investigated this approach as part of this chapter. I have found it useful in understanding methodological comparisons, and it gives me further confidence in autoethnography as a methodology compared to action research and more traditional research topics which have their doubters, too.

I have used some "slang" and other language of culture in my writing to be consistent with the culture in which I have experienced the research data and to be more precise in the description of how I have worked. I believe that this is acceptable as a contribution to the overall methodology, like, for example, the acting or poetic approach used by Spry (2001). However, this feedback is also useful, and much of the reviewer comments have been used to strengthen this paper which is an autoethnography of the data governance process – and which is now under review for publication in a significant I.S. journal.

2.3.4. Writing my third paper

My most recent article is a completed research paper on the governance of evolving a technology solution for trusted data. Once again, I was able to use the initial data collected but also brought in more of the interview "other data" that resulted in an important perspective. This paper is also under review with the initial rework recommendations that were made to me falling into three categories – namely, precision, consistency and contribution. I have now reworked this paper and resubmitted it to this tier one Information Systems journal. These three points of criticism in relation to my autoethnographic methodology are along the lines of the following:

Precision: The main challenge on precision, according to the reviewers, was that I needed to be precise in how I define my reflections when I use a theoretical lens to analyse – in other words, the match between my reflection and definition in a framework. This is a similar point to that made in my first paper to evaluate exactly how I held views at the time of the autoethnographic story. Words, such as precision and sharpness, were used by the reviewers to show how sometimes the emotional and evocative story may need scientific precision.

Consistency: In relation to methodology, the point of consistency relates to the consistency required between data collection, data management, interpretation and analysis. I have shown within my layer framework how consistency should be enhanced between levels.

Contribution: Relates to my opening point in this part that I must be focused on the science to which I can inform. If I am targeted, for instance, at the technology reader, then my food traceability specifics were less relevant in my story.

This output from the latest review with this journal has caused me to develop the autoethnography layer approach as I have outlined in this chapter and to review the contribution of each layer to the three elements of precision, consistency and contribution. This has been immensely valuable feedback for me and has improved my discipline in writing for all my research.

2.4. Summary, conclusions and recommendations

I chose autoethnography as a research methodology because I can contribute from a unique and personal insight from what I have experienced. I must apply rigor to my research, and I must respect the scholarly requirements of academic research, similar to Duncan (2004) and the many recent papers using the methodology. I must also challenge the review process and defend the methodology. I have also discussed the peer-review feedback. I acknowledge that I have received valuable feedback from these peer-review processes; I have learned from them and they have helped in writing new autoethnographic work which we have completed since then. From the comparison of methodologies, we can see that all have differences and similarities – and strengths and weaknesses. However, the basics of scientific research must apply to all methodologies, including the precision, consistency and contribution that the research must achieve. Where this is achieved and autoethnography is suited to the research topic, then it is a valuable research methodology offering new and unique scientific value. It is beneficial if peer reviewers are aware and somewhat understand the autoethnographic methodology and its application when they review this kind of work.

2.4.1. Practical lessons learned

This point is further illustrated in the following comparison between prior literature and that of my own experience. In Table 2-2 below, I compare key learnings from literature with those which we have learned from our own writing.

What the Literature says	What I have learned
Writing is a form of enquiry, and autoethnography through its emotional and evocative style brings insight that other research methods do not offer (Moustakas 1961; Richardson 1994; Ellis, 1991).	Yes. Autoethnography and the creative writing style give unique insight, but ability to manage data, interpret and analyse it must also make a contribution to the research.
Emotional, evocative, introspective writing is a form of interpretation and analysis (Ellis et al. 2011; Denzin and Lincoln 1994).	Yes. However, doing so in a way that might seem informal or "non-scientific" may compromise its consistency and precision and detract from its contribution. Language should be purposeful, and its interpretation should be within the writing and not left to the reader.
Evolution of data analysis techniques and tools helps the scientific research contribution of autoethnography (Chugtai and Myers 2016; Chang 2016).	Yes. It is not a fairytale. The data management, analysis and interpretation develop the inquiry for the research. Tools, such as transcription, mapping data, vignettes and use of lens, all evoke the inquiry in such a way that the contribution is rich, consistent and precise.
Autoethnography attracts the practitioner (Klein and Rowe 2008; O'Riordan 2014).	This is true, but a side effect is that the academic cohort will challenge the science vigorously and, as a result, it must meet academic requirements.
Autoethnography is a lazy approach to analysis; it is too artful and it short cuts data collection (Delamont 2007).	Our experience is that the systems of scientific research have strong review processes with built-in checks and balances. The proximity of data provides an advantage, but this is offset by the additional work that is required to deliver precision in the data, consistency in the story and contribution to scientific research.
Greater depth of insight (Reed-Danahay 1997)	We do not believe that any other research methodology will give the same insight into governance of system build like our autoethnographic research.
Ethical challenges (Ellis 2007)	There are, indeed, some ethical challenges with protection of information in autoethnography. But the researcher has the ability to manage and avoid these ethical pitfalls though anonymization or blind review of such areas.

Table 2-2 Comparison of literature and lessons learned

2.4.2. An Autoethnographic work cycle

From our experience, we know that the writing process for autoethnography follows a gradual cycle of development. This is shown throughout literature and from our own experience as detailed above. Confidence in our research has enabled us to develop a cycle with a rhythm or cadence of research that ensures the progress of research. The experienced research cycle is illustrated in Figure 2-3.

2.4.3. A Layer Framework for development of precision, consistency and contribution

One particular challenge with the autoethnographic methodology is to achieve the right balance between the writing of self-experience and the other levels of rigour required for scientific contribution. To attain this balance, we have proposed a new model to support autoethnographic research. This model uses the five layers of analytic rigour as shown in Figure 2-1 of this chapter, and also applies the challenge of precision, consistency and contribution of the analysis. Figure 2-1 is the illustration of this proposed model, showing how these layers will ensure strong scientific outcomes for the research.

This model combines the learnings of literature with our experienced understanding of writing this methodology. The model can, and should, be debated and criticised. As it is interpreted, it does not have to be single directional either in steps of process or in time, but it should be interpreted in its completeness. It offers multiple voices to the story of self that add value at every level (Winkler, 2017). At its apex, with all levels completed, it will ensure scientific contribution research from the individual to the theory.

Finally, the blending of academic research with practitioner experience offers great potential to new scientific discovery in new methodologies, with new participants, and from new sectors. The potential benefits to academic research can be great as a result of its new contributions to scientific research. We recommend a continuous refinement of this methodology using our framework and others as a platform to multiply its research use. Hey, practitioners and engaged scholars, come, enter, discover, research and teach us new things!

2.5. References

All references in the published or peer reviewed papers are now consolidated in Chapter 7.

3. CHAPTER 3 – ON THE ROAD TO TRUSTED DATA: AN AUTOETHNOGRAPHY OF COMMUNITY GOVERNANCE AND DECISION MAKING

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Paper Summary Chapter 3- Community Governance Title On the road to trusted data: an autoethnography of community governance and decision-making			
Peer review	Analysis Method	Key Data	Key contribution
IFIP conference 2016 Journal of Decision systems 2016	Autoethnography and analysis through the lens of Dhanaraj and Parkhe (2006)	Insight into the collaboration within the data community to deliver and use data	Industry and cultural knowledge and skills Cultural behaviours Leadership in hub role

Table 3-1 Paper summary

Note: Some sections of the published paper, have been removed from this chapter since they repeat the relevant sections in Chapters 1, and 2 related to general introduction and methodology *These are noted in italics*.

Abstract

This paper is an autoethnographic account of the governance of a large decision-making community responsible for the data requirements for the Irish Agri-food industry. The primary author was the leader in a major stakeholder organization within this decision making programme. The programme is currently used to underpin the regulatory compliance, quality, and sustainability of Irish food. The programme is recognised worldwide as innovative and the data is trusted at national and international levels by all members of the community. The decision making process for this programme was complex with many stakeholders and diverse interests. The paper reflects upon and analyses the key concepts emerging from this personal study and triangulates the reflections and analysis to the key network orchestration activities outlined by Dhanaraj and Parkhe (2006), namely, knowledge mobility, appropriability and network stability. Key points emerge from these reflections, with some new insights arising from the autoethnographic account which imply the need for future research.

Keywords: Decision Making, Community Governance, Trusted Data, Data Lifecycle, Network Broker, Autoethnography, Self-Reflection.

On the Road to Trusted Data: An Autoethnography of Community Governance and Decision Making

3.1. Introduction

Note: Since this is a thesis by publication, the case introduction in each separate paper is now included in Chapter 1 of this thesis.

This paper begins with a discussion of autoethnography as a method. This is followed by a brief discussion of the community governance context focusing on the work of Dhanaraj and Parkhe (2006). We then present the autoethnographic narrative, the analysis and reflection upon this narrative, and a triangulation of the key findings with Dhanaraj and Parkhe‘s (2006) work on innovation networks. We conclude with the contribution of the study to our understanding of the decision making and governance processes in large communities, and implications for future research

3.2. Methodology

Detail on methodology in the published article is included in Chapter 1, Section 1.5 and Chapter 2 of this thesis.

3.2.1. Analytic lens: Community governance

In section 1.5.6, I have explained the use of concept lens to ground the research. Dhanaraj and Parkhe’s (2006) framework of network orchestration was identified as a relevant and appropriate “current understanding” of governance in large decision making communities to use as the lens to support analysis in this paper.

Dhanaraj and Parkhe (2006) put forward a framework for evaluating effective governance in innovation networks. They specify the role of the hub firm as having three key roles in the orchestration of networks. The innovation networks which are examined by Dhanaraj and Parkhe (2006) offer an excellent parallel to the current study because of the way the community had to operate in order to create the data lifecycle and the resulting trusted data. Dhanaraj and Parkhe (2006) identify three orchestration processes that a hub firm must perform. These are managing knowledge mobility, innovation appropriability, and network stability.

- ***Mobility*** is defined as the process with which knowledge is shared, acquired and deployed within the network.
- ***Appropriability*** looks at the ability of the network to capture the profits from the innovation. The hub firm should understand the motivation of network members so that there is no attempt to cheat or leak to competing networks.
- ***Stability*** of the network refers to the ability of the network to sustain mobility within and without the network so that roles can change within and actors can come in and out of the network while it continues to go about its business.

Dhanaraj and Parkhe's (2006) framework thus provides us with the underlying research questions behind this autoethnographic account, namely "How did we achieve mobility, appropriability and stability in our network?" and "What are the learnings arising from this comparison?"

3.3. Autoethnographic narrative (my story)

My background and the story of my company, SouthWestern, and its relevance for this study that was included in the published article, is now included in Chapter 1 of this thesis.

3.4. On the road to trusted data

3.4.1. Timelines overview

The evolution of the brand of Irish food from regulatory compliance through to differentiation as a premium brand occurred over a 20 year period and will continue to improve in the future. In the Table 3-2 below I have coded some key phases in this evolution. Each phase accomplished new data sets.

Phase 1: In Phase 1, the animal identification national database was set-up by my firm and this database produced the datasets of land parcels, herd numbers, animal tag number and other unique data sets that identified animal and animal movements. Every farmer had to comply under government legislation. The data accuracy and completeness improved over time. The I.T. systems that we developed also became sophisticated including strong analytic capability used primarily to track compliance with regulation. Since the implementation of the system, we have done many upgrades - and external challenges have occurred, including the outbreak of foot and mouth disease in 2001. The national database and traceability system was the national control at this important time

Phase 2: I have defined Phase 2 as the introduction of the Bord Bia Quality assurance scheme. This scheme added in previously unknown data on the quality

of animal farming that exists inside the farmer's gate. SouthWestern was the chosen service provider for this phase also and I led the design of the new technologies requirements and a new process for collecting data from every participating farm. This scheme was voluntary to the farmer, but funded by the Irish Department of Agriculture. Over time, the meat markets paid extra for food certified under this programme and participation by farmers is very high.

Phase 3: This phase is the addition of a sustainability measure to the previous data sets .Once again, as leader in SouthWestern I led the design of this complex people- process-technology solution. The strategic goal is to show how Ireland's food is produced mostly on open grassland and in an environmentally friendly way. Some of the data could be calculated by previously collected data sets from the prior phases and other data points could be extrapolated for this by using equations developed by Teagasc, the national food science agency. Other data still needed to be collected inside the farm gate and these data requirement formats were added to the onsite questionnaire. This is an innovative solution and I take great pride in leading the consortium from the large community involved to offer a workable solution to this challenge. It has been a huge success.

Phase 3a was the same as phase 3 but added in dairy farms which represented a 100% growth in the size of the programme. This phase was driven by the needs of premium markets for environmentally friendly food sources. The dairy marketing board (Irish Dairy Board) is not governed by the Bord Bia government agency; instead, it is owned directly by the Irish co-ops. It is a co-op of co-ops! As phase 3 was progressing, I worked extensively with the Irish Dairy Board on the concept of introducing this Quality and Sustainability scheme into the Dairy Industry. We brokered a new solution which is now in full operation.

This programme timeline including scope, strategic drivers and data analysed, is summarised in Table 3-2:

Phase	Activity	Scope	Dates	Strategic Driver	Data Sets
1	Traceability	Bovine first then all livestock, all farms (140000 approx.)	1995	• EU Directive • Protect food chain	• Land • Herd No • Tag No • Birth • Movement
2	Quality Assurance	Mostly beef and lamb Approx. 20000 on farm audits Per annum	2005	• Government initiative to improve Quality of food production	• Audit of Farm methods • Husbandry • Medicine • Record keeping • Cleanliness
3	Sustainability	All Meat Types Same as 2 but greater adoption approx. 30000 on farm audits)	2010	• Markets driving need for Environment friendly. • Competition from emerging markets	• Environmental Information on farm including • Fertiliser use • Slurry • Energy used • Outdoor/grass time
3 (a)	Sustainability (dairy	Same as 3 plus 30000 dairy farms	2014	• New Markets • China and USA • Pride • Better price	• As in 3, except for Dairy with appropriate new data sets: e.g., parlour cleanliness

Table 3-2 programme timeline

3.4.2. Challenges and implementation Process

Each phase above required its own implementation process or sub-phasings. At a very simple level, these sub-phasing were as shown in Figure 3-1:

Figure 3-1 Delivery sub-phasing

As CEO of SouthWestern I led the decision making in each stage of this programme and also through the external challenges and events that influenced the programme over the 20-year period. Given this significant change-management program and its complexities, it was made all the more complex because of the large communities involved, as is seen in the next section below.

3.4.3. Communities involved

A particularly challenging aspect of this data programme was the large number of people who participated in or are in some way involved in the gathering and analysis of the data required to run the programme. In order to complete a full data set, have it ratified by the competent authorities and get buy-in from all community participants, the involvement of the complete agri-food commercial ecosystem was required. A full list is in Table 3-3 below.

Group	Role Code	Role	Strategic Intent	Phase
European Parliament	Legal and Government	• EU Directive on traceability of food 1996	• Protect EU food chain • Animal disease control	Phase 1
Irish Department of Agriculture	Legal and Government	• Implement EU directive • Support and drive performance of Irish food production as a major industry	• Protect Irish food chain • Improve Irish Farming • Support a major industry	Phase 1, 2 and 3
Agri 2020 and Origin Green	Legal and Government	• Strategic Planning body set-up under Department of Agriculture to set the future of Irish Agriculture	• Set the Future of Irish Agriculture with Premium Branding, Access to top markets based on optimum production system	Phase 1
Bord Bia	Legal and Government	• Irish Food Marketing Board, Agency of Department of Ag	• Increase value of Irish food brand	Phase 2, and 3
Teagasc	Science/ Benchmark	• Irish food science Agency	• Optimise food production through science expertise	Phase 3
ISO, NSAI, INAB	Science/ Standard/ Benchmark	• International Standards Organisation • National Standards Authority of Ireland • Irish National Audit Bureau	• International Quality Standards and their implementation in Ireland	Phase 2 & 3
Carbon Trust	Science/ benchmark	• Global agency for Carbon Measurement	• Benchmark and approve Carbon measurement systems	
Irish Dairy Board	Farmer Representatio	• Irish Dairy food Coop	• Market Irish Dairy product like Kerrygold	Phase 3

	n			
IFA & ICMSA	Farmer Representation	• Irish Farmers Association and Irish Creamery Milk Suppliers association • Farmer representative bodies	• Protect the Interest of the farmer	All
SWS (SouthWestern Services)	Service Provider	• Design support, co-ordination and accountability for all phases of operation	• Commercial agreement	Phase 1, 2, 3 and future
Meat Plants (Several in Ireland)	Industry Supplier	• Buy Livestock from Farmers • Agreed to incentivise Farmers for Phase 2	• High Quality Product. The higher the Quality the better the price	Phase 2
Milk co-ops, Dairy Food producers	Industry Supplier	• To move away from self-assessment of Quality and sustainability and adopt the National scheme implemented in 2014	• Improve Quality of produce • Develop Premium Branding of Irish produce	Phase 3 a
Supermarkets	Retail & Consumer	• E.g. Sainsbury's, Marks & Spencer's	• Major Buying Power • Can dictate Buying standards	

Consumer	Retail & Consumer	• Pay for and Eat the Food	• Best Quality at Best Price • Health Awareness • Environmental Awareness	All

Table 3-3 Community participants

I have coded this list into 6 distinct categories or clusters as follows:

Legal and government: The original legislation for food identification was developed as an EU directive through the European Parliament. As an EU directive, each government was required to pass legislation in the state requiring full identification of the food source. This was the starting point of Phase 1. The Department of Agriculture in Ireland is a senior government ministry position, due to the important role Agriculture plays in the Irish Economy. As a result, it is well funded and well run. The Department of Agriculture also includes a number of agencies to support its charter. One of these, An Bord Bia, is responsible for the marketing of Irish food produce and its remit is as follows: "the functions of the Board shall be to promote, assist and develop in any manner which the Board considers necessary or desirable the marketing of Irish food and livestock and the production, marketing and consumption of horticultural product" (www.bordbia.ie). As part of this charter, An Bord Bia has developed the brands of "Origin Green" and "the Bord Bia Quality assurance Mark". These brands were developed within the strategic planning process of the department of agriculture. The brands are underpinned by this whole case study i.e. the traceability, quality assurance and environmental assurance of all food production in the state. As a key stakeholder in this programme, I worked extensively with the government

department and its agencies, though procurement dialogue forums, in order to optimise the research for solutions, and the eventual decisions that were made to meet their requirements.

Science and Benchmark: In order to support the programmes implemented through the legal and government directives, any solutions provided would need to stand up to the most rigorous scientific testing, and be recognized at a Global level for its standards in delivery. As a result I built strong relationships with the best scientific and benchmarking bodies that were appropriate to our solution. The organisations included ***Teagasc, Carbon Trust and the Irish National Accreditation Board (INAB)***. ***Teagasc*** is the agriculture and food development authority in Ireland. Its mission is to support science-based innovation in the agri-food sector and the broader bio economy that will underpin profitability, competitiveness and sustainability. (www.Teagasc.ie). The ***Carbon Trust*** is a globally recognized authority on carbon management. "The Carbon Trust's mission is to accelerate the move to a sustainable, low carbon economy. They are independent experts on carbon reduction and resource efficiency……" (www.carbontrust.com). ***The Irish National Accreditation Board (INAB)*** is the national body with responsibility for the accreditation of laboratories, certification bodies and inspection bodies. It provides accreditation in accordance with the relevant International Organisation for Standardisation ISO 17000 series of standards and guides and the harmonised EN 45000 series of European standards.

These three organisations were the principal advisors to that data model and data collection process designed within sub-phase 2 of the model. In addition the ICBF (Irish Cattle Breeding Federation), Animal Health Ireland and other expert groups supported each phase. I led the SouthWestern team in building relationship with

these stakeholders and built collaboration forums in order to design solutions and decide on the optimum architecture for the national systems.

Farmer: But of course, there's the Farmer! Phase 3 of this programme is the first known in the world to efficiently and comprehensively measure sustainability data inside the farm gate. (Source: Carbon Trust). Of course the farmer is the source of the data for every phase of the programme. The farmers in Ireland are represented by a number of co-op movements, representative bodies and unions. The IFA (Irish Farmer's Association) is the largest farmer representation body in the state. It supports the cultural, financial, welfare and professional interests of over 88,000 farmers. If you want to do anything with farmers in Ireland, you need the support of the IFA. In addition to the IFA, there are other important co-ops, or associations including the Irish Dairy Board (a farmer owned co-op responsible for dairy product marketing) and the ICMSA (Irish Creamery Milk Suppliers Association), representing specific interests of dairy farmers.

The farmer is critical in this programme. Of course farmers are not all created equal either! There are big farmers, small farmers, farm managers, part-time farmers, mixed farmers, single-produce farms, and just about every other kind included in the mix. Farms are almost always family-run businesses, with a deep cultural heritage, and belief in their land. They are a very strongly aligned cultural group and protect their interests very well. Working with the farming community is a great honour and a pleasure. They have great pride in what they do; in addition, they are friendly, welcoming and appreciative of supporting systems. If you are honest and open working with them, they will embrace you. If you are not, they will not work with you at all. Trust is sacrosanct in this environment. It was an important part of my work to build and manage strong relationships with

this group. I did this easily not only because of my own background, but also because of our passion for working within this sector.

Service providers: SouthWestern is now a regional leader with contracts in Ireland, Northern Ireland and the UK. Southwestern have been involved in Agriculture services since 1957, and in data processing of Agriculture information since the mid-1990s. I am proud to have led these developments over the past 14 years. There are other service providers in this sector, but SouthWestern is by far the largest and most experienced in the field of data processing for Agriculture. As a result SouthWestern have been the solution provider of choice for all phases to date in these programmes.

Industry suppliers: These are the groups who buy the produce from the farmers. They include dairy-processing companies in Ireland such as Glanbia, Kerry, Dairygold, and international food producers who use Irish Dairy produce such as Danone and Nestle. The industry suppliers also include the meat producers such as Slaney Meats and Dawn Meats. These companies were keen to work with the retailers and to satisfy consumer demands for higher-quality and well-branded food sources. In the case of Phase 2 (Table 3-2), i.e. the first quality improvement initiative, the meat producers agreed over time to give higher pricing for quality-assured product under the new scheme. As dairy produce was introduced into the

Figure 3-2 Visit by Chinese premier to a quality assured farm

programme in 2013, up until that point, the dairy producers had been "self-assessing" quality standards and did not have a sustainability measure. They "handed over" the quality and sustainability to this independent programme and therefore built systematic trust into the assurance of their product. This also helped them significantly in the opening of infant milk formula exports to the Chinese market, now a now major market for Ireland (Figure 3-2). We worked with the industry suppliers to understand their requirements and they in turn provided valuable input for my company to be able to provide strong solutions to the programme.

Retailers & consumers: The major retail chains in the UK and Ireland were big influencers on the way the original programme solution was run. Retail companies such as Sainsbury's, Marks & Spencer, Tesco, all had significant carbon reduction programmes. However this could only cover areas such as their supply chain, packaging, facility management and other enclosed areas. They used the Carbon Trust to help them achieve these reductions and we in SouthWestern knew this through our collaboration with the retailers and consumer groups. This is what led us to the Carbon Trust, and when I introduced them to the solution they brought a trusted element to the calculations and scope that was eventually defined within our proposal process. The food retailers had conducted widespread consumer market studies to understand the needs of the consumer and these market studies also informed the design of the solution. There is a growing need for more socially and environmentally produced food. This need was the main driver of the traceability movement, the Quality Assured programmes and the sustainability programme which was now branded as "Origin Green". Similarly, the Irish marketing boards such as Bord Bia and the Irish Dairy Board understood the fast

growth of middle classes in the developing world, especially in China, India and even now in parts of Africa. This meant that diets were starting to move also to western-style, protein-rich diets. This created massive attraction for the Irish food industry. The consumer is demanding…. and the Irish food industry is responding! I was delighted to be a key partner in this team!

3.5. Community governance and network organisation

In this large community, the people did not all exist in any one company, physical location, or organisation. It involved people from every part of the agriculture and food community. Respect for people was paramount in building the trust to propose and deliver a workable solution at each phase.

The effectiveness of the network governance was based on strong leadership at every stage in the process. Leadership was displayed by every organisation

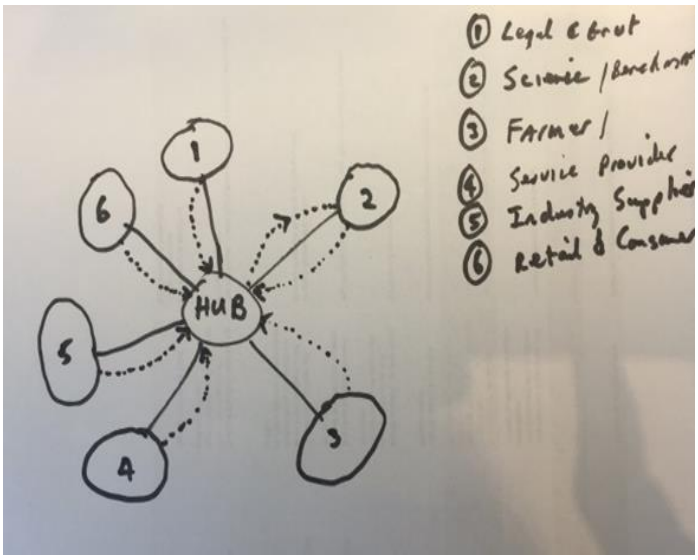

Figure 3-3 Hub and network mobility

throughout this time. Of course it is also the case that every organisation must follow this leadership throughout. To make this possible the leadership worked in a sort-of "hub and spoke" manner where particular organisations within the Network would need to assume Leadership for the overall solution- and others would need to follow.

When the process would move onto a different phase, or sub phase then another organisation within the network would need to assume the leadership or hub role. This movement of hub role according to knowledge and phase, allowed for the long-term stability of the network. The leader (hub) needed to not only lead the direction of the sub-phase, but also broker the roles between actors, and ensure the long term stability of the network. This dynamic is illustrated Figure 3-3. An example of this working was when we in SouthWestern very invited to tender by the government agency involved. The government agency was the "hub" leader

during this procurement phase. However, as the solution was being developed, the government agency did not lead but my team in SouthWestern took the leadership role with all stakeholders to develop the complete solution. This hand-off was well coordinated because of the relationships and trust I had built with the government agencies and all stakeholders. As I moved SouthWestern to the hub leadership position, the community network responded with positive support at all times.

The nature of the role in the "spoke" would also change throughout the programme. So for example at the early stage of the quality assurance programme service providers-including SouthWestern-would participate in a "competitive dialogue" with the government agencies involved. This dialogue focused on the type of legal or standard framework the government was considering and how potentially it "could" be delivered on the ground. So SouthWestern's role in this case was to advise as a potential expert. At the next stage, where proposals were invited, SouthWestern needed to lead the network in order to build the solutions and get buy-in from all stake-holders. Our roles continue to change throughout the various stages and also even within the stages. This role changing was sometimes "explicit" because of the role of the organisation or actor, but often implicit because of the competitive advantage shown by the skill of the organisation. Examples of these "explicit" roles were as follows:

- The government makes legislation and enforces it.
- The farmer has the data and owns it.

These roles were a "given". We all knew our place. No other group within the network could assume these roles even if we would have wanted to. There is only one source of legislation and one source of this data i.e. there is no competition.

"Implicit Roles": The implicit roles were based on the expertise that each member of the network could bring to the table. Examples of this were as follows:

- SouthWestern are an expert in data processing in the field of agriculture
- Teagasc is an expert on agriculture and food science
- Sainsbury's is a leading UK-based food retailer and an expert on the needs of the consumers.

For these implicit roles, there is competition at every level. So how does the Network hold itself together and avoid knowledge going to competitive networks? If any of the stakeholders fail, the overall programme will fail. Managing this network is a critical skill, in which SouthWestern excelled (the government agencies excelled also). This network is very strong today, just as it has been over the twenty years. The next section analyses this management in terms of the orchestration processes discussed in Dhanaraj and Parkhe (2006).

3.6. Analysis of my story

3.6.1. Knowledge mobility

Figure 3-3 illustrates knowledge mobility throughout the sub-phases of Traceability, Quality Assurance and Sustainability. In the traceability Phase 1, Table 3-4 shows my perspective on how there was little involvement of the industry suppliers and therefore fewer actors.

Stages/Stakeholders sub groups	**Stage 1 Government**	**Stage 2 Proposals**	**Stage 3 Implementation**	**Stage 4 Monitor and Improve**
Legal & Government	Leader	Decision Maker	Observe	Legislator
Farmer	Expertise	Expertise	Provide Data	Decision maker
Service Provider	Expertise	Leader	Leader	Leader

Table 3-4 Phase 1 knowledge mobility by sub-phase

In Phases 2 and 3, the government agency reacted to the consumer demands. My relationships across the community were invaluable in participating in this community and I have presented the role played in Table 3-4. The full eco-system was involved in the programme to some extent, but the roles changed during the sub-phasing of the programmes as shown in Table 3-5.

Stages/ Stakeholders sub groups	Stage 1 Government	Stage 2 Proposals	Stage 3 Implementation	Stage 4 Monitor and Improve
Legal & Government	Leader	Decision Maker	Observe	Decision Maker
Science & Benchmark	Expertise	Expertise	Expertise	Expertise
Farmer	Expertise	Expertise	Provide Data	Leader
Service Provider	Expertise	Leader	Leader	Expertise
Industry Supplier	Expertise	Expertise	Facilitate	Expertise
Retail and Consumer	Expertise Advisor	Expertise	Market	Expertise

Table 3-5 Phases 2 and 3 knowledge mobility by sub-phase

3.6.2. Appropriability

Dealing with cultural appropriability first; Was I, as CEO of SouthWestern, responsible for the success of these schemes? Of course I was not! We were a team of teams! Every team member within SouthWestern and within the large network was a part of creating this programme, which because of its success is greater than the sum of all these parts. The reputation of Irish food in the world today is premium and much of our produce now fetches premium pricing in the market. Food exports from these programmes are growing fast from €8bn just three years ago to €11m in 2015 and predicted to be €20bn by 2020. The farmers

take great pride in this success, and so do all of the stakeholders in every other part of the network. It would be arrogant and wrong for any one part of the network to claim credit and if that were to happen, it would likely breach the trust within the Network. In terms of economic appropriability, each part of the value chain works for a different incentive as illustrated in Table 3-6:

	Incentive 1	**Incentive 2**	**Incentive 3**
Legal & Government	Civic Duty	Protect the citizen	Promote Ireland
Science/Benchmark	Civic Duty	Create/Invent	Pride in Culture
Farmer	Financial Benefit	Pride in Produce	Minimise Bureaucracy
Service Provider	Financial Benefit	Effectiveness/efficiency	Sustainability
Industry Suppliers	Market Growth	Efficiency	Innovation
Retail & Consumer	Better food	Price	Pride in Culture

Table 3-6 Stakeholders incentives

Each part of the network continues to contribute to this programme over time. Participation rate of Farmers is very high at 100% on Phase 1, though this is mandatory, but is still over 80% on phases 2 and 3. It has been important for us as a sometimes-leader in the network to have knowledge and recognise the incentives and contributions of each part of the network.

An illustration of this dynamic is my reflection of my meeting with another key stakeholder, the farmer. I was at an important point in time in the development of the carbon solution in phase 3 and I needed to invite the leadership of the Irish Farmers Association (IFA) down to SouthWestern. I wanted to tell them about the

work our firm was doing on measuring carbon output on farms/inside the farm gate. We also had an idea at this time that we might have been able to include carbon sequestration from forestry in the equation for measuring on farm carbon (that hasn't worked out yet!). I expected that the IFA, as the largest farmer representative body, would have had concerns about many issues, including protection of their data, and potential financial implications of the scheme, carbon tax, and many other possible "mouse-traps" that might be caused by measuring carbon. It was a very open, honest and respectful meeting where the expertise on all sides was apparent. The IFA asked me to keep them informed each step of the way of the development of the solution. I committed to doing so. The spirit of partnership that had existed for years between the IFA and SouthWestern was very much strengthened that day. They knew that we were a private enterprise working for profit and with great skillset and likewise, we recognised that they represented the owners of all the data and their co-operation was essential.

3.6.3. Network organisation stability

The eco-system or network that established the traceability process back in 1995 has grown and is stronger today than it has ever been. There has been little attrition of its members. I noted a number of reasons for this: a) a viable economic equilibrium has been maintained among all members in the network, and b) each stakeholder group is consistently able to achieve its personal financial and professional goals. This worked in a fairly non-transparent manner since all parts of the network must operate at arm's length. For example, my company SouthWestern has made profits and has grown on the back of this programme. The farmer has achieved better profits on its farm. The government has been able to provide budgets to operate the system within the economic constraints of the

country. There has also been appropriate investment by all network actors. Each part of the network invested in the model. Some of my reflections on these incentives were as follows:

- The government subsidised the costs of the initial traceability process for farmers, and also paid for the inspectorate process that runs phases 2 & 3. This got buy-in.
- The scientific and benchmarking organisations invested resources in order to produce the world-class standards. They were also paid of course.
- The subcontractors invested in the technology and training requirements to make the systems work at world-class levels.
- The farmer invested in cleaner and more environmental farming practices. In addition they are now investing in greater capacity to produce food at this very high standard level.

Cultural affinity. All members of the network worked in a culturally united way. This cultural affinity was apparent in many ways e.g.

- Most staff working on the operation of the scheme came from rural areas, and had backgrounds in farming. They were able to talk the talk!
- The language and terminology used in agriculture and food is specific to the industry, including use of known slang and local words.
- There is common pride in the production of high-quality product.

Communications important to mobility, appropriability and stability

There have been very strong communications systems in place in the Agriculture and food industry in Ireland for many years. One of the most popular forms of this communication is the Farmers Journal. For the Irish farmer, and anyone involved in the industry, the Farmer Journal is a must-read every week. It is very informative and an excellent route to market, and all stakeholders, from the government minister down- provide regular updates on a continuous basis. Every January the Farmers Journal hold their Xmas Party and they invite all key stakeholders in the agriculture and food community. It is a simple sit-down buffet dinner; with of course the best in Irish-produced food. But it is attended by representatives of all stakeholders. The food, though delicious, is dispatched quickly, there is just a two minute speech from the Farmers Journal MD; and then the real business begins. Those intent on sorting out matters, will cross the floor, to meet the industry man, or the civil servant, the farmer, or the marketer. Everyone is there, and everyone is welcoming of old friends and new alike. Business is conducted at a pace and meetings are set up for the weeks and months ahead. This gathering in itself is a very visual example of how the network communicates so very well.

3.7. Triangulation of findings and conclusions

My reflections on how the national data on production was built, and my analysis of how the decisions were made through excellence in governance of a large community, have provided useful and sophisticated answers to the research questions that emerged from Dhanaraj and Parkhe (2006). These are summarised in Table 3-7.

Concept	Looking for	Dhanaraj & Parkhe (2006)	Supplementary to D&P
Mobility	How knowledge was shared, acquired and deployed within the network	Prominence of the role of the Hub	Role mobility
Appropriability	Capture of profits No cheating or leaking	Financial incentives Civic duty Government subsidy Competition	Cultural incentives Behaviour e.g. Humility, pride Patience
Stability	Sustains mobility allows people to go in and out over time	Building of trust and mobility Strategy participation	Face-to-face Ambition and pride
Hub	Orchestrator	Hub, Broker, Shared win	Explicit and Implicit nature of hub and roles From the industry

Table 3-7 Chapter contribution summary

The "Supplementary to D&P" column outlines some of the practices revealed through the autoethnography and analysis, that extends our knowledge of network and community governance beyond the model proposed in the framework. These

additional factors outlined are worthy of additional research in future studies, and begin to provide us with the constructs and processes needed by a network governance model for achieving trusted data.

The eco-system or network that established the traceability process back in 1995 has grown and is stronger today than it has ever been. There has been little attrition of its members. As we speak, SouthWestern is working within the community on the next phase of the journey, which may include the capture of greater detail on animal genomics. The full community, once again, is participating and will deliver future value as we continue on the road to trusted data.

References

All references are in Chapter 7

4. CHAPTER 4 – BUILDING TRUSTED DATA IN FOOD TRACEABILITY SYSTEMS: AN AUTOETHNOGRAPHY OF DATA GOVERNANCE

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Paper Summary **Chapter 4 – Data Governance** **Building Trusted Data in Food Traceability Systems: An Autoethnography of Data Governance**			
Peer review	Analysis Method	Key Data	Key contribution
In review with Journal of decision systems since May 2017	Autoethnography with vignettes, other case data through the lens of Khatri and Brown 2010	1st hand account of Data Governance in action with working examples in defining, implementing and monitoring data	Five stars of Data Governance process including strategy, Roles, Standards, Technology and actionable output

Table 4-1 Paper summary

Note: Some sections of the peer reviewed paper, have been removed since they repeat the relevant sections in Chapters 1, and 2 related to general introduction and methodology *These are noted in italics*.

Abstract

Since the mid 1990's the Irish branding of food has been built upon a strongly legislated and calibrated food production data system that verifies the source, quality and sustainability of its produce. The data that qualifies these brands is collected from the birth of animal and origin of produce, through the farm gate and on through its supply chain. The data informs:

- Approval for government food traceability and disease-free regulation.
- Branding as a quality-assured product under the Bord Bia Quality Assurance programme.
- Branding as sustainably produced under the Origin Green label for food sustainability in Ireland.

The food data programme is the driver behind Ireland's €11 billion food exports. It underpins access for Irish produced food to 175 countries in the world. For the past 15 years, the lead author of this paper has led SouthWestern, a major stakeholder in all of these data initiatives. SouthWestern have been a stakeholder in the design, implementation, and delivery of each stage of the programme since their foundation and continue to be the delivery partner today. This chapter researches the governance process of defining, implementing, and monitoring of trusted data systems.

The Khatri and Brown (2010) framework of five decision domains for data governance is used as a “conceptual bin” aid in order to ground, organize and extrapolate meaning from the data for analysis (Miles and Huberman 1994). The paper describes the food data programme at a high level and gives a more detailed account of the data governance concepts using vignettes from the overall programme. The paper concludes with analysis and exploration of learnings from these data programmes and makes recommendations for further research and practice.

Keywords: IT Governance, Data Governance, Food Traceability, Decision making, Food

4.1. Introduction

See Chapter 1 for introduction into the research and detail on methodology that was originally in the peer reviewed paper.

As a means of organising our analysis of the autoethnographic story, we have used the Khatri and Brown (2010) data governance framework as a conceptual bin (Miles and Huberman 1994). Khatri and Brown focus on five decision domains for data governance including Principles, Quality, Metadata, Data Access and Lifecycle. A brief description of these decision domains is provided in Table 4-2 below.

<table>
<tr><td colspan="3">Data Principles
“the boundary requirements for the intended uses of data"</td></tr>
<tr><td rowspan="2">Data Quality
“sets the organization’s standards for data quality"</td><td>Metadata
are the basis for “how data is interpreted"</td><td rowspan="2">Data Lifecycle
“the production, retention and retirement of data”</td></tr>
<tr><td>Data Access
the basis for how data are "accessed by users"</td></tr>
</table>

Table 4-2 Khatri and Brown (2010) decision domains

The Khatri and Brown (2010, p.150-151) data governance model explains the five key decision domains as follows; Data Principles “foster opportunities for sharing and reusing data” and “define the desired behaviours” both for data creators and data users. Data Quality highlights the ability of the data to “satisfy its usage requirements”. Metadata helps to “interpret the meaning or semantics of data”. Data Access aims to “ensure the confidentiality, integrity and availability of data” while Data Lifecycle espouses the need to “understand how data is used” over

time. It is worth noting that for most companies today these five decision domains present real ongoing challenges, but these challenges are even greater in the context of this research, where data governance is being defined, implemented and monitored within a large community of diverse, independent and data-sensitive stakeholders, with responsibility for the data requirements of the Irish Agri-food industry.

4.1.1. Methodology

Methodology is now described in section 1.5 and was originally part of peer reviewed article.

In this Chapter, my "stories of self" are told through three key vignettes that represent key decision milestones in the programme over the 20-year period, including how data identifiers were decided, how the data governance process works, and how new data capability was added to the programme. The vignettes are analysed for their types of decisions and categorised as either defining-, implementing- or monitoring-type decisions, so as to further inform the research into data governance as is the stated aim of the paper. The concluding analysis identifies the 5 stars of data governance. This chain of evidence approach to this analysis is shown in Figure 4-1 below:

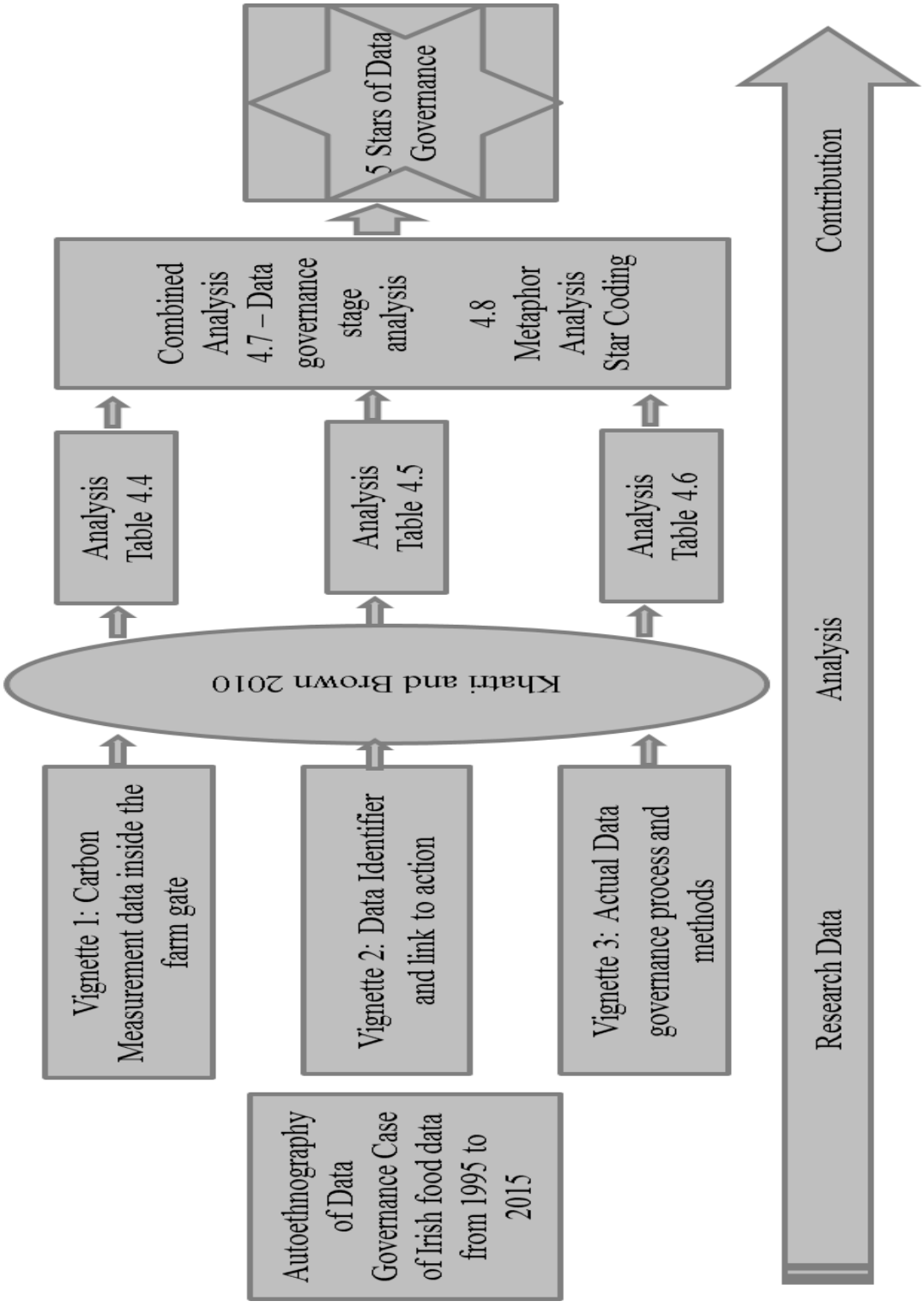


Figure 4-1 Research paper chain of evidence to contribution

4.2. Data governance case overview

The case subject of this autoethnographic study is the traceability, quality and sustainability measurements that have been implemented since 1995 in order to underpin the reputation of Irish food. In a previous paper (Costello et al 2016) we have told this story in great detail. For the benefit of this paper it is summarised in Table 4-3.

Initiative	Food Traceability Phase 1 (1995 to date)	Food Quality Phase 2 (2005 to date)	Food Sustainability Phase 3 (2009 to date)
Description	Origin of food from breeding through to food preparation incl. control of movements, disease management and compliance to legislation	Adherence to best practices of food management from time of breeding through to the table.	Sustainability of farming from a social, economic and environmental
Branding	Regulation	Bord Bia Quality	Origin Green
Data Examples	• Tag Number • Birth, Movement and disposal date • Disease control	• Record Keeping • Medicine management • Hygiene • Farm safety • Housing comfort	Carbon Footprint (KG of Carbon per KG of food) • Nitrates • Weight Gain • Calving rate • Grazing season
Key Data Outcomes	• Permission to trade • Subsidies • Safe food	• Premium price from factory • Good farming • Access to new markets	• Premium price • Access to new markets • Reputation

Table 4-3 Summary of case programme

Table 4-3 shows the types of data collected, and the outcomes that define the data programme.

As CEO of Southwestern, the lead author led the decision making for much of the data governance in each stage of this programme and also through many of the external challenges and events that influenced the programme over the 20-year period. In the context of this paper, it would not be possible to describe the whole programme in detail; therefore, we present three vignettes and analyse them using the five decision domains proposed by Khatri and Brown (2010). Given the autoethnographic nature of the study the remainder of this paper is written in the first person from the point of view of the lead author.

4.2.1. Vignette 1: The first-in-the-world carbon measurement system inside the farm gate

In 2009, An Bord Bia introduced the food sustainability programme (Phase 3 Table 4-3). It was the first programme of its kind in the world that would measure the carbon footprint of food production from inside the farm gate. It underpins the eco-friendly nature of Irish food production methods and assures its continuous improvement as a sustainable source of food.

The focus on carbon footprint followed the Kyoto agreements signed up to by over 190 countries in the world with a commitment to reduce greenhouse gases such that they would not present a threat to the climate system. The European Union introduced the carbon trading scheme in 2005. This was a carbon trading system based on reporting for the major industries in each country.

We in SouthWestern had been involved in many areas associated with environmental energy, forestry and agriculture since the foundation of our parent company in 1957. We built wind energy farms, we had forestry and we had the food traceability databases (phase 1 in Table 4-3) developed in our IT services business. We engaged with all members of the agriculture and food industry to determine how, and if, Irish Agriculture should measure its carbon footprint. We developed a number of different models as to how carbon would be measured. It was complex, but we knew we could do it. The challenge was that most carbon emissions on farms come from "animals burping and farting" (as quoted by a student at one of our information presentations!) So how do we measure that?

The European Union's Emissions Trading System (ETS) places carbon compliance targets on each country with a threat of fines or penalties if these targets are exceeded. From a financial perspective, farming was already a marginal business that requires subsidies to support production, so the prospect of fines or penalties being imposed because of carbon was a threat to the industry. In response to this threat, we devised a proposal to measure carbon output on farms to include the positive contribution of forestry and shrubbery on the farm. Forestry is a natural carbon sink and producer of oxygen. If we measured this as an offset, at a farm level, it would encourage positive farming methods such as, for example, more trees thereby minimising the potential financial penalty burden on the farmer. As we developed this idea, we met with government agencies including the national environmental protection agency in Ireland, the department of agriculture, Teagasc (National Agriculture Research body) and the farming unions (IFA and ICMSA).

As I reflect on these meetings I recall how a number of the discussions and barriers arose. For example in one such meeting, the IFA President and General Secretary came to visit us in our office to look at how we registered the traceability of all their animals, and to discuss our new proposals. They were hugely complimentary of the great service we provided to the farmers for this regulatory work; however they expressed concern at our proposal for carbon measurement inside the farm e.g. "Would this require even more inspections on farms? There was already enough". "What will ye do with the carbon information? We don't want to be taxed on carbon" … and the questions went on. It was a positive collaborative meeting and we agreed that we would work with them on the best proposals for the farmer.

When I met the Environmental Protection Agency (EPA), they told me that forestry carbon credit was a separate measure from the farming measure. It was measured at a national level. We would need to change the national or EU measurement mechanism in order to credit the carbon of forestry against the farming, even if on the same farm. We would therefore probably need to exclude on-farm forestry from any metric to measure carbon! That didn't seem right, but it clarified the scope that was available to our data programme.(This rule is since changed).

At this same time, the Department of Agriculture were continually working to improve the quality and reputation of food from Ireland. We met the department civil servants involved in the planning and I presented our proposals on how carbon might be measured at the farm level and discussed the issue of carbon offset from forestry. They discussed the potential in detail and talked to us about the use of carbon information to enhance the reputation of Irish food, as a kind of

marketing benefit. They told me that they had asked An Bord Bia to lead an initiative to add sustainability measurement to the existing Quality assurance scheme. The programme would soon be launched. So then, in September 2009, An Bord Bia published a request for tender to run the sustainability system on Irish farms for the first time ever and it was the first time this was done in the world. We got to work on its design. We offered a superb solution proposal the objectives of which were as follows:

- To undertake environmental audits on a sample of existing farmers who have different production systems so as to develop a robust benchmark of performance and provide details on their overall carbon footprint.
- To identify areas within the different farming systems that perform most strongly and those that offer potential for improvement, which could enhance the performance of farms while also offering potential cost savings.
- To identify if the measured carbon footprint could be extrapolated to a larger sample or perform the same audits in all farms.
- To provide actionable data back to the farmer about his carbon measurement with recommendations on how it could be improved.

Our proposal dealt with the following questions: *What would we measure on the farm? And what data did we need to extract from the national traceability systems?* Our proposal included our measuring the carbon-producing elements on the farm including herd size, use of slurry, outdoor time, indoor time, energy use,

feed types and volumes, and many more. It detailed the data-collection mechanism including training. It had detailed calculators with materiality and risk identified. The questionnaire that needed to be completed for each farm included the actual data measurements. The reports were also detailed on what should be produced for the programme. It proposed that we would operate under International Standards for quality, data security and environment.

It would be run by us in SouthWestern and calibrated for carbon data measurement standard purposes by the Carbon Trust and Teagasc. All of proposed systems and processes were ISO certified and this consisted of full quality control checking mechanisms including technology-enabled data checking, observation checks, accompanied data collectors and regular independent audit. The proposal included full technology proposals including the use of handheld technology on farm to relay data. System proposals included government class security standards that comply with ISO27000 (IT security and Data standards). It was a world-class proposal and I was pretty proud of it. ISO certification meant that all system routines and processes would have documented policies, work procedures and work instructions. Written into these were operation detail policies such as code of ethics which included prevention of bias, data confidentiality, approval, audit and check routines, and so on. They were very comprehensive and verified by external audit in order to be certified. We would need around 50 new trained staff and contractors to deliver the program on a national basis.

Following submission of the proposal, there was a long review period. We had partnered with Teagasc and the Carbon Trust and we were confident we had a practical and workable solution. We were eventually selected as the main provider

for the programme. But the contracting authority made some amendments to our proposal, including:

- It would be a national system and therefore they would run the technology platform themselves. We would need to integrate to that platform with our mobile data solution.
- The calibration work with Teagasc and Carbon Trust would from that point forward be taken on directly by An Bord Bia. We would need to work with them to have change control on questionnaire formats and quality control.
- They would retain an additional quality control audit team over and above the proposed model to further assure data quality.

We were happy with the agreement, thus allowing the programme to go forward even with those design changes. There still remained for us a very large services contract with the Irish Government for which we are still the service partner. We had won a major piece of business to run the programme. The programme has been a huge success and is now represented in the promotion and advertisement of Irish food all over the world, with the SouthWestern field staff starring in many of these promotions.

Analysis of vignette 1

The following key lessons, as shown in Table 4-4 are learned from the vignette, leveraging the 5 decision domains proposed by Khatri and Brown (2010). These lessons are coded to examine their role in the stages of the programme from defining the programme (d), Implementation approach (i) or the monitoring stages (m).

Decision Domain	Lessons learned (Coded for d) defining, i) Implementing or m) Monitoring impact
Data Principles	• Principles were discussed with stakeholders (e.g. EPA and IFA) before the programme even started (d) • Carbon would be used for marketing and reputation purposes and not for other legislative or tax purposes (d) • Forestry would not be included (d) • Farmers would receive actionable feedback (d)
Data Quality	• ISO standards were used as the framework for data quality assurance (d) • Using technology-based algorithms for sophisticated data quality assurance (i) • The contracting authority retained a data quality brief over and above the data supplier (us) which was also ISO certified.(m)
Meta Data	• The scope, definition and interpretation of metadata was a major design part of the work (d) • Third parties (ISO standards, Carbon Trust, Teagasc) calibrated all definitions (i) • Meta data evolved over time, as new data was defined and the model refined (i)
Data access	• Data access permission required a signature from the farmer to release national data about his herd number to the scheme (i) • Government took over access control of national database. (d)
Data Lifecycle	• Records retained for 7 years (d) • Audits are repeated per farmer every 18 months (d) • Government I.T. security standards implemented (m)

Table 4-4 Vignette 1 decision domain analysis

4.2.2. Vignette 2: Data identifier and link to action

The herd number is the "glue" or master reference for data about the herd that flows from one system to another. The herd number is an identification number for a "holding" of animals. Its origin goes back to the 1950s when disease eradication in food sources was established in the state. It is issued by the regional government veterinary office and is in place primarily to control disease. We have worked with the herd number as the master reference since we started traceability in 1995 (phase 1, Table 4-3). In 1998 when animal movements were set-up in the food traceability system, over 12,000,000 movements between herd numbers needed to be recorded each year. Animal movement (sold from farm-to-farm, in the mart, to the factory or that die) is the greatest threat to animal disease spread. In 2005 (Phase 2, Table 4-3) when the Quality Assurance programme was set-up, the same herd number was used as the master reference for the data. In 2010 on the introduction of the sustainability scheme, master data from the traceability programme was required to be pulled down to calculate herd sizes, etc. The herd number was the master reference for sharing this data. The herd number allowed strong data control and data sharing such that data was only collected once for all programmes. An example of the value of the herd number was the management of disease outbreak that threatened our food supply in 2001. It worked as follows;

During the 1990's the Department of Agriculture developed an epidemiology process, for the management of the outbreak of foot and mouth disease. This process involves the identification, control and elimination of disease outbreak. The first case in Ireland was on the Cooley Peninsula in 2001. Our systems were used to identify all herd numbers close to the area and stop all animal movement and trading. The disease outbreak was therefore controlled at a local level by

isolating the offending herds in this way. This data provided herd number, size, ownership, movements and all key data to allow tracing of every animal in the herd so disease could be fully isolated and then treated humanely. A similar situation arose in 2008 when pig meat was contaminated through feed in Co. Carlow. The traceability systems for pigs run by SouthWestern were used to identify all herds in the area and prevent those food sources from entering the food-chain.

In contrast, during the horse meat scandal of 2013, it was not as easy to identify the source of horse meat found in some consumables. Horses were not a part of the food traceability programmes discussed in this paper and "herd numbers" or any other unique identifier of holdings were not properly enforced. This has since been addressed and horse traceability is now run via a decentralised approach by each breeder federation.

There are many examples of how the herd number is used in all phases of the programme. This sample letter in Figure 4-2 shows how the herd number also links to the quality assurance audit.

Letter to Farmer in Co. XXX: Extract of non-compliance communication:

Thank you for your recent participation in the SDAS scheme and this letter details the issues raised during that inspection. A number of **major** non-compliances were raised during your inspection on xx/xx/2014. You must address each of these major non-compliances and submit close out evidence before the agreed date of xx/xx/2014. The full list of your major non compliances can be seen overleaf. For more specific details on each major non-compliance please contact your Co-op Advisor / Milk Purchaser and work with them in addressing each issue. Once these major non compliances have been closed out and satisfactory evidence has been submitted to XXX the certification committee will decide if the milk production process employed by you complies with the requirements of the quality assurance scheme.

Major Non-Compliances for Herd Number XXXXXX

- No records (prescriptions, purchases, usage) were made available for inspection. (ref 3.1.b)
- Significant unexplained gaps in records (3.1.c)
- No records of remedy purchases were made available for inspection 3.4.b
- No usage records were available for inspection 3.4.c
- No usage records were made available for inspection 3.4.d
- Animal remedy usage records do not contain the required detail. This applies to the following requirements:
    - Administration dates for remedies;
    - Authorised name of each remedy; Quantity of remedy administered;
- There were no visitor controls in place. 3.9.a
- No footwear washing / disinfection facilities were provided on the farm. 3.9.b
- There is no FSRA/FSS available for inspection 3.13.a
- No evidence of registration was available for inspection from either the
    - milk purchaser or the producer. 3.14.a
- Not possible to confirm if remedy withdrawal dates were observed in full as complete animal remedy records not available to auditor. 3.3.f

** Refer to Section 3 of the Quality Assurance Scheme for a detailed description.*

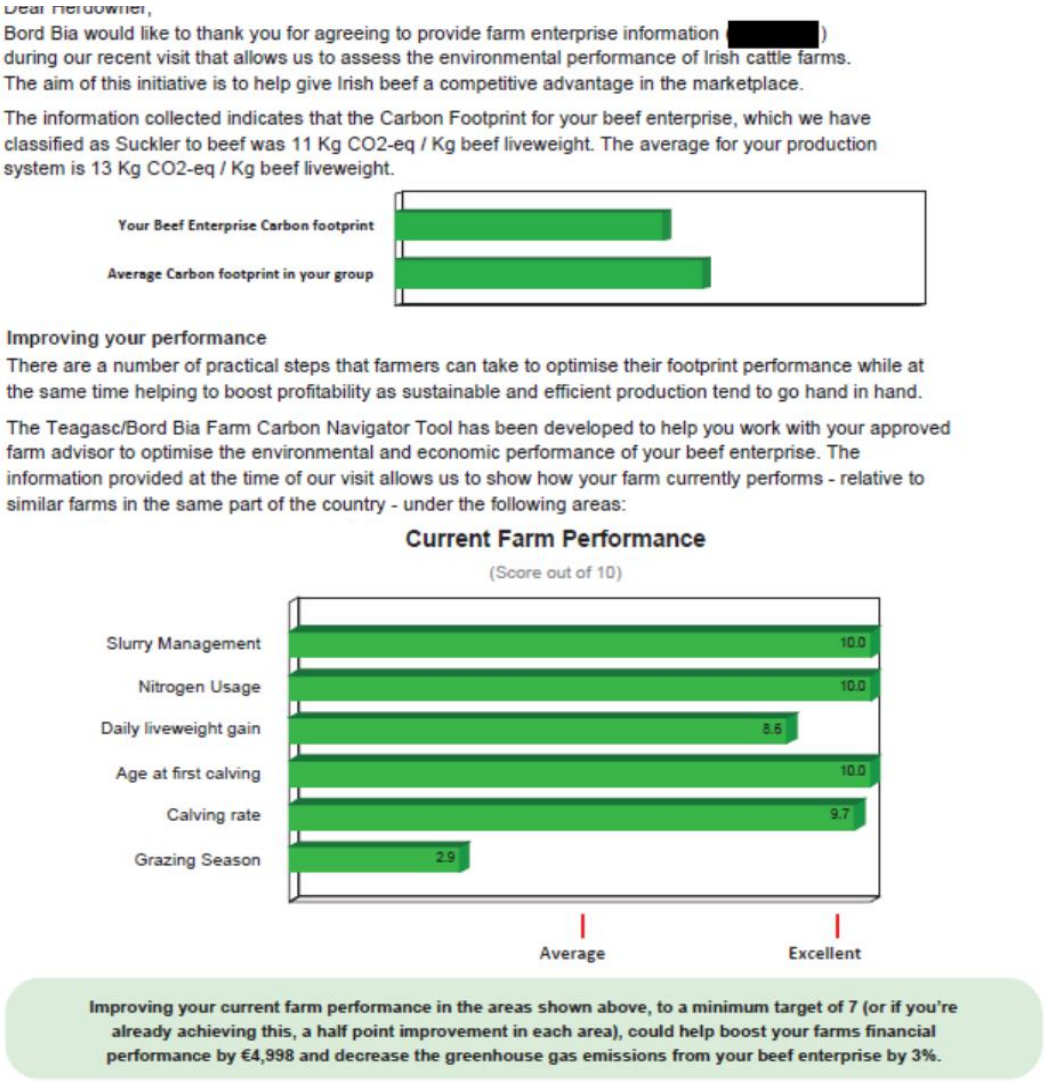
Figure 4-2 Sample letter to farmer

The letter shows the metrics that are collected and compared to required data sets. As you can see the report is led with the herd number as the key identifier. The detail of the report show the data collected under the areas of:

- Good record keeping
- Management of animal remedies
- Farm health and safety

In addition, there is a corrective action clearly associated with the data and a follow-up timeframe to resolve all outstanding issues.

Figure 4-3 below shows a carbon footprint measurement report. Once again, the link to the data is herd number. The farmer is shown the result of data including the specific measurement, and how he/she can affect that data for the future.


Dear Herdowner,

Bord Bia would like to thank you for agreeing to provide farm enterprise information ([redacted])
during our recent visit that allows us to assess the environmental performance of Irish cattle farms.
The aim of this initiative is to help give Irish beef a competitive advantage in the marketplace.

The information collected indicates that the Carbon Footprint for your beef enterprise, which we have classified as Suckler to beef was 11 Kg CO2-eq / Kg beef liveweight. The average for your production system is 13 Kg CO2-eq / Kg beef liveweight.

Improving your performance

There are a number of practical steps that farmers can take to optimise their footprint performance while at the same time helping to boost profitability as sustainable and efficient production tend to go hand in hand.

The Teagasc/Bord Bia Farm Carbon Navigator Tool has been developed to help you work with your approved farm advisor to optimise the environmental and economic performance of your beef enterprise. The information provided at the time of our visit allows us to show how your farm currently performs - relative to similar farms in the same part of the country - under the following areas:

Improving your current farm performance in the areas shown above, to a minimum target of 7 (or if you're already achieving this, a half point improvement in each area), could help boost your farms financial performance by €4,998 and decrease the greenhouse gas emissions from your beef enterprise by 3%.

Figure 4-3 Sample carbon footprint measurement letter

Analysis of vignette 2

Leveraging the five decision domains of Khatri and Brown (2010), the following lessons as shown in Table 4-5 are learned from this vignette:

Decision domains	Lessons Learned through the stages of defining, implementing and monitoring (d,i,m)
Data Principles	• Adoption and consistent use of unique identifier (d) • Consistent data set enabled actionable data governance (i)
Data Quality	• Herd owner receives their report promptly and this allows a data quality check by the owner.(m) • The data sent to the herd number owner is referenced back in detail to the root cause of the data (m)
Meta Data	• Different data existed e.g. disease control, quality, carbon, etc. it was clear from reports how these are interpreted (i) • Use of International standards and global best practice for benchmarking metadata e.g. Carbon Trust (d) • Though complex in its design, outcome needed to be simple so as to be actionable (m) • Meta data and the formulas for calculation can, and do, change over time for various reasons including regulatory, environmental or climate. (i)
Data access	• Data is collected once from each farm. For example relevant data from animal registration is shared-using the herd number-with food quality and food sustainability programmes. (m) • Data has significant health, safety and economic impact and hence must be restricted.(d)
Data Lifecycle	• Farmer is given a timeline to resolve areas that cause failure within a specified timeframe, but the programme is continuous with repeated audits every 1.5 years (i) • An auditor can only review a farm twice and he should not be related to or have any interest in the farm being inspected. (d) • Data must be secure with ability to store for 7 years and a business continuity process and infrastructure must be in place that can withstand most disasters and be always available. (d)

Table 4-5 Vignette 2 decision domain analysis

4.2.3. Vignette 3: Actual data governance process and methods

In the years since we started delivering this programme, we have worked in many trying circumstances from weather-impacted times, through disease outbreak to system or operational challenges. One of the continuous challenges with the programme is to identify fraudulent activity in real time. One of the causes of these fraud attempts is that there may be a different subsidy programme in place between the UK and Ireland and this would lead to smuggling of animals across the border. We run many different types of algorithms in our systems to identify fraud. One such example was the high incidence of twin births of animals close to the border between Ireland and the UK. Animals would be smuggled in to the Republic of Ireland and for the purpose of state subsidy they would be registered as a twin of another calf. High twin rates were identified using simple algorithms in the data system and alerts reports were sent to the Department of Agriculture who could then do an inspection of the animals. Other algorithms run in our system included the measurement of gestation period of calves being born since sometimes a farmer might try and register calves to cows, on a higher frequency than nature could allow, as a mask for smuggling animals! In the area of quality or sustainability measurements on phases 2 and 3 (Table 4-3), algorithms that profile normal metrics on inspection reports would ensure that all outlier data is monitored for error or re-inspection. There are 3 levels of data of data quality than can be implemented on the operational metrics as shown in Figure 4-4 Data quality process:

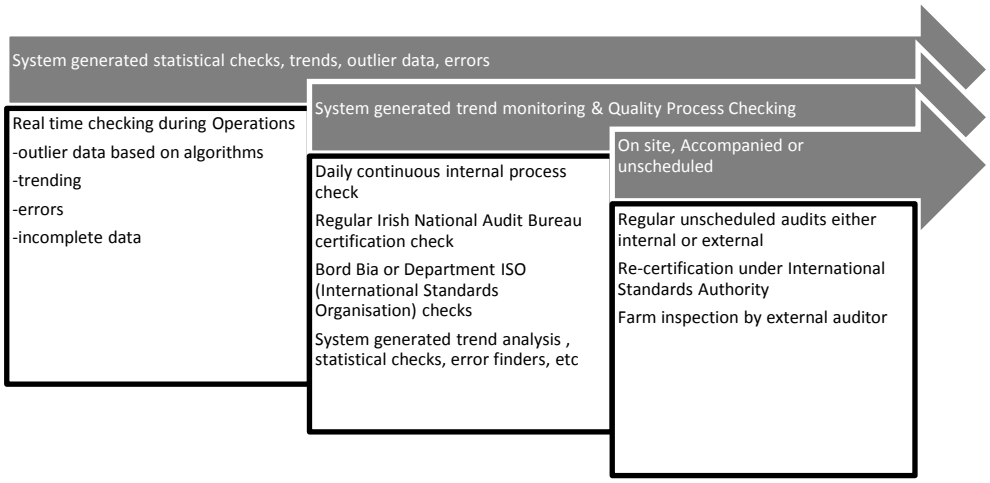


Figure 4-4 Data quality process

A critical activity associated with the production of these metrics is the continuous review process that is at the heart of the implementation and monitoring of data governance in the programme. This model for continuous review is designed to assure trust in data at all times, and for all stakeholders. Whereas the model of data governance is planned as part of the data governance design process, it is also fully documented for ISO certification, training and operation manual purposes. The documentation is at a policy, procedural and work-instruction level. This detailed preparation and implementation leads to normalising a culture of strong metric and process monitoring.

I learned this culture of rigorous metrics in a previous role when I was Managing Director of a service programme between Unisys Corporation in Philadelphia and Dell Computer Corporation. As leader of this global team, I was responsible for service management of the Dell client base all over the world. While working with Dell, we implemented a data governance routine for customer experience that gave me a continuous snapshot of customer experience all over the world. As

a result, Dell had an award-winning service reputation with service levels exceeding 95% consistently every week. We did not focus on the 95% though; we focused on the 5% and how to make that smaller. This experience with Dell gave me many of the learnings I needed to deliver great data governance in the food data programme in the more recent years.

With the food data programme we have been a key part in an implementation and monitoring routine that has helped us deliver with great success over the years. This routine assures great data governance of the agri-food sector and is the foundation of the traceability, quality assurance and sustainability of Irish food. The routine is shown in Figure 4-5 below.

	Governance Team	Activities
Every 3 to 5 Years	Full Community led by Department of Agriculture Incl; Legal & Government agencies, Science & Benchmark, Farmers, Industry suppliers, Subcontractors, Retail and consumers	• Revisit Strategic Plan e.g. Harvest 2020 • Review Principles • Request revised Proposals
Every Year	Data Quality Review Team • Leadership of Department of Agriculture • Irish Farmers Association review • Programme Leadership • Farmers Journal Xmas Party (Full community)	• Service Level Metrics for the preceding year • Expected changes in the coming year • Learnings • Corrective action • Renew/Strengthening of relationships • Data Quality Reports
Every Quarter	Data Quality Review Team • Director of Programme • Quality Review Team • Operations Leadership	Service Review Pack Detail • Results • Metrics • Trends • Outlier data • Corrective action
Monthly	Stakeholder monthly Review	Service Review Pack Update
Every Week	Data Quality Team	Operational Metrics trends
Every Day	Supervisory	Quality Metrics
Every Hour	Team Leadership	• Scheduling • Quality Monitoring • Efficiency • Backlogs • Error reports
Live Data analytics	Technology based	• Data error formulae • Data accuracy analytics (outlier) • Data rejection

Figure 4-5 Implementation and monitoring of data governance

This data governance routine was critical to the establishment of trust in data by all stakeholders. The following analysis in Table 4-6 summarise the key learnings from vignette 3:

Decision domains	Lessons Learned through the data governance stages of defining (d), Implementing (i) and monitoring (m)
Data Principles	• Data Governance organisation structures are designed from the outset (d) • Its systematic work is a key principle of how data quality is measured.(m) • International Standards adopted (d) • Governance principles such as right experts, segregation of duty, conflict of interest, declaration of interest are employed to retain data integrity including its boundaries (d, m)
Data Quality	• Standards of Data Quality are assured through the Governance organisation's systematic review (m) • Information technology or DQ software is essential at point of data-entry, at analysis stage and at output stage (m) • Performance management must be delivered at an individual, company and user level (m) • Some data quality measurements will be constant, some less regular, and some will be *ad hoc* and unplanned (m)
Meta Data	• Data Governance must ensure that Data analysed is actionable through clear understanding of root causes or construction i.e. if data is not clearly interpreted, it is useless. (i,m)
Data access	• Confidentiality, data access, data integrity are all common discussion items at regular data governance reviews (m) • There are regular system, process, and resource audits to verify integrity of the programme(m)
Data Lifecycle	• Retention of data and trend analysis is an important quality indicator (i)

Table 4-6 Analysis of vignette 3

4.3. Analysis summary

Alhassan et al (2016) analysis of literature on Data Governance tells us of the low frequency of research of data governance and especially in the stages of implementing and monitoring of data governance. Table 4-7 is a summary of the 43 data governance decisions discussed through these vignettes and the table shows an even distribution of research data on decisions coming from Defining, Implementing and Monitoring stages of data governance .

Decision Domains	Defining Decision	Implementing Decisions	Monitoring Decisions	Total Decisions
Principles	8	2	2	12
Quality	1	1	7	9
Meta Data	2	5	2	9
Data Access	2	1	3	6
Lifecycles	4	2	1	7
Total	17	11	15	43

Table 4-7 Analysis of data governance decisions discussed in this research

This gives us some insights to the focus on data governance within this research case study.

Of the total of 43 decisions discussed in these vignettes and as shown in Table 4-7, 16 relate to design (40)%, 10 are of implementation (26%), and 15 related to monitoring-type decisions (34%). Therefore the vignettes show a more balanced analysis of the governance process from design to monitoring and give insight beyond existing data governance papers where over two-thirds are about defining the process.(Alhassan 2016). To look at the detail of these decisions throughout

the program, Table 4-8 below consolidates the Table 4-4, 4-5 and 4-6 into the stages of data governance as per the coding in those analyses.

Decision Domains	Defining	Implementing	Monitoring
Principles	• Stakeholders • Data purposes • Data Scope • Data action • Unique identifier • Regular review • ISO • Right People	• Consistency in implementation • Right People	• Systematic • Right people
Quality	• Calibrate to Global Standard	• Use of DQ Software Technology	• Multi-Tier QA • Systematic review • Checking data with Owner • Root cause analysis of DQ • DQ technology • Performance Management • Ad hoc Analysis
Meta Data	• Design expertise in all areas • Global best practice	• Scientific expertise • Managed change process • Communication • Ability to change • Link meta data	• Complex to build, simple to action • Monitor outcomes of meta data
Data Access	• Government control • Major impact of data	• Signature process	• Trust breach will stop data access • Reviewed at DG level • Independently Audited
Lifecycles	• Regulated or not • Frequency of refresh • Role Ethics • Not a project, a programme	• Use of deadline for corrective action • Retention of integrity of historic data	• Security Monitoring

Table 4-8 Decision topics through the stages of data governance

4.3.1. Recommendations: A framework for data governance delivery and its 5 Stars.

In Table 4-9 we have simplified the analysis of our decision topics (Table 4-8) into conceptual questions by using metaphors to code key questions (Miles and Huberman 1984) at each stage of governance, and for each domain of data governance in Table 4-8 e.g. the prominence of strategic direction decisions in defining principles in Table 4-8 gives us the metaphoric question of "do we have a data strategy" in Table 4-9 and so on. The analysis is designed in a questioning format for each of the stages of design, implementation and monitoring of data governance so as to offer a useful framework for data governance. Following this each question is categorized into 5 common areas (5 Stars) to provide solutions for the complete framework.

Governance Domain	Define	Implement	Monitor
Data Principles	Do you have a data strategy? Strategy	Do you have a best in class implementation team? Roles & Responsibility	What is the governance organisation structure? Roles & Responsibility
Data Quality	Do you have specific certifiable standards, and codes of practice? ISO, ethics Standards	Do we have technology and process implementation skills? Technology	Is a rigorous data action monitor process in place? Standards
Meta Data	What experts do we need to define meta data? Roles & Responsibility	Do we have implementation skills to simplify and implement meta data? Roles & Responsibility	Is the data actionable? – presentation style. Actionable output
Data Access	What data do we protect for whom, and what can we share and with whom? Standards	Do we have access control mechanisms, technology? Technology	Do we have dynamic detection technology and regular governance? Technology
Data Lifecycle	What are the lifecycle relevance's o data? Standards	Does my technology and process deliver data evolution? Technology	What is the data presentation/review cycle? Actionable output

Table 4-9 Data Governance process: Star questions

This framework is a direct learning from building Ireland's food traceability systems over the last 20 years. It proposes the key questions of data governance delivery for each domain and stage of implementation plus the 5 key tools for delivery. Those 5 stars of delivery are strategy, roles and responsibility, standards, technology and actionable output. They are explained further as follows:

Star 1) **Strategy:** The high-level goals for this food traceability programme include achieving an export volume for food of €19 billion per year by 2025. The data programme provides the food safety, quality and sustainability data to assure access into the global consumer markets to achieve this growth. Knowing and reviewing the data strategy is critical to the success of the data governance program. The data strategy is a driver for all other stars.

Star 2) **Roles and responsibilities**: This involves putting the right people into the right roles. The teams involved in governance of the various stages of the programme were staffed and led by the right skillsets. The strategy groups included skills as varied as those of leaders, economists, scientists and industry people. The design teams in the 1st vignette, had strong cohorts of scientists, technology experts and delivery skills. The unique identifier code in vignette 2 has passed the test of time through many legal and political challenges. Implementation teams had a strong cohort of project management certified personnel and IT experts. Monitoring roles and responsibilities had operational expertise. Included in the monitoring roles and responsibility personnel were certification teams, which included third-party experts to certify farmers based on this data.

Star 3) Standards: (regulation, governance standards, codes and certifications): In the programmes described in the vignettes, we adopted International Standards Organisation (ISO) standards and regulatory type code. Standards adopted included ISO9000 (Quality), ISO27000 (data security) and ISO14000 (Environment) [www.iso.org]. These International Standards provide a strong platform and format for documentation of policies, procedure and work guidelines that are aligned to the strategy and reviewed by the governance teams. They should specify routines such as the governance routines as shown in vignette 3. In our programme a strong code of ethics was built into those standards as outlined in the vignettes. These codes of ethics protected the programme for bias - either deliberate or accidental - and provided a resolution where conflicts would occur. There are many other standard templates that should be used depending on the type of programme and sector.

Star 4) Technology: Standards governance and codes of ethics will define governance, but smart technology is required in a big data environment to protect governance and to add value to the data governance including improving data quality and data analytics. Our vignettes have shown some of the reporting from our work/research notes but this paper is focused on the process…. and technology is worthy of its own specific paper (Chapter 5).

Star 5) Actionable Output: Data output, of course is the result of all of this. Creativity, simplicity and emotional intelligence are skillsets required in the creation of excellent output. Included in the data output from these reports include are internal reports for the department of agriculture that

support disease-eradication programs, reports for farmers that show actionable data for their farms and national census reports for the Central Statistics Office. The data needs to be read by varied expert and non-expert stakeholders and therefore need to be comprehensive for the scientists and yet simple for the less scientific minded stakeholders. Reports dealing with personal matters always require sensitive treatment.

4.3.2. Concluding remarks

Trusted data is critical to the way we live today. We have used the experience of building the food traceability in Ireland as a basis for delivery of a trusted data system. The main contributions from this case research offered are a proposed framework of decisions to be made as presented inTable 4-9 and the associated 5 Stars of Delivery be used as a practitioner's guide for delivery of a trusted data system. It is proposed that this framework and the 5 stars can be applied in many sectors especially those with similar dispersed and complex data sources, and I recommend further research to this aim.

The Irish food traceability system, from which this research is derived, has supported the growth in exports of Irish food from €3 billion to over €11 billion by 2015 and the industry is ready to continue to scale to €19 billion by 2025. This is possible through growth in world populations and new markets, and as these markets source their food, they will check the credentials of our produce using the data from our systems. Furthermore, as many do, they will visit our farms and data centers to see the proof in action. We will, as always, welcome them and show our pride in our great food produce! Furthermore, we can also rest assured that we can prove its great credentials through our data!

References

All references are included in Chapter 7

5. CHAPTER 5 – HOW I.T. GOVERNANCE EVOLVED IN A NATIONAL FOOD TRACEABILITY SYSTEM: AN AUTOETHNOGRAPHY OF TECHNOLOGY GOVERNANCE

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Paper Summary **Chapter 5 – Technology Evolution Governance** **How IT Governance evolved in a National Food Traceability System: An Autoethnography of Technology Governance**			
Peer review	Analysis Method	Key Data	Key contribution
In 2nd stage review with MIS Quarterly Executive (11/17)	Autoethnography with use of other data including interviews through the lens of Weill and Ross' (2005) technology governance framework	Detail account of the evolution of data systems over 20 year programme as data needs grew and changed	Four mantras of data technology evolution and a new decision matrix for technology evolution decision making

Table 5-1 Paper Summary

How IT Governance evolved in a National Food Traceability System: An Autoethnography of Technology Governance

Abstract

In this paper, we will tell an interesting story about how the national food traceability system for Ireland evolved from a small private venture into an important government/business partnership that relied extensively on IT. The story is narrated by the long-term CEO of an outsourcing company that developed the software and was deeply involved in operational aspects of the system at all stages of its evolution. The main focus in the story concerns the way IT governance evolved over time as the system evolved.

Trusted data is essential to prove safe food and Ireland is renowned for its safe, quality and sustainable food. The systems that produce the information needed to support safe food were developed by a (then) small company in the south west of Ireland. This paper is a first-hand account (autoethnography) by its CEO of how the systems were developed over time with a focus on the governance decisions made over the stages of system development. The systems collect, process, manage, record and report data required for food safety, quality and sustainability. The data is comprehensive and some of the data, e.g. carbon emissions on farm, was measured for the first time ever in the world, inside the farm gate. The paper presents a detailed account of the evolution of I.T. Governance examining key decision making along the way. We conclude with some key recommendations and a template for governance that shows how the provision of a high quality of service to all stakeholders, the integrity and security of data, and the expertise of the people must be a focus to allow full membership of the data programme,

eliminate business risk, provide value for money and support strong market growth over time.

Keywords: I.T. Governance, Food Traceability systems, Decision making, Autoethnography

5.1. Introduction

The introduction to my research included in the original peer-reviewed paper is now included in detail in Chapter 1 and therefore not needlessly repeated here.

This is the third of the individual papers researching the governance of the evolution of technology in this trusted data programme. In this chapter, through research of the technology evolution of this food data governance programme, we will analyse the key decision made and recommend a template for decision making that can be used by practitioners or by researchers in new sectors.

5.2. Research methodology and food traceability programme overview

This section of the original peer reviewed paper is now replaced by the detail on methodology in Chapter 1 and Chapter 2 of this thesis

5.2.1. Decision domain analysis approach

In chapter 1 (Section 1.5.6 and 1.5.7) and in chapter 2 we have discussed the analytic approach to autoethnography that is used in this research including the use of conceptual lens approach used in my research. In this chapter for technology governance, we have selected the Weill and Ross (2005) as the appropriate lens to use for this analysis. Its similarity and grounding with the Khatri and Brown (2010) used in Chapter 4 also is beneficial to the consistency of my research when developing combined contributions in Chapter 6.

Weill and Ross (2005) five decision domains breaks down the governance decision categories in IT between: principles, architecture, infrastructure, business application needs and investment/prioritization and hence serves as a simple lens

though which to support the analysis of our case data. These decision domains are described in Table 5-2:

1. I.T. Principles	How do the business principles translate to I.T. principles that guide I.T. decision making?
2. I.T. Architecture	What are the core business processes? How are they inter-related?
3. I.T. Infrastructure Strategies	What infrastructure services are most critical to achieving the strategic objectives?
4. Business Application Needs	What are the market and business process opportunities for new business applications?
5. I.T. Investment and Prioritization	What process changes or enhancements are strategically most important to the enterprise?

Table 5-2 I.T. governance decision domains (Weill and Ross 2005)

In the context of the evolution of this major technology programme for food traceability in Ireland these decision domains had the following interpretation in this paper:

1) **I.T. Principles**. The principles of how we delivered our technology programme were documented in national legislation or in sectoral business and technology strategies throughout the programme. The legislation and strategies included timelines, business scope and budgets and they were updated and changed regularly. However there were two major decisions at a national level that drove these principles and these are referred to throughout the paper because they had to be turned into I.T. delivery: They were:

    a. Legislative: It was a European Union (EU) parliament directive that drove the 1995 decision to implement a food traceability

system throughout the EU area. It was a basic design initially and was continuously amended in both EU and in national legislation for the protection of food. It requires the identification and traceability of food from origin to point of consumption. Its evolution in terms of amendments, inclusion and scope was a principal driver for the three stages of I.T. development in this paper. The farmers had to comply with this legislation in order to be allowed to trade their produce. To do this, they needed to provide birth data on animals, details of sale or movement to another herd and details of end of life.

b. Farm Quality Assurance (QA) and Sustainability certification. This is an assurance of farm produce that informs the consumers that food is produced in a safe, clean and environmentally friendly way. The environmental data includes measures of carbon per unit of produce per farm, and this programme feature is the first of its kind in the world. These standards are voluntary for the farmer -he/she is not obliged to participate - but the markets favour produce coming from farmers who do participate. Those who do participate are certified by the national agency responsible, i.e. Bord Bia. Almost all farmers sign-up. Data is more detailed and when farmers sign-up, it is necessary for one of our trained agents to visit the farm and collect the data. Its data requirements evolve to greater detail regularly and are driven by the continuous improvement in good farm practice and scientific measures of

sustainability - and the technology suite interprets, calculates and adapts these practices to collectable data sets.

All these programs are government funded and report ultimately to the Irish department of agriculture. We are a major contractor to the department for the design, implementation and running of all programmes.

2) **I.T. Architecture:** The I.T. architecture is the description of the design of the I.T. components of the complete business and its connection to other stakeholders. As can be seen from the principles the architecture requires multiple forms of data input, data quality, data analysis and reporting over the 20 years - so therefore it continually evolved. We have divided this evolution into three phases in order to support our analysis of decision making. The **Start-Up Phase** was almost a home-grown prototype that ran out of steam with volume and complexity. The **Scale Phase** was the migration to enterprise class architecture at a community level with decentralised control. The **Open Phase** is represented in the paper as the centralisation, and nationalisation of critical data sets, with the redesign of architecture associated with this centralisation and the required sharing of data. (See page 172 for phasing) . Types of decisions included the type of data input, databases, integration to printing, and transfer of data to other community members.

3) **I.T. Infrastructure**: The I.T. infrastructure included all the I.T. hardware systems and facilities that were needed to operate the I.T. architecture and how these were changed over the period. These included system servers, telecommunications and network systems, data rooms, telephony systems, call-centre space and facilities, printers and print rooms, enveloping and

postage. In addition to the changing requirements over time, technology also evolved through growing processing power, new capability and better telecommunications. Stakeholders and the method of communication with stakeholders changed over the period, depending on process change or technology change.

4) **Business Application Needs:** The software platforms that delivered the business needs were built and used by our firm and were continually improved upon over the course of the programme. They were similar to supply chain systems with large databases and reporting capability. They needed to integrate with other stakeholder systems within the overall architecture such as printing, call centre and data reporting. The types of decisions involved in choosing them included ability to meet compliance requirements, budgetary restrictions, business proficiency capability, compatibility or interoperability with community systems and ability to build and deliver these platforms.

5) **Investment and prioritisation:** As stated above, legislation and strategy at the highest level (European Union and State) drove much of the planned priority of implementation. The mechanism for putting these into action and therefore investment and priority in I.T. terms was through an EU standard public sector procurement process. This is a detailed process that ensures detailed scoping clarity and transparency into public procurement. Interpretation of legislation and strategy was included in the scoping, though most of the interpretation was required through the business and technical skills of the tenderer. These public tenders were re-run every three to five years in lots of various parts of the programme. We were the

successful tenderers in the above programs from 1995 to 2015 (the period of the paper). But there were many other non-planned priorities that would also occur including the challenge of food fraud, the risk of disease outbreak and opportunities from new markets.

5.2.2. Phases of evolution

While food traceability in Ireland has gone through significant changes of technology capability over the 20 years of implementation, for this purpose of this paper, we have simplified this evolution into 3 key stages that define this evolution. The three stages are as follows:

1) **Start-up:** This stage represents the initial architecture required for the delivery of food traceability fundamentals with basic infrastructure and business application capability.
2) **Scale:** Over time the architecture needed to change because complex enhancements were needed to deal with the data requirements and to capitalise on emerging technology.
3) **Open:** Most recently architecture was changed again because the technologies needed to "open-up" in order to allow transparency of relevant data, open competition and distribution of data to all required agencies. At the same time, the value of data became a security concern and became centrally controlled.

These phases do not follow a linear timeline and overlap as the new environment is developed but subsystems of the previous stage need to keep running. A simple snapshot of the timeline is shown in Figure 5-1 below.

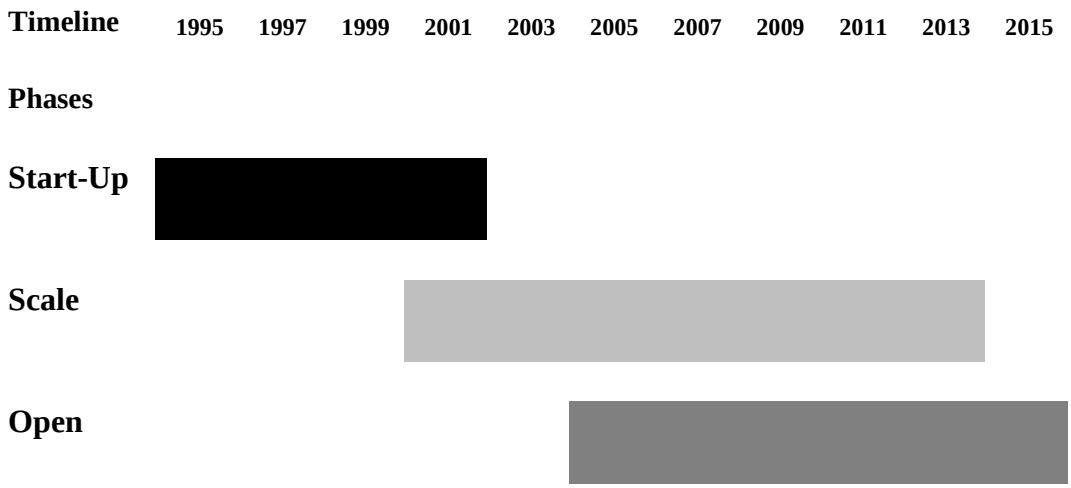

Figure 5-1 Systems evolution timeline

5.2.3. Resulting analysis matrix.

In order to undertake an in-depth analysis of the food traceability programme we examine I.T. governance by decision domain across the three stages of system implementation (Table 5-3)

	Principles	Architecture	Infrastructure	Business Application Needs	Investment and prioritisation
Phases-Start-up	Data is provided using a coded 1st hand account of the evolution of I.T. systems over a 20-year period examining the changes in characteristics of data, or the tensions that cause new decisions to be made and the outcome of those decisions.				
Scale &					
Open					

Table 5-3 Summary of analysis method

From this analysis we conclude by examining the themes that emerge including some of the simple recurring themes of evolution and the important interrelationships between the business priority and the service outcomes of the I.T. programme that was maintained throughout the evolution.

5.3. The food traceability systems evolution

This section gives the detail of how some key decisions were made to evolve the I.T. programme over the 20-year period. We ***highlight*** some of those key areas of insight for further analysis in the summary.

5.3.1. Start-up phase Analysis

In 1995 the Department of Agriculture issued a tender for the building and operating of a bovine (cattle) traceability system. It was issued within a procurement competition open to any suppliers in the European Union. My firm made an application with our proposed business process solution supported by a simple technology solution. It may not have been the best I.T. solution; however, we had the best experienced personnel to help build out the system over time.

Governance of I.T. principles at start-up phase:

My company was involved in agriculture services since 1957 and delivered the first national milk records data system in the country from 1988. The technology capability learned from national milk records was the business experience needed to build the first national registration/traceability system built in my firm. From the start we had to build an I.T. system to collect, store and report the data in order to ***meet EU regulatory compliance requirements.***

The government started to procure a system - and we were runners up (2nd) in the first procurement tender competition. Another software development company with database experience won the tender; however, they failed on due diligence because they did not have the required farming knowledge. So, we were then awarded the contract. Our timelines were tight to deliver a system and so we built

a ***minimum compliance*** solution as required by the tender that would work given the variable nature of farmer administration. To do this we had to focus on paper registration - from farmers - posted to us. We would enter these onto a simple database for recording, analysis and reporting. This initial system was built by our team and written in FoxPro for Dos on a PC over a single weekend. It was very basic, but allowed the manual registration of every animal birth in Ireland. Initially, we wrote the software using our own knowledge of the business sector, its design based on the experience we gained on the national milk records project. We had a deep knowledge of the business models required and the initial solutions for collecting data were quickly built by our team. However the initial systems, while functioning, did have many problems including high error rates, different sources of the same data and non-conformance of farmers. An example of the initial duplicate source of data was at the start, as two-part paper forms were filled in by the farmer, one part to register the animal, (including tag number, DOB, breed, mothers tag number,) and the second part was an animal passport with the same data but retained by the farmer for trading purposes. Early on it was experienced by our team that the manual process of filling in two parts, for the same data, caused a large number of data errors, and so in cooperation with the Department of Agriculture, the process was made simpler as it was decided that the passport would be produced from the data processed in our company. This "***one version of the truth"*** initiative would become one of the features of I.T. governance. This was one of the many changes that evolved with the system as a culture of ***continuous improvement*** emerged including the development of data quality sub-systems. However a ***compliant system*** was now up and running.

Governance of I.T. architecture at start-up phase

From an architecture perspective, minimum compliance presented a number of challenges including;

a) We had to cater for all users of the system. There were about one hundred thousand farm holdings at that time ranging from small part-time farmers with no digital capability, to enterprise farms with sophisticated process and administrative capability.

b) The ability of farmers to trade commercially was dependent on the proper working of the programme. This was because animals could only be sold on exchange of an animal passport. This is a physical document that is issued by the programme and therefore is a key output. Because of this commercial dependency, turnaround times of the process, from request of registration to passport receipt by farmer had to be less than three days.

So we had to go live with ***large volumes in a live environment***. The architecture of the systems required to deliver on these requirements therefore had a broad scope from paper to digital, data input to special printing, and ***fast response times*** of documents, customer service and data reporting. The initial architecture was basic and was based on a paper form registration system. Paper cards similar to Figure 5-2 were designed to incorporate the registration process and passport documents designed to show proof of ownership. The passports were official government documents and were embossed with a state stamp on a special heavy duty paper. Special printers were required and the only ones capable of doing the job at the time were cumbersome impact printers. They were mechanical and troublesome. The registration system itself was a simple database whose fields

resembled the paper forms. Backup routines were run each night for the data on floppy disks. These discs were loaded onto a separate PC network in the helpdesk centre about a mile away. Therefore the helpdesk was working off the previous day's data. As the volume of data built up, the system response time became slower and slower and this caused significant efficiency issues in the operations centre. The resulting systems architecture was therefore slow, cumbersome and indeed had significant risk of failure and data loss. ***However, it worked - and it was live***.

Governance of I.T. infrastructure at start-up phase

We started delivery of the contracts from our office which was a converted cattle shed on a farm in the heartland of farming in Ireland. The farm was owned by an agricultural co-op that was the owner of our company at that time. Our clients were the government of Ireland and every farmer and market in Ireland. Our

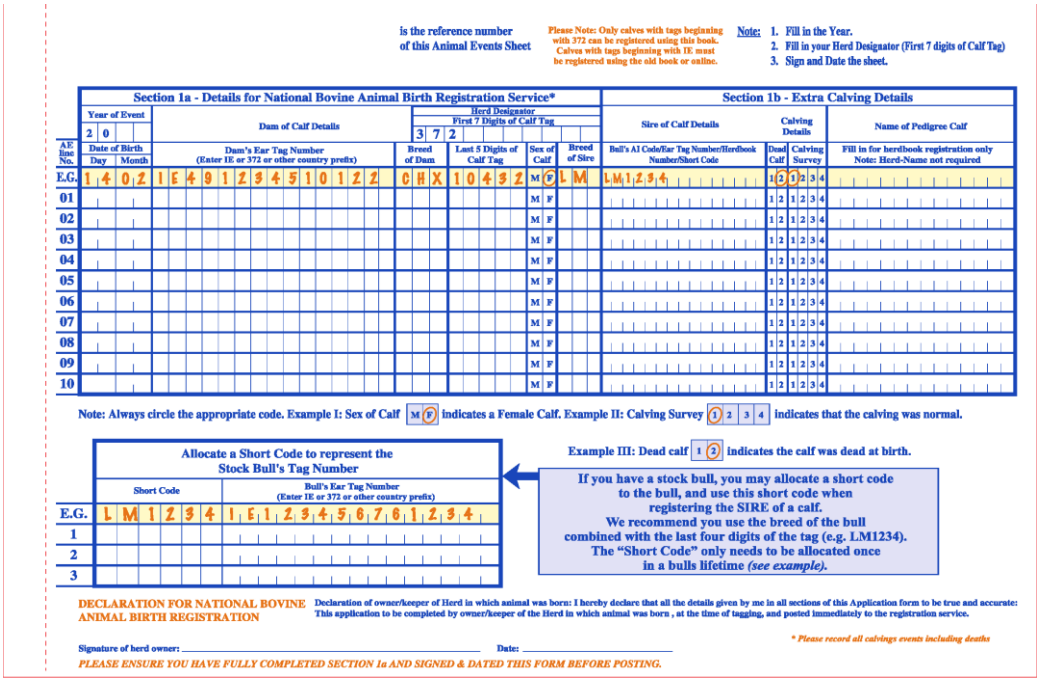

Figure 5-2 Paper form used during start-up phase

infrastructure needed to be able to reach all stakeholders who were located all over the country. The converted “shed” had all of the basic requirements of a data processing centre built into it. We had ***hired our software development teams*** from the local University a few years before and they were based there, co-located with data input teams and a print and enveloping room. It was at on one side of the farm and the corporate head office, Figure 5-3 below, was in a grand country house on the other side of this magnificent 360-acre farming estate. The call centre and also the back-up servers were located in the converted farm house and files were transferred by disk. Overnight, this quiet rural retreat became one of the busiest postal addresses in the region with millions of paper records being received, processed and stored, and also with millions of passport documents being posted back to farmers within the three - day deadline. In order to make the deadline, a special postal courier took mail direct to and from the regional postal depot.

Figure 5-3 Headquarters around 2001

Telecommunications were critical during the early phase for providing customer service to farmers and other stakeholders and for transfer of data to government buildings in Dublin, 300 miles away. In addition all operating markets needed to transfer files to our data centre from around the country. Files transfers at the time were via modem link. In 2001 there was a Foot and Mouth disease outbreak threat and emergency measures needed to be rolled-out to secure food, but allow commerce - so faxes were then used as a critical clearance document for trade. At this time twelve fax machines in a row received continuous forms from farmers trying to trade in restricted conditions just to keep their business going. Making decisions on our feet was important at such times, but overall the architecture worked and we delivered an ***operating model that provided service quality to the industry*** right from the start.

Governance of business app needs at start-up phase

In the start-up phase, our team wrote an animal database and simple application for the registration of calf births on a PC. The PC was networked to a number of others to allow data input of all the registration cards that would be received. We needed to add a maximum volume which was about 40,000 new records per day in high season (about a 3 month period from April); accordingly, the network needed to be able to scale up to a number of PC's. Soon after starting out, there were very large numbers of corrections required on the farmer cards e.g. incomplete or incorrect data. ***Continuous improvement through an agile*** approach to development was also made with data verification and data quality coding with error tables added to the application to automatically reject incorrect data. Many processes were manual though e.g. if a farm was restricted because of a bad veterinary test, a computer printout from the department of agriculture

veterinary unit had to be manually checked to stop passports for those herds. Initially passports were written by the farmer themselves as the registration document was a two-part document. However this was very open to errors as the data was often inconsistent. Thus it was decided that the passports should be printed centrally by my company. Every night the server PC was backed up by floppy disk and the disk loaded on another PC network in another building. This network acted as a back-up and also as a call centre. In summary, business applications developed over this period included:

- Animal registration database with consistent structure to the government database
- Basic data input screens
- Correction file letters and correction input screens
- Files for verification of herd numbers, tag numbers, and other basic data
- Call centre/back-up and restore system
- Passport printing and sorting applications

The software development at this stage was “homemade” and our team developed the business need applications in two ways:

a. By observation of activity at the data input centre, call centre and print room we were able to re-write each application over the five-year period to improve productivity, and provide a more efficient service to all stakeholders. Our teams would make decisions on the floor and specify coding changes straight away. There were many new and innovative initiatives

during this phase including design of algorithms for data quality and fraud protection purposes.

b. By working extensively with the Department of Agriculture, new legislation, processes and verifications were discussed. These discussions were facilitated in regular monthly meetings between the I.T. teams who decided on mutually beneficial changes that may have been different to the initial requirements. The start- up model impressed the agriculture community; however, the business systems were unstable and the applications were incapable of continuing to grow in scope and volume. The systems crashed from time to time, and even though the back-up's were effective, they caused significant downtime and operational delays. Despite this, the great service meant we got great buy-in from all stakeholders.

Governance of IT investment and prioritisation during start-up phase

The priority for the government in 1995 was to follow EU directives and start the implementation of a food traceability system and to secure the safety of our food supply. The government set aside a significant budget to build these systems and the EU-regulated procurement process was used to run a competitive tender in order to obtain best value for public sector money. We won the tender competition. All farmers were required to comply with the registration process and the government helped this by ***linking compliance to the payment of farming subsidies***. This ensured that we got ***complete data*** from the start.

Over time it was clear that the initial standards for technology and scope of work would need more sophisticated solutions and compliance with international standards of good I.T. management. Therefore, investments needed to grow to meet these challenges.

5.3.2. Scaling phase

Whereas our technology and processes were able to deliver the required traceability system, the addition of real-time animal movement data pushed the volume requirements to breaking point for the old system. We needed to upgrade or lose-out on the sector opportunities. Another important change over this time happened when the government food agency, Bord Bia, introduced the new food quality measurement system in addition to the traceability data and my firm was successful on winning the tender to deliver this.

Governance of IT principles during the scaling phase

With over 14 million transactions per year, this now meant a larger and more comprehensive data system was needed and this was implemented. To illustrate the use of the system and the importance of its data the following brief story may help paint a picture of the vital need for accurate and current data. Around 2001, foot and mouth disease broke out in the UK and there was an incidence of the disease in Ireland also. Our systems were used to immediately stop all cattle movements around this outbreak and also to isolate any transactions from the affected farm. ***Data to achieve this needed to be real-time*** in order to achieve the accuracy required to stop trading of specific herds. This was a

Figure 5-4 Foot and mouth disease, UK 2001

major benefit of the ***new systems*** and so would add to the now-established ***one version of the truth*** trust of the programme.

Governance of IT architecture during the scaling phase

There are two main types of animal movements: farm-to-market and farm-to-farm. Farm-to-farm movements needed to be reported by farmers when selling animals to another farmer. Separately, marts and factories (markets) needed to report all animal sales and factory process directly to the database. Real-time movements were required to keep location records accurate to protect from disease spread. To help achieve this, the Department of Agriculture implemented data integration systems into every market in the country. There was a "push and pull" of data to and from the national database to ensure that owners were entitled to sell (Herds were not restricted) and buyers were allowed to buy. Over time, the department and my company co-operated with software providers for markets to export sales data to the national database. All records were retained both in electronic format and in paper format (see Infrastructure below). ***Data volumes surged.***

Data security was an important concern. Our start-up systems simply were not scalable enough to deal with the volume of data, and so data loss was a risk. We decided on a major investment for our firm, which was to ***buy an Oracle***

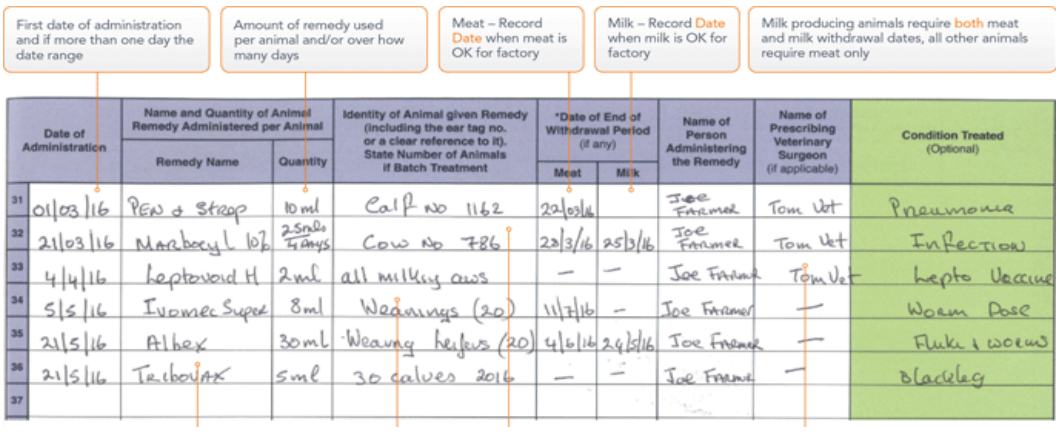

Figure 5-5 New data requirements form

developer licence and also hire skilled developers who could replicate the system on Oracle. We went live on the Oracle system in June 2001. June was "post" high season and so this gave space for "teething" problems. The Oracle system had dual servers with instant copying of data between servers. It sat on the most powerful and up-to-date server technology with huge capacity to store data. Hence ***security of data*** was significantly improved. ISO27000 principles (International Data security standards) were introduced as well as Agile programming methodology to improve software development practice. This allowed for well documented and tested programming and new improvements to the databases and applications. As the new farm quality data requirements were developing, we needed to build new processes for these. These, initially were manual forms for collecting the new quality data, with a data input centre located in our offices to provide data to government systems. So as the initial traceability part of the programme scaled and stabilised, new data requirements were being built again using basic process such as illustrated in the new data collection forms used at the start of this program as shown in Figure 5-5.

Governance of Infrastructure during the scaling phase

Figure 5-6 New facilities around 2004

The growth in data also meant we needed new infrastructure. To allow for scale, in December 2003 we relocated operations to a state-of-the-art technology park (Figure 5-6) in

Clonakilty, Co. Cork, a small regional town with good telecommunication connectivity. The technology park had been built a few years before to attract foreign direct investment to this rural part of Ireland. A fibre optic cable linked the technology park to the national fibre loop. We now had ***high speed data*** linked through burstable bandwidth to the world! We had about 30 staff involved in our business, but over time this would grow to over 1000 staff for all contracts (Including non-government and international contracts). We invested heavily in infrastructure security; we needed to build back-up facilities using alternative telecom providers. Our old site on the farm also acted as a business continuity site, with full disaster-recovery facilities in compliance with ***ISO27000 standards***. We had printing, enveloping and storage that remained in the farm location. All else moved to the new facility. The new technology environment of Oracle systems on dual servers with offsite backup worked well in this new set-up and we started to sell this capability for other business process outsourcing contracts. Our infrastructure was now state-of-the-art and was in compliance with Government & Industry technology standards including ISO27000 and ISO9000 (The ISO 27000 series of standards are specifically reserved by ISO for information security matter and align with a number of other ISO standards, including ISO 9000 for service quality management)

Our call centre was now co-located with the data processing facility. The Oracle suite allowed real time data for the call centre, and hence service to the farmers was continually improving. The links to the printing, enveloping and storage meant that we comfortably achieved the turnaround time from registration from farmer to passport back to them within three days. Service levels also required us to produce original documentation on demand and the link of the Oracle system to

the physical storage also enabled fast turnaround of original documentation. We now had ***speed of process.***

Governance of the Business App Needs during the scaling phase

In 1999, our team realised that the initial systems could not continue to take the large volumes of data that would continue to grow over the following few years. We invested in the new platform; ***new technology skills were hired;*** and our marching orders to them were to replicate all existing business application design on the Oracle platform. Electronic registration was added also and this was done in collaboration with the farmer software package providers so that registrations could be integrated with their software. Manual processes in the start-up stage, for example the restricted herd file, were automated through feeds from the government system through to our database. The verification and error management process became more detailed with hundreds of formulae for ***greater data accuracy*** now being implemented. These included smart measures using industry-specific algorithms e.g. using gestation periods to prove birth date, calculation of frequency of birth of twins to identify fraudulent claims or smuggling of animals, herd and tag verification etc.

Governance of I.T. investment and prioritisation during the scaling phase

The start-up phase proved the value of data and the effectiveness of the program. Disease prevention was a major priority and its return on investment was linked to the value of the industry; as a result, greater investment was required and justified. Major investment, such as the new technology platforms, therefore proceeded accordingly. The new system platforms greatly ***reduced the risks*** to the industry. In addition, the need for access to new markets drove the implementation of the

food quality assurance programme in 2005, requiring so many new data sources. The quality assurance systems were developed in line with this need and my company operated these systems initially using paper based data collection forms.

5.3.3. Open phase

Governance of I.T. principles during the open phase

Up to now, the department of agriculture had reached out to the market to build the best systems. Around this time, they ***hired a new CIO***, who would radically change the operating model by ***centralising control*** of data and setting in place a data-sharing strategy through the introduction of Web services. Addressing the paradox of greater central control and security of data while opening-up the sharing of key data was a new challenge for our sector at the time. So, under the new CIO's stewardship, the department started to "open" the systems from 2003. The cattle ear tag allocation was the first function of the traceability process and when the animal "Ear Tag" tender was issued in 2003, the department had moved the application intelligence (allocation of tag numbers etc.) in the technology to the department's own systems. It would take another 11 years to complete this open system build for all functions and it was completed in 2014. All master data was now centralised with distributed input and reporting to authorised stakeholders including better farmer reporting who could trust data better now because of its transparency and protection.

Governance of I.T. architecture during the open phase

This phase started the process of building the ***"master data"*** in the department systems and linking them to all stakeholders via web services. In addition data analytics and data sharing with other agencies became a greater requirement. ***Web services*** allowed controlled sharing of information to authorised stakeholders such as The Irish Cattle Breeding Federation (ICBF), Teagasc (Irish Agricultural science authority) and Bord Bia.The other major action during the web services

programme was, following successful implementation, much of the scale systems capability was disabled. This assured a ***single version of the truth*** and avoided data conflicts.

The existing data on herds, animals, and veterinary detail is shared with the farm quality assurance programme. Collection of additional data required to certify a quality assured farm was done using a data collection process where audits were done on the farm and the data initially collected on paper by certified auditors who we employed. Over time we introduced handheld mobile devices for completion of these audits. The devices could store the information on the device until the auditor got to a Wi-Fi location where the completed file would be loaded to the data system via mobile web services. The signature of the farmer was required to allow sharing of data to specified organizations and this was initially done on the paper form but could now also be done on the digital tablets.

Governance of I.T. Infrastructure during the open phase

Our offices in the technology park allowed for modular growth - and scale down (for low season) as required. As the systems opened up through web services, our existing business applications were changed to integrate with the new government systems. My company's system is now used as a data provider and a back-up to the government database.

Over this time, all systems - and sub-systems - scaled. The telephony systems started out as a simple office exchange and grew to be a state-of-the-art call centre system with full back-up in the event of failure. All infrastructures needed to be in place in two's, live and back-up, in case of problems. Single points of failure were not an option on anything that delivered or protected the data. The phone systems

were integrated with the data so as to show records quickly to the operator. All systems and processes involved in the handling or processing of data were now compliant with **ISO27000** and these compliances were regularly checked by independent and government external audit.

Governance of business app needs during the open phase

Between 2003 and 2014 the Department of Agriculture developed the new centralised system, called AIM (Animal Identity Management), to replace our Oracle master database and to be the master data file for the industry. AIM is now also, a multi-species database and had all of the business rules and logic that existed with the existing systems.

Our IT team ***collaborated extensively*** with the department‘s IT team to build this logic into AIM using Agile development methodology. The system was completed in 2014 and the database that we had run for the previous 19 years, with all its rules, was now transferred (rebuilt) by the Government. It was now an ***open market*** so that ***more vendors*** could enter the data services tender competition and this would reassure all stakeholders. However we were confident of our collaboration despite being exposed to more competition. We had already significantly grown our business through delivery of more data collection of quality and sustainability measurement data. We had also recently started to deliver similar services in the UK. We had a growth mind-set, and we firmly believed that collaboration was a better engine for growth.

Governance of I.T. investment and prioritisation during open phase

As the programme evolved there were continuous assessments for prioritisation of work and value for money. Investments over the three phases increased exponentially in line with the investment in I.T. resources. A table of estimated investment in I.T. versus the return in the industry is shown in Figure 5-7 below.

Year/Value	1995	2000	2005	2010	2015
IT Costs	€ 7m	€ 10.5m	€20m	€30m	€53m
IT Cost Growth	-	50%	90%	50%	77%
Exports	€ 3bn	€ 5bn	€ 6bn	€ 8bn	€ 11bn
Export Gr		66%	20%	33%	38%
IT Cost % of Export Value	.0023%	.0021%	.00333%	.00375%	.0048

Figure 5-7 Schedule of estimated return on investment over time

(Note values in Figure 5-7 are authors estimates based on own data and market data)

As can be seen from Figure 5-7, when the amount of ***data increases so too does the cost of processing the data***. The table also shows the remarkable growth in exports of Irish food since the start of the program. The costs, on their own would show a remarkable and worrying growth; however, with strong growth in exports, costs ***remained relatively low as a percentage of export value.*** But the story of investment and prioritisation is not influenced by costs only. In addition to the costs, stakeholders were motivated by a number of other criteria including;

- Elimination of business risk
- Access to new markets for Irish food
- Access to new markets for all stakeholders such as ourselves.

So the whole industry has backed the data program including the significant investment costs because of the opportunity provided by ***growth into global food markets.*** This concludes the data presentation under the Weill and Ross conceptual lens. Now let's look at the analysis of the story.

5.4. Lessons learned and concluding remarks

5.4.1. Analysis and lessons learned

During the course of the evolution of I.T. systems in this story, our company grew from this single customer and programme to multiple customers delivering not only in Ireland but also to multinational locations. By 2015, we had 1000 employees with new offices in Ireland, the UK and central Europe. This business growth was built upon the knowledge and experience that we learned in the traceability programme which we were able to extend into other sectors covering financial services, media and publishing, the travel industry, Utilities and many other government contracts. Contracts in these sectors often went through similar evolutions of development as described in this paper. We developed a name as a trusted partner of all of those clients.

Figure 5-8 below shows us the summary of the evolution of the decisions made throughout the systems programme as highlighted through this self-account. The table shows how evolution occurred arising from the changing needs of the data which required decision making to assure trusted data.

Phase evolution by Domain		Principles	Architecture	Infrastructure	Business App needs	Investment and prioritisation
Start-up	Data Characteristics/ tension	EU legislated food chain system requirement (**QS**)	Process large data volume in live environment (**QS**)	Data to link stakeholders (**DQ&S**)	How to match technology and business knowledge (**P**)	Data provider participation/ compliance (FM)
	Decisive action	build a compliant system with continuous improvement (**QS**)	Design system to assure response times, (**P**)	Assembly of best solution available (**P**)	Tech skills hired had with agile development approach (**P**)	Incentivise key data creator buy-in and participation (FM)
	Outcome for trusted data	Expertise delivered a compliant programme (**P**)	Data programme fit industry and data need (**QS**)	Operating model that fit industry profile (**QS**)	Data systems buy-in through good quality of service (**QS**)	Full data Participation (FM)
Scale	Data Characteristics/ tension	Data currency & system stability in new volumes (**QS**)	Scale is greater than initial design (**QS**)	Growth in data Volume, Technology evolution (**QS**)	new volumes and new data types needed new system (**QS**)	Disease outbreak would shut down the industry (R)
	Decisive action	Procure new system for real time data , stability and scalability(**DQ&S**)	Implement system for growth, stabilisation and data analytics (**DQ&S**)	New Location, New technology (**QS**)	hiring of new technology skills (**P**)	Protect from risk of disease outbreak though better data.(R)
	Outcome for trusted data	Real time data gives "One version of the truth " (**DQ& S**)	Greater accuracy and security of data (**DQ&S**)	Speed of data process trust to industry (**QS**)	Continuous improvement in data accuracy (**DQ**)	Data sets are improved and risks avoided (R)
Open	Data Characteristics/ tension	Need to centralise control and improve transparency of data **DQ &S**	Centrally secure yet share data P&S (**DQ&S**)	Centralised control with data sharing /transparency (**DQ&S**)	Centralised master data (**S**)	Food market growth while the data systems are complex and expensive (V&M)
	Decisive action	New CIO, Centralise control and share data (**P**)	Build master data centrally with web services distribution (**DQ&S**)	Implement ISO27000 and ISO 9000 (**QS & S**)	Collaboration of teams to support centralisation (**P**)	Increase investment to enhance the value of Irish produced food (V)
	Outcome for trusted data	Data Programme secured ,controlled with sharing for integrity, transparency and growth (**DQ&S**)	Transparent accuracy, control and stability of data (**DQ&S**)	Secured data models for growth with mobile and web data collection and sharing (**QS&S**)	Open market for new data service providers , process transparency (**DQ**)	Stakeholders especially consumer is assured and exports increase (M)

Figure 5-8 Evolution of I.T. governance from 1995 to 2015

Figure 5-8 takes the call-out tensions, actions and outcomes from each domain stage and plots these across the stages of start-up, scale and open phases. A number of consistent themes emerge in our analysis and we have coded these in Figure 5-8. The themes divide between the operational outcomes and the business priorities that drive them through the evolution. The operational outcomes include the outcomes in the domains of Principles, Architecture, Infrastructure and Business application needs. It was these domains that set the direction and delivery of the operation of the systems. The Investment and Prioritization domain on the other hand was a driver of governance of the other four domains and shows the business priorities that were consistent.

Operational outcomes: The consistent operational outcome themes are coded in the table; these are Data Service Quality (QS) , Data Quality (DQ), Security of Data (S) and People Expertise (P). These four themes are consistent across all domains and all phases and are key contributors to the evolution of trusted data from these systems.

Business Priorities: In addition we see four consistent themes of business priorities from the Investment and Prioritisation domain. These include Full Membership (FM) of the programme, Elimination of business risk (R), Value for money(V) and Driving market Growth (G). These are further explained as follows

5.4.2. Operational outcomes

- **Data service (QS)**

Data service quality emerges as a strong operational theme throughout which highlights the critical importance to my team of the smooth and efficient running

of data collection and data delivery processes. It was a priority outcome throughout the evolution. Good service to data owners for data collection, and to agencies for reporting data assured trust in the systems and therefore encouraged and supported all business priorities e.g. Data service quality assured the meeting of service levels to farmers so that their business transaction would not be delayed, and supporting full membership and timely data reporting could help isolate risks in the case of disease outbreak.

- **Data Quality (DQ)**

In this case data quality is the integrity and accuracy of the data and was a focus of the evolution. Data quality gave trust in the system to all stakeholders, hence incentivising full membership, reduced business risk, value for money and giving good data that promoted access to new markets. Therefore all business priorities that benefited relied upon data integrity and accuracy i.e. (DQ).

- **Data Security (S)**

Trust in data security allowed stakeholders to participate in the programme with knowledge that their data was safe. Initiatives such as the robust architecture evolution and continuous improvement in security certification under ISO27000 are examples of how data security was a constant focus at all times. Data security also assured protection of competitive data to support market growth.

- **People expertise (P)**

Business and technology expertise throughout the programme was required to deliver the programme whether this came from our legacy, or we had to go and hire new skills. Throughout our case, people expertise played a key role in the

evolution of systems from the first prototype, through the new skillsets to scaling the systems and the hiring of a new CIO in the department of agriculture. The skillsets were not just technical I.T. skills, but equally industry experts with a wide network within the industry.

5.4.3. Business priorities

- **Full Membership (FM)**

Our data compliance needs at start-up and the additional requirements and changes over the programme would not have been possible without the full membership of stakeholders. Partial membership would have rendered our food produce unsafe. At the start, there were specific financial incentives for participation and penalties for non-compliance; however, data service quality, accuracy of data, data security and the know-how of our people were also critical to full membership e.g. Service quality assured the fast turnaround of documents so as to allow for commercial transactions - and real time data processing was implemented at markets to process sales transactions.

- **Elimination of business Risk (R)**

Service quality aspects, such as turnaround time of data processing and reporting assured accuracy of data and therefore elimination of business risk such as control of disease spread or the levy of major penalties on the industry for lack of compliance to legislation.

- **Value for money (V)**

We were spending government money and were always under the spotlight to account for value for money. In addition recurring tenders assured open and fair

competition. All desired outcomes were included in these tender documents and so there was strong pricing competition to win these contracts.

- **Market Growth (G)**

All initiatives in our case were aligned to market growth and outcomes ensured a quality of process and data that assured customers around the world such as the Chinese delegation that was featured in the case in the recent years. Farmers and producers wanted growth. Our goals needed to be aligned.

5.5. Recommendations

The evolution of a food traceability system brings a number of important lessons related to IT governance. Our summary in Figure 5-8 offers some stand-out lessons learned from this story that not only applies to the building of food traceability systems but also to evolving trusted data systems in all sectors. These important lessons for IT governance are as follows:

5.5.1. Governance evolves

The analysis of this case shows a data technology implementation as it evolves from simplicity to maturity and then to centrality-type architecture. Figure 5-8 shows this evolution and how the changing nature of data and the tension that it creates causes new design decisions that bring about new contributions to trusted data at each stage in every decision domain. We believe this model as shown in Figure 5-8 is a useful guidance for CIO's who are about to embark on a large data systems implementation.

5.5.2. Four easy takeaway mantras

As shown throughout this case and summarized in Figure 5-8, some simple mantras were followed along the evolution. Four of these were:

- One versions of the truth: Because of this mantra, there was a continuous elimination of potential duplicate or conflicting data sources and this evolution led to better systems flows and more accurate data.
- Manage the paradox of protection of data while sharing it more to provide transparency and therefore improve the accuracy and trust in data.
- Applying the principle of continuous improvement right from the start, in all domains was a valuable driver of good systems evolution.
- Use of existing global standards of excellence like the ISO standards made choices - such as security and quality standards - so much easier to decide upon.

5.5.3. Template for governance of I.T. systems evolution

As in any data system, the recruitment, retention and growth of good data is a critical evolution. Our analysis from Figure 5-8 shows how the same business priorities and operational priorities were prevalent throughout the program. These business and operational priorities are of course dependent on each other. This interdependence therefore provides us with a matrix that can be generalised in many I.T. evolution environments and can be a valuable guide for practitioners involved in I.T. systems development for deployment especially in a live business environment. It will assure business buy-in and a trusted data model for all stakeholders. Figure 5-9 below shows this interrelationship in a matrix format.

		Business/Industry Priority			
		Full Membership	Eliminate Business Risk	Value For Money	Drive Market Growth
Operational priorities	Data Service Quality				
	Data Quality				
	Data Security				
	People Expertise				

Figure 5-9 Decision matrix for governance of I.T. evolution in trusted data

This matrix shows how the provision of a high quality of service to all stakeholders, integrity of data, its security and the expertise of the people must be a focus to allow full membership of the data programme, eliminate business risk, provide value for money and support strong market growth over time. Therefore as a practitioner prioritises each of these operational areas he will assure the business priorities. The practitioner must put a "tick" in each of these boxes to assure governance of decisions over the evolution of IT e.g. If the IT decision risks Quality of Service, then one or all of the business priorities will also be at risk. The priority affected can be identified and the decision/risk assessment can then be made assuring good governance of data.

5.5.4. Conclusion

The continued growth in world population alone drives an urgent need for safe and sustainable food production. On a more general level, it is estimated that there will be massive growth of data under-management in organisations and business

sectors between now and 2025 with some industries retained data doubling every year (Tallon et al 2013). Of course there is an underlying need to trust the output from this data in most businesses and government services. The governance model developed in Ireland to build our food traceability systems - as outlined in this paper - has stood the test of time and can serve as a model for other data systems. Therefore we believe that the outcome from this research, its summary, recommendations including the proposed template for governance of the evolution of I.T. systems may provide helpful insight into the management of this data over time.

References

All references are included in Chapter 7

6. CHAPTER 6 – CONCLUSION: A FRAMEWORK FOR TRUSTED DATA GOVERNANCE

This final chapter presents a combined comparative analysis of each of my chapters and through an analysis of this data presents a new Framework for Trusted Data Governance.

6.1. Introduction

My study has focused on the contributing factors to governance for trusted data using my autoethnography of a national food programme evolving over twenty years and which provides the trusted data that powers an € 11 billion (2015) industry from Ireland and Europe's largest dairy export market. I have studied this through the lenses of community governance, data governance process and technology evolution governance. Now, in this final chapter, I will do a comparative analysis and present an evolution of governance over the lifetime of the programme and finally, a new framework for trusted data governance. Once again, my method is autoethnography, which is my introspective reflection on my story and seen through the lens of the papers I have written. As a result, this concluding section is, perhaps, a deeper reflection (reflexive analysis) of the outcomes of all of my research to date.

6.1.1. Trustworthiness of the research

This research is completed using autoethnography as my methodology and studying a live case study over a twenty year period from 1995 to 2005. The

combination of transparency of the case study, robustness of method and level of peer review serve to underpin the trustworthiness of the research. Trustworthiness of research is defined as it credibility, transferability, dependability and confirmability (Lincoln and Guba 1985). In Chapter 2, I have discussed my methodology in detail and my overall approach to the research. The "layer approach to autoethnography, as discussed in Chapter 2 and shown in Figure 6-1 shows the methodical approach to attaining this trustworthiness.

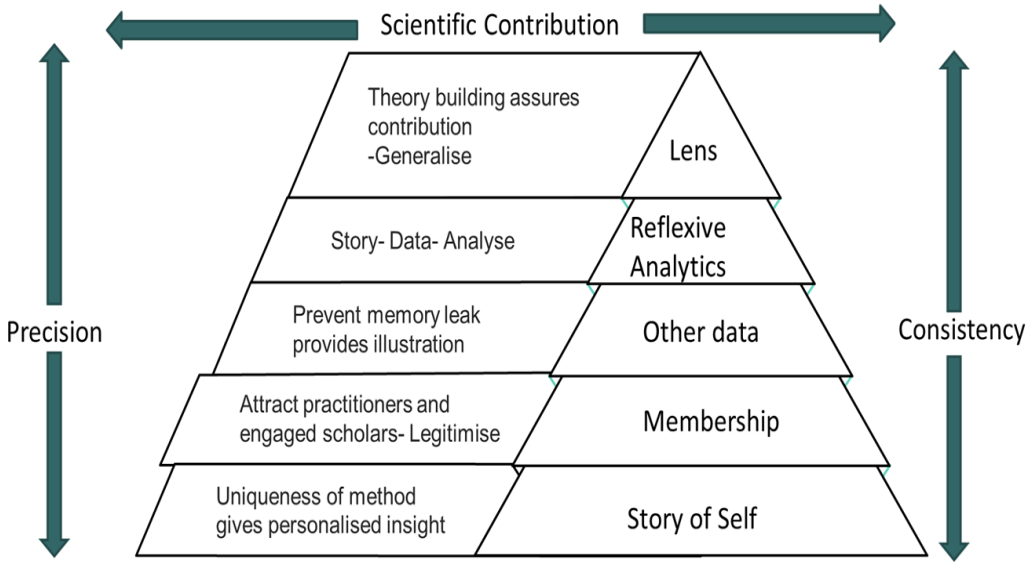

Figure 6-1 Autoethnography- The layer framework

In addition to this method approach, the following also underpins the trustworthiness of the research.

a) Public profile of the data. The case study researched is a national food programme for which much of the data is public and transparent and especially the growth in the value of the case study from approximately €3 billion in 1995 to over €11 billion in 2015. This rich case study of food traceability has researched detail aspects of the food data that is directly used to help grow this industry over this period of time.

b) Membership. Whereas it is already included as part of the "layer" approach to the methodology as detailed in chapter 2, my own membership in both determining the research question and in the case study used for research are two separate personal events. As a full member my research is informed by thick descriptions of those experiences including story of self, vignettes and other data that is in my possession. This thick description allows me to generalize from my research question to the research. My recommendation from the research is proposing further research including new sectors for this data governance framework.

c) Persistent observation. Each of my research areas including community governance (Chapter 3) , data governance (Chapter 4) and Technology evolution governance (Chapter 5) have used persistent observations using the same data collection and analyses techniques.

d) A full comparison of my approach to this thesis and Lincoln and Guba (1985) is shown in Table 6-1:

Lincoln & Guba Heading and subheading	Layer Framework	Other Data	Examples
Credibility			
Prolonged engagement	Full membership	Twenty year case study	• Section 1.7 Case overview including 20 year timeline
Persistent Observation	Story of self and vignettes	Common methodology throughout	• Chapter 4- Vignettes
Triangulation	Other Data		• Use of external data in Figure 5-7, Figure 5-5
Peer debriefing		Published papers and peer review process	• All chapters are peer reviewed
Negative case analysis	Reflexive Analysis	Strong analysis of paradox throughout Extensive analysis	• Analysis of Chapter 5. Section 5.5. Data security Versus Data sharing • Extensive analysis throughout
Referential adequacy		Theoretical discussion and literature review	• Chapter 1 and Chapter 7 References
Member-checking	My full membership	Triangulation to other data	• Table 1-10 Data sets used
Transferability			
Thick description	Story of self	Use of vignettes	• Chapter 2, rich story. • Chapter 4
Dependability			
Inquiry audit		PhD Supervision over 3 years Peer review process Practitioner journal review	• Supervisors are shown as co-authors on each published paper and chapter
Confirmability			
Confirmability audit		• Supervision over 3 years • Peer review & • Practitioner journal review	• See table 1.1
Audit trail	Interviews Other data	• Inventory of other data • Concept Centric Matrix • Tables of analysis	• Table 1-10 Data sets used • Tables 1.7,1.8 & 1.9 • Extensive use of table to list data
Triangulation	Other data		Table 1-10
Reflexivity	Reflexive Analysis	Introspective story of self	Chapter 2

Table 6-1 Trustworthiness of research comparison to Lincoln and Guba (1985)

As described in the opening chapter, autoethnography as a methodology is proving over time as a valuable scientific method. My approach to it, as validated by my peer reviewed approach, assures the trustworthiness of the research as defined in Lincoln and Guba (1985) and the extensive analysis of the history of the method in Chapters 1 and 2.

6.2. Cross paper comparison

In order to do a comparison of the papers and a consolidation of the study, I have summarised the analysis and contributions of each paper using the following approach:

- What were the key steps along the evolution path?
- What has my study of each concept contributed to the governance of trusted data?
- What are the key points in those research papers that underpin those contribution points?
- As a reflexive analysis of those key points, how do they overlap or cooperate with another domain? To see this, all contributions from each domain are coded in order to map the domains and the overlapping areas so that we understand interdependencies - and which enables us, therefore, to simplify a model. This coding is illustrated using a Venn diagram as shown in Figure 6-2 as follows:

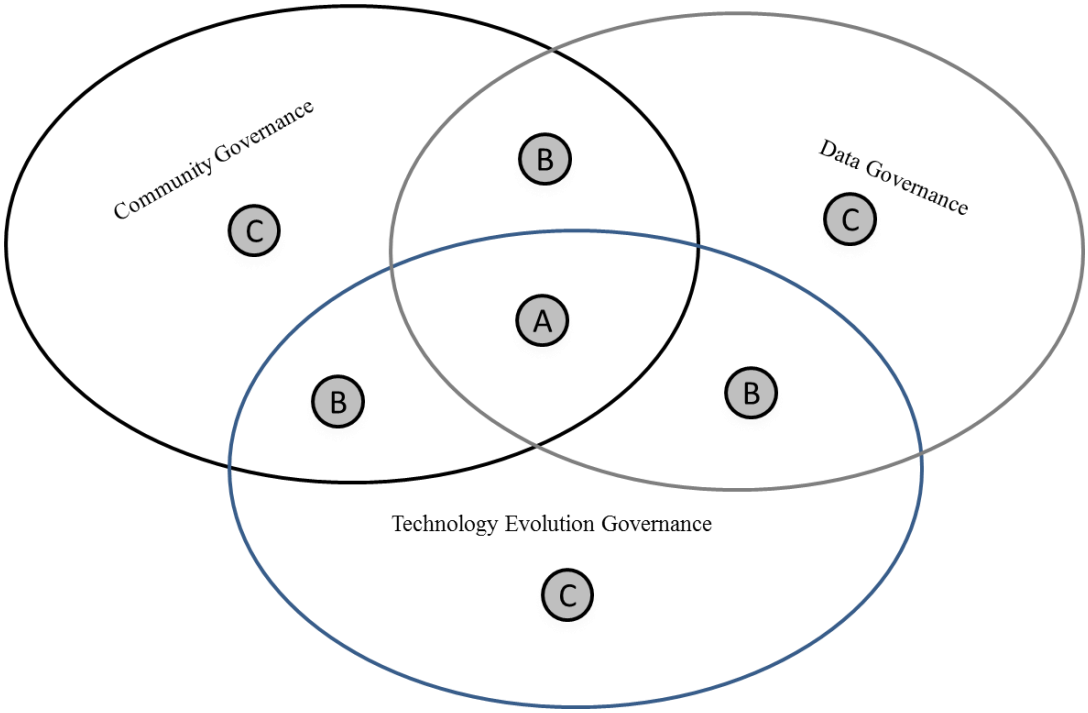

Figure 6-2 Coding for comparative analysis

The comparative analysis below for each domain is therefore coded as per this Venn illustration as either overlapping with all domains (A), co-dependent on another domain (B)'s, or independent on its own domain (C)'s. This simple coding will allow us to understand, and draw conclusions from, the comparative analysis.

6.2.1. Community governance comparative analysis

My paper in chapter 3, "On the Road to Trusted Data: An Autoethnography of Community Governance and Decision Making" (Costello et al 2016) delivers a strong contribution to the concept of how innovations occur in data governance in a widespread community. The chapter offers data on a real-life community governance practice site to produce trusted data which leads on to achieving trusted data. The main contributors from this chapter were the mobility of knowledge and skills of the people involved, the incentives or reasons for

participation, the long-term stability of the community and the mobility of leadership in the hub role. The aligned analysis is shown in Table 6-2 below:

How Communities collaborate in order to build trusted data systems and produce trusted data.			
Contributions	**Key Points from Chapter 3**	**Evolution**	**Reliance on Process and/or technology Domains**
Knowledge and skills availability andK mobility	Importance of Industry knowledge and its mobility around the community in order to deliver data value	Cultural and industry knowledge. Focus on hiring and developing new skills. Evolving the knowledge with stakeholders	No overlap: Knowledge and skills were hired, developed and mobile within the stakeholder community. C
Integrity of trade and behaviors of community members	Appropriability of incentives. Prohibition/non tolerance of cheating	There were always challenges but there was always control and consequence to manage these.	Overlap with Data Governance Process for oversight process of incentives, controls and conseq B
Stability of the network and participation of stakeholders in the long term	Network behavior (cultural, civil, social) contributors were security, shared strategy, freedom to come and go.	Growing participation in strategic planning run every five years Regular meeting Security continuously improved	Trust was sustained within the community to keep participation. Security and strategy were shared with other concepts. A
Hub/Leader Mobility	Entrepreneurial or process driven (implicit/explicit)	Great leadership always ready to step in to the hub role at the right time	Central to all domains A

Table 6-2 Community governance comparative analysis

6.2.2. Data Governance comparative analysis

Chapter 4 delivered a new contribution to a Data Governance framework in the form of the 5 stars of data governance which emerges from the analytic review of our case using the Khatri and Brown (2010) framework and which therefore extends that framework. The five stars are represented in this aligned study as in Table 6-3.

An effective data governance process must be in place for trusted data			
Contribution: 5 stars	**Key Points**	**Evolution**	**Reliance on Community and/or technology concepts**
Data Strategy	Aligned and part of the business strategy, Cross stakeholder Ambitious	Every five years with a ten year vision. Memorable new name each time	Overlaps and participation with all concepts as it must be informed (A)
Roles and responsibilities	Aligns skills and knowledge to data process ownership and accountability	Continuous competition for roles	Overlaps with Community stakeholders (B)
Data Standards	Policies, procedures and work instruction on all aspects	Continuous improvement	Data process independent audit capacity. Does not overlap (C)
Data Technology (Smart)	Specific use of technology for data integrity, security and artificial intelligence	Always adapted new technology	Overlap with process to that process is built into data technology tools (B)
Actionable Data (trusted data)	If data is not used it is not trust worthy	Continuous improvement and value checking	Overlaps with process and community (All) to determine action and stakeholders to deliver change related to data (A)

Table 6-3 Data governance comparative analysis

6.2.3. Technology Evolution Governance (TEG) Comparative

Chapter 5 gives us contributions with its "four mantras" of Technology Evolution Governance and the template for I.T. Evolution Governance. The overall takeaway, i.e. that technology must evolve as data needs evolve, is also a lasting takeaway. To combine the analysis I have first of all combined the four mantras of TEG with the template as follows:

- One version of the truth is a part of eliminating risk within the template since allowing duplicate data collection risks data accuracy
- Managing the paradox of sharing and protecting data is a part of security and presenting actionable data
- Applying the principle of continuous improvement is a key component of data service, data quality, security and expertise.
- Similarly, global standards are drivers for data quality, data service, security and people expertise.

These four mantras are behaviours across the template for Technology Evolution Governance. Therefore, I have included them in the combined analysis as part of the template. Similarly the two-dimensional presentation of the technology evolution framework in Figure 5-9 of that chapter is reverted to a one dimension and each of the priorities including - Full membership, Risk, Value for Money and Growth - is combined for this analysis as "Investment and priority" areas inTable 6-4 below. This revised presentation of the contributions in Chapter 5 allows us to present a comparative analysis of this Chapter as shown in Table 6-4.

Technology must evolve to data needs			
Contribution	**Key Points**	**Evolution**	**Reliance on People/Process**
Data Service	Efficient and ease of participation. Service levels, Actionable data	Priority from the start , service can never break	Stakeholders will participate with systems that work so overlap with community! (B)
Data Quality	Data integrity and compliance with regulation. Rules based technology	Continuously improved through new process and technology	Standards of data quality and regulation, data quality control checking overlap with DG (B)
Security	All security types; theft, leakage, loss, access.	The systems scaled over time and security process and technology always updated	Common to all domains. Stakeholders will not participate if data is at risk. Regulation of access controlled through governance proc (A)
Data expertise	Understanding of meta data,, business rules and data nuance	In place at the start and recruited, educated continuously	Strong overlap with stakeholders who need to provide these skills (B)
Investment & Priority	Participation, manage risk, provide value for money and growth	Risk Management priority Investment Grew Value grew	Overlaps with community since stakeholders need to provide funding, priority and they also benefit (B)

Table 6-4 Technology evolution governance comparative analysis

This individual comparative analysis can now be combined to deliver a completed Venn analysis as shown in Figure 6-3:

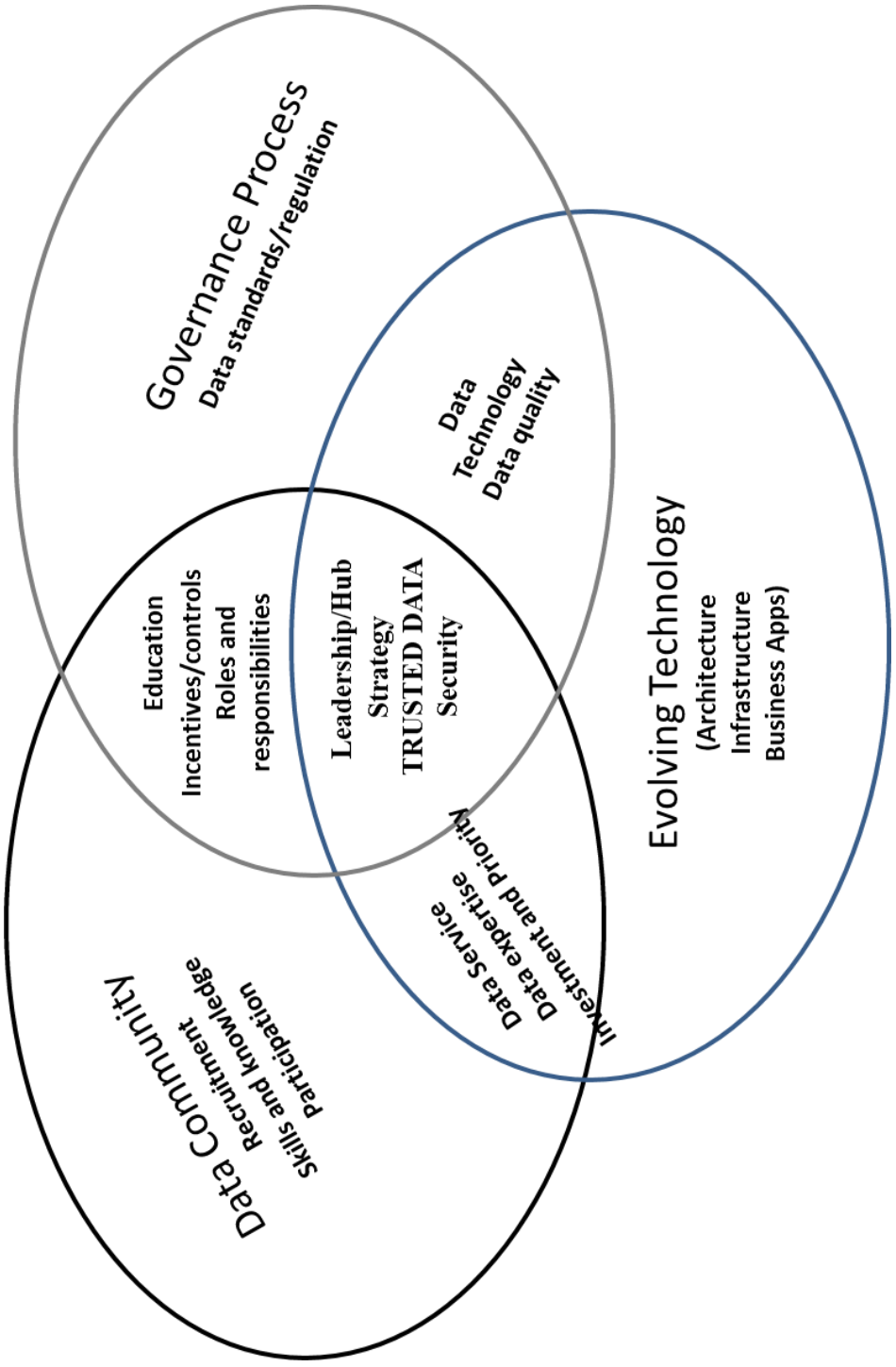

Figure 6-3 Comparative analysis of papers, Venn illustration

As I conclude this part of the data comparative analysis, let's discuss the overall contributions we can draw from this research before I discuss the limitations and finally the conclusions and recommendations in section 6.6.

6.3.1. Comparative analysis of domain papers

My research up to now had focused on the three domains of data governance that emerged from my story of self in order to understand how each concept has contributed to the trusted data nature of the traceability of Irish food. The papers are similar in that they have used:

- The same methodology: All the papers have used autoethnography with the use of a conceptual framework lens to help the analysis.
- The same story of self: They have all used the story as told by me, of my experiences, using my words and descriptions.
- The same case programme: Each paper analyses the concepts of people, process and technology within the Irish food traceability programme.
- The same overall timelines: They all developed their contributions over the same timelines.

In addition:

- Each has made contributions to the overall research.
- Each one has been focused on the contribution made to the governance of trusted data

In this final chapter, I will co-ordinate the contributions into a similar format so that they can be consolidated into a single framework for trusted data governance. I will discuss the limitations of the research and I will conclude with my recommendation for a "New Framework For Trusted Data Governance", discuss the data that supported this framework throughout the study and, finally make

recommendations for future work in terms of research for new students of data governance and also for practitioners of data governance who can use this model to either improve or to implement a new trusted data governance programme.

6.4. Discussion and Conclusions

The analysis in section 6.3 presents us with two contributions from the research.

6.4.1. The Road to Trusted Data

The path of evolution in community governance, data governance and technology shows a continuous growth, continuous improvement and continual investment profile as the data strategy continues to deliver value to its stakeholders as shown in Table 6-2, Table 6-3 and Table 6-4. An illustrative analysis of this evolutionary path, and how it occurred, is summarised in Figure 6-4:

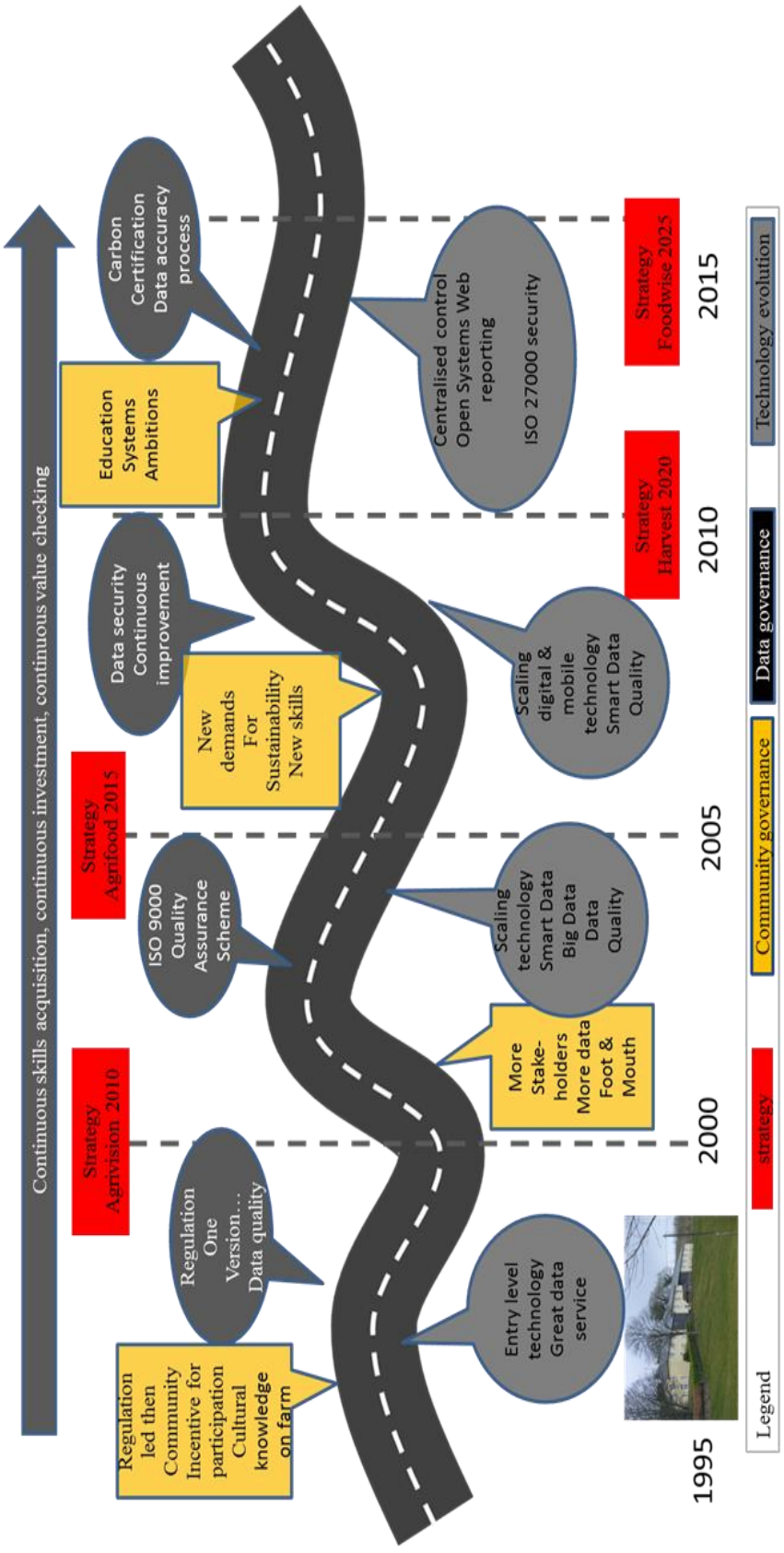

Figure 6-4 The Road to Trusted Data

Figure 6-4 depicts the continuous development of trusted data over the twenty-year period and as studied in the comparative analysis in Section 6.2. The "Road to Trusted Data" shows how new skills and new stakeholders entered the community, how continuous improvement in data governance evolved through new regulations and standards, and how technology evolved through scaling of the data technologies and adaptation of data management tools to govern the ever-growing data needs. This growth is continuously enabled through both repetitive strategic planning led by different leaders in the community, and continuous investment, as the value of the programme grows over time. A significant contribution in Chapter 5 on technology evolution was that technology evolves as the data needs grows, but now we can see from this analysis that the combined domains, including Community, Data and Technology, all evolve over time as Trusted Data therefore evolves.

As pointed out in many vignettes in earlier chapters, it doesn't always work according to plan and things often go wrong many times along the way. In our programme there were many such times including disease outbreak threat, tough economic times for farmers, system breakdown, backlogs of processing, public complaints, and many more examples. However, each and every time these problems occurred there was a swift and corrective response. The resilience provided by the strong community governance, a thorough governance process and access to evolving technology governance was always able to address the most challenging of problems.

6.4.2. Why is it a new framework?

A background and history to data governance research is discussed in detail Chapter 1 (page16). In this final Chapter we present a new framework for governance of trusted data. We can assert its uniqueness and newness because data governance as a researched topic is at its infancy (Weber et al 2009, Wende and Otto 2007, Otto 2011, Alhassan et al (2016). Khatri and Brown (2010) developed one of the early frameworks for data governance using the Weill and Ross (2005) technology governance framework as its basis. Up to December 2015, just 35 research papers were researched in Alhassan 2016, as discussing Data Governance activities. My further research of these papers shows that 12 of these 31 research papers are a general discussion whereas the other 19 are from research in specific industries including 6 in the Health sector, 2 in pharmaceutical, 2 in Information technology, 4 in Telecommunications, 2 in accounting, 2 in financial services and 1 in the defence industry. Ten of these research papers present a framework for data governance of some kind. These papers have been analysed as I choose a conceptual framework for this research.

A significant contribution from this research is a "new framework for trusted data governance". It is new because it is the only research paper that uses the food sector as the basis of the research. In addition, whereas many of the frameworks discuss roles and responsibilities, my research goes in to most detail on the stakeholder participation. Just one of the 31 papers referred to above uses a similar holistic approach of using the People, Process and Technology approach to the analysis (Panian 2010). Hence this new framework presents new research in a new sector and is recommended for further research as such. So the uniqueness in its completeness (People, Process, Technology) and its basis on real life proven case study in food should add considerable value to the existing poor status of

data governance for which some papers assert that just 3% of company data meets basic quality standards (Nagle et al 2017) as already identified in Chapter 1.

6.4.3. A new trusted data governance framework

The Venn illustration shown in Figure 6-3 now gives us the basis for a new contribution which is a "New Framework for Trusted Data Governance" as shown below in Figure 6-5. As the Venn illustrates, this new framework combines the analysis in a consistent way for all domains at the levels including:

a) Shared Domains.(The A's from the comparative analysis in Section 6.2) The governance principles including leadership, data strategy, data security and actionable output are central to all domains and provide the foundation of the framework for trusted data governance.
b) Overlapping domains (The B's in our analysis in Section 6.2) include the important areas of reliance between any of the two domains, eg where data quality is assured by the incorporation of regulation and standards into the technology capability.
c) Single-domain (The C's….) areas present the importance of individual responsibility of each domain to contribute to trusted data.

The framework is explained in more detail as it relates to the study after Figure 6-5 below:

Figure 6-5 New Trusted Data Governance Framework

6.4.3.1. Foundation of Framework, Central Concepts (A's)

The foundations of the framework or bottom layer as shown in Figure 6-5 are the central themes of trusted data governance and include leadership, strategy, security and actionable data. Reminders from our research in these areas is discussed below.

- **Leadership,** role of the hub. There is no doubt but the mobility of leadership in the community was a key driver in delivering trusted data throughout all phases of the evolution. Whether this was down to the government or EU leadership in implementing regulation, to our own leadership in bringing forward and leading the technology solutions or to to the farmer organisations in their participation, every step of the way leaders came forward to bring about solutions to the delivery of trusted data. Lack of leadership would have stagnated the delivery or use of data.
- **Strategy** : The road to trusted data in Figure 6-4 clearly shows the recurring discipline of strategic planning in this programme and this process is central to all domains in the delivery of trusted data as shown in the foundation of the framework in Figure 6-5. Within the strategy, standards are set, goals are made for delivery of those standards, the technology to enable it is funded and the community participates in the development of the strategy.
- **Security**: Data security is central to the framework and to all domains. Security standards are set through continuous improvement in policies and standards and in continuous adaptation of the latest technologies to

protect data, within the context of also sharing the data as needed amongst users. Of course if data security is threatened, data owners will not participate. In Chapter 3 (Community Governance) we included in our data an account of our meeting with the Irish Farmers Association when they made it clear that their participation in the calculation of carbon data was dependent on the full security of use of this data. There were many other such cases. Commitment to security of data was also a key stabilizer and was continuously improved upon as the value of the data increased.

- **Actionable data**. The actionable data became the trusted data over time. Data is actioned to assure standards in data governance. It is used in the algorithms within the technology to control data quality and of course the consumers use the data to satisfy the credentials of the food. As the process evolves so does the trusted data.

6.4.3.2. Overlapping or co-operative domains (B's)

Our new framework in Figure 6-5 shows the next layer in the framework as being the part of the framework where two of the domains cooperate. These are further discussed as follows:

- Community Governance and Data Governance co-operate in areas such as, the assurance of the integrity of incentives and controls, the clarity of roles and responsibilities where required and the education or communication of the data governance process. The incentives to participate (Legal, financial, civic, cultural) as presented in Chapter 3 (Community Governance) vary from one stakeholder to the next; however, breach of incentives or cheating puts the network at risk - and so these regulations

must be clear. Examples include the outbreak of foot and mouth disease in the Cooley peninsula in 2001(Vignette 2, Chapter 5). The associated herd and herd owner were stopped from trading. The processes were in place to identify the herd and herd owner and to isolate the herds through good process management. There have been many fraudulent trading attempts over the 25 year period and, each time, the governance process played a key role in isolating the fraud and allowing appropriate remedial action. In addition the governance process must have well-documented roles and responsibilities that define accountability and ownership for delivery of trusted data.

- Data Governance and Technology evolution: For big data, such as that used for food traceability in this research, adaptation of new and smart data technology is a prerequisite to assuring Data Quality standards and regulation, because of the complex scope of the network and the high number of sources and users of the data . Data process and technology have to work together so that these standards and regulations are completely aligned with the technology capable of enforcing/policing them through their smart algorithms.
- Technology Evolution and Community Governance. The overlapping areas between the technology and the community include the Data Service needs, as presented in Chapter 5. Data Service assures owners that their data will be processed and issued in a consistent and timely manner such that commerce is not interrupted by the process. Similarly, markets and regulatory agencies must have timely data. The user-experience for data must be good; otherwise, participation will suffer. Similarly, in order to

design the technology to the needs of the data, the community needs to provide the (meta) data expertise. Examples in our research included the use of the government science agency and *The Carbon Trust* (Chapter 4) to help define carbon data during the development of the online carbon calculators. Finally of course the investment required to build the technology must come from the financial models within the community, whether this be the price the farmer pays for his animal identification tags, the investment my company made in the technologies or the prices paid by the government for delivery of the services. This financial and prioritization model must provide for the high cost of the systems.

6.4.3.3. Specific to each domain (C's)

As per the top level of the framework for trusted data in Figure 6-5, each domain of Community Governance, Data Governance and Technology Evolution Governance makes its own contribution separate from other domains - and these are discussed as follows.

- Community Governance. Skills and knowledge will mostly come from within the industry community. In one example from the programme research in Chapter 5, I presented how when the Department of Agriculture initially awarded the contract for building the traceability system in 1995, it was awarded to a technology company with no stakeholder knowledge. They failed on delivery and it was at this time that my company, SouthWestern, were awarded the contract because of our knowledge and skills within the community. Similarly the design of the carbon calculator included contributions from Teagasc, the agriculture

science arm of the department of agriculture and from the Carbon Trust who are specialists in carbon calibration. But skills also evolved as shown in Figure 6-4 (The Road to Trusted Data). We continuously nurtured and acquired new skills through strong communication, recruitment and education. Succession planning for skills was visible amongst stakeholders and was the driver of key initiatives over the longer term e.g, The CIO of the Department of Agriculture was recruited from Revenue Services and introduced web services which enabled greater protection and sharing of data. The future is secured through this focus.

Participation or stability of the community network is also critical. Maximum participation must be achieved in order to improve the value and quality of the data. This participation is built by assuring participation and support for the data strategy, protection of data for its purpose, and other trust-building initiatives including face-to-face meetings (as identified in Chapter 3) if at all possible and ensuring representation of all stakeholders in such meetings.

- Data Governance process. The data governance process must manage a set of regulations and standards for designing, implementing and monitoring of the data. As shown in our research in Chapter 4, many standards types may be needed to cover the different elements of data accuracy including for example, ISO9000 for processing quality, ISO 27000 for I.T. security, or carbon trust certification for environmental sustainability. The regulations and standards will include controls and consequences for failure or breach including penalties or recovery planning as presented in Chapter 4.

- Technology Evolution Governance. The technology sub-domains of architecture, infrastructure and software development evolves within this domain (Weill and Ross 2006). Chapter 5 presented how this evolution continuously advanced these aspects to the changing needs and scope of the data.

The data used to develop this framework, and detailed above, is a summary of all the data in this study including all Chapters in this thesis. Therefore, I believe that it is a most comprehensive framework for the Governance for Trusted Data.

6.5. Study Limitations

My methodology in Chapter 2 identifies the layer approach to autoethnography which I developed during my research. My goal by using this layered approach is to eliminate all areas of potential bias or memory loss in my data. The fact that I was, and still am a full member of the community gives unique insight and the triangulation of my story of self to external data, including interviews of stakeholders, photographs, project documentation and official record, has helped to ensure the accuracy of all data. The other layers of reflexive analytics and the conceptual lens of analysis have helped also to ensure that data conflict or lack of precision or consistency is eliminated. However, as with all qualitative methods, there is some measure of subjectivity in the analysis, but that is the price to pay for the unique practitioner insight.

The choice on concept lens has been an area of concern. On one hand, I should not worry because as a lens, it just guides the analysis - it does not analyse it. On the other hand though, these lenses do guide the analysis in a certain direction as defined by the selected framework. So the question I have asked myself is: Would

my outcome be different if I had chosen a different lens? My method for selection of lens tried to avoid this bias by choosing a lens from a similar sector, in governance and that therefore could inform my research question. Furthermore, my literature review has analysed the frameworks of all the major contributions on data governance, and through this review I am satisfied that I have continuously checked all references to frameworks and not just those used as a lens. I believe the contributions in each chapter and especially in this final chapter are new and important to academia and practice alike. So therefore I believe I have chosen the best options as a lens for my analysis.

6.6. Opportunities for further research and concluding comments

This thesis offers many new contributions with opportunity for further research including the following significant contributions for each chapter as summarised in Table 6-5 and the table is further explained below:

Papers	Contribution	Recommendations for further research
Chapter 2 Method	New practitioner perspective on writing research using autoethnography	Provides an experienced account of writing of Information Systems research by practitioners and thereby attracting new researchers
	New framework for writing analytic autoethnography	Provides an opportunity for researchers to test the use of this "autoethnography analytic framework", and provides a practical writing support for practitioners entering into research in their own field.
Chapter 3 Community	New data on community governance for data	Data can be used for future research on the role of the community in data governance programmes with unique insight available for new research on data governance involving the whole data community.
	Extension of community governance framework	Practical new insight on behaviours in the community that go beyond the Dhanaraj and Parkhe (2006) framework and enable trusted data with good community governance
Chapter 4 Data	Data Governance in action	New reference data for future research in data governance
	5 Stars of Data governance	The five stars are a practical checklist to use in implementation of data governance projects
Chapter 5 Technology	New data on evolution of technology in data system development	The concept of systems evolving to data needs is a valuable data support to future research in data governance
	Four Mantras of technology evolution in data governance	This checklist could be developed for practical use in data governance research and implementation programmes in practice
	New Template for trusted data, technology evolution	This is an "easy to use" prioritisation and investment template for technology evolution governance for trusted data that can be tested in research and used in data governance practice.
Chapter 6 Governance For Trusted Data	A "Road to Trusted data" data template	A unique first hand account of the "Road to Governance for Trusted data that can inform and be challenged in future research
	A New Framework For Trusted Data	This framework can be further evaluated in data governance research in sectors outside of the Agriculture and Food industry. It is also a practical model that can be deployed in data governance practice.

Table 6-5 Schedule of contributions and opportunities for further research and use in practice

Table 6-5 is further explained as follows:

- The methods paper in Chapter 2 offers a new practitioner perspective on writing research and on the experience of using autoethnography in the field of data governance. The new framework for writing analytic autoethnography, presented in this chapter, can be used by new practitioners entering the field of research and can be further developed by students of autoethnography in the pursuit of advancing this unique contributive method.
- Chapter 3 on "Community Governance" for Trusted Data sets the lens of Dhanaraj and Parkhe (2006) as a conceptual lens to analyse the governance of the community in a real life trusted data governance field site. The data emerging from the paper offers new insight on how governance in the community can operate in order to allow the delivery of trusted data from the community. The additional insights into the Dhanaraj and Parkhe (2006) framework give new insight into industry and cultural knowledge influence, skills and behaviours and the availability and mobility of the leadership hub role in the community.
- Chapter 4 on "Data Governance" gives a first-hand account on the processes evolving in a large data governance programme and analysed through the conceptual lens of Khatri and Brown (2010). The chapter offers new contribution in the model of the "5 Stars of Data Governance" as complementary to the existing framework on Data governance.
- Chapter 5 also brings new data on how the decision making for technology evolved over the twenty year programme through the additional use of programme data, interview and the conceptual lens of Weill and Ross

(2005). The paper offer the four mantras of technology evolution decision making as well as a new framework for technology evolution governance offering strong advancing governance for technology for trusted data.

Finally, in Chapter 6, the data from the other four chapters is cross-compared in a consistent and precise analysis, to offer two new contributions in this final section as shown in Figure 6-4 The Road to Trusted Data" and Figure 6-5 New Trusted Data Governance Framework". The "The Road to Trusted Data" contribution will be of significant benefit to practitioners who are starting a new programme of Data Governance and the learnings that are included in my analysis of "the road" will be of practical benefit for the early stages and the development of data programmes.

The "New Framework for Trusted Data" offers a complete solution template for Data Governance that assures completeness of delivery through its focus on the People, Processes and the Technology. Furthermore the framework in Figure 6-5 identifies the key dependencies across domains and specific to domains. The framework applies across the lifecycle of data governance of defining, implementing and monitoring and, therefore, attention to detail of this framework will assure trusted data for the practitioners.

6.6.1. Conclusion

And finally I am very pleased that even though one of my key motivations for doing this research subject was very personal, it drove me to engage in this three-year research programme and it provides new context-rich research data as I had set out to do in my research objective. I have the experience and the career history to bring the data on this subject to my research papers and this thesis. The

methodology of autoethnography has helped me to harvest this data and to provide the insightful contributions that I have given. I am happy to have proposed all these contributions and recommend further research and practical implementation for all contributions. I am looking forward to continuing this research myself from both a collaborative academic research approach with my University and also in business where I continue to develop new business opportunities through the application of "the framework for trusted data" into the next generation of food data, and also by its use in other sectors.

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