

# TOWARDS A MODEL FOR EVALUATING ORGANISATIONAL READINESS FOR ERP AND DATA WAREHOUSING PROJECTS

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## Abstract

*The need for an integrated enterprise-wide set of management information pronounced Data Warehousing the 'hot topic' of the early-to-mid 1990's, however, it became unfashionable through the mid-to-late 1990s, with the approach of Y2K and the widespread implementation of ERP (Enterprise Resource Planning) systems. However, in recent times, the re-emergence of Data Warehousing, coupled with ERP implementations, to address the limitations and unrealised benefits of ERP systems in the area of reporting, provides researchers and managers with new challenges. This paper lays the foundation for a model of organisational prerequisites for enterprise-wide integration projects. The model is aimed at the 'Intelligence' phase of managerial decision making for such projects and should help managers assess their organisation's readiness for ERP and data warehousing projects. The main objective of the paper is to present a literature-based model which lists the key prerequisites that organisations should assess prior to undertaking these expensive projects.*

*Keywords: IS Integration, Organisational Prerequisites, Data Warehousing, ERP*

## 1 INTRODUCTION

To date, researchers have looked at the ERP (Enterprise Resource Planning) market as the place where organisational needs, in terms of integrated enterprise-wide systems, were met by the packages proposed by ERP vendors. However, current research in ERP (e.g. Hossain and Shakir 2000, Wood and Caldas 2001, and Sammon and Adam 2002) has found that the ERP market is characterised by a strong vendor and consultant push whereby organisations appear to have little choice but to jump on the bandwagon (as described for Activity-Based Costing by Jones and Dugdale 2002, and IT outsourcing by Michell and Fitzgerald 1997, and to some extent for e-commerce development by Howcroft 2001). The strong vendor push that characterises the ERP movement inherently favours the sales discourse (that which is proposed by ERP vendors and ERP consultants) and eclipses the needs discourse (that of the implementing organisation). According to Westrup and Knight (2000, p.641) “the deployment of ERP systems takes place in a marketplace of ERP vendors generally mediated by ERP consultants. Their aims, though never publicly formulated, are to sell ERP systems and consultancy services respectively”.

However, it has been reported that ERP packages are rarely sufficient to cater for the information needs of most organisations. Even though all the required information is available in an ERP system, the data retrieval capabilities and the report generation capabilities of the system are not sufficiently flexible. In smaller organisations, these problems are often solved by acquiring third party software that uses the data contained in the ERP system to provide the drill-down and reporting capabilities required by managers (Adam and Doyle 2001). In larger firms, this problem can prove problematic, leading to what we term a ‘double learning curve’ for organisations, who must undertake both ERP and Data Warehousing initiatives. At this point in time, ERP vendors and ERP consultants are actually extending their range of products and services to provide these Data Warehousing functionalities (Watson and Schneider 1999, Inmon 2000). This further complicates the ERP implementation projects faced by organisations and poses the additional risk of consultants trying to force an unsuitable generic model on their clients and reinforces our contention that implementing organisations need to develop their understanding of the key issues involved in the concepts of ERP and Data Warehousing. Only then will they be in a position to internally assess, if not their readiness for ERP and Data Warehousing, their ability to manage the external parties (the ERP consultant and the ERP vendor) within the ‘ERP Community’ (Sammon and Adam 2002).

‘Ignore history - condemned to repeat it’ (Judge 1997, Webster 2000) seems to be an adequate statement when it comes to describing the mixed fortunes of organisations deploying Information Systems (IS) and researchers approaches to studying these IS evolutions. This may be due to the fragmentation of research in IS as described by Blanville and Landry (1989) and Adam and Fitzgerald (2000). Indeed, Lucas (1991) suggested that, as a field, we need to think about interesting problems and look for underlying issues rather than focus on today’s ‘hot topic’ to keep up with the latest IS fashion. Therefore, addressing the suggestions of Kraemer and Dutton (1991) and Land (1995), the objective of this paper is to build upon existing research carried out in the areas of Data Warehousing (DW) and Enterprise Resource Planning (ERP), therefore, emphasising a ‘continuity of ideas’ and constructing a ‘cumulative’ body of research.

The first section of this paper retraces the history of DW initiatives in organisations and compares the scope of DW and ERP projects. The concept of prerequisites as it applied to DW projects is then presented. The paper concludes by showing how the reality of ERP implementations undertaken by organisations today, and the problems encountered, could be addressed by applying the concept of prerequisites to ERP projects.

## 2 STUDYING IS APPROACHES TO INTEGRATION: INTEGRATING ERP AND DATA WAREHOUSING RESEARCH

Although Data Warehousing and ERP represent two alternate approaches to IS integration in organisations, a number of common defining factors exist between these two types of IS project implementation, as illustrated in Table 1. Due to the constant regeneration and redefinition of the Data Warehousing concept, an ‘inclusive’ definition of Data Warehousing is still elusive. However, proposed definitions identify the goal of Data Warehousing as enabling the provision of better corporate information to support an organisation. As a result, the main objective of a Data Warehousing solution is to turn data into information. Therefore, by design, Data Warehousing is informational, analysis and decision support oriented, rather than oriented towards transaction processing (Babcock 1995). Although there is no agreed upon definition for ERP systems, their characteristics position these systems as integrated, all-encompassing (Markus and Tanis 2000), complex mega-packages (Gable et al. 1997) designed to support the key functional areas of an organisation. The American Production and Inventory Control Society (APICS) defines ERP as “an accounting oriented information system for identifying and planning the enterprise-wide resources needed to take, make, ship, and account for customer orders” (Watson and Schneider 1999). Therefore, by definition, ERP is an operational level system. This means that DW and ERP systems are, by design, rather complementary in their orientation.

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

*Table 1: Defining Characteristics of Data Warehousing and ERP*

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

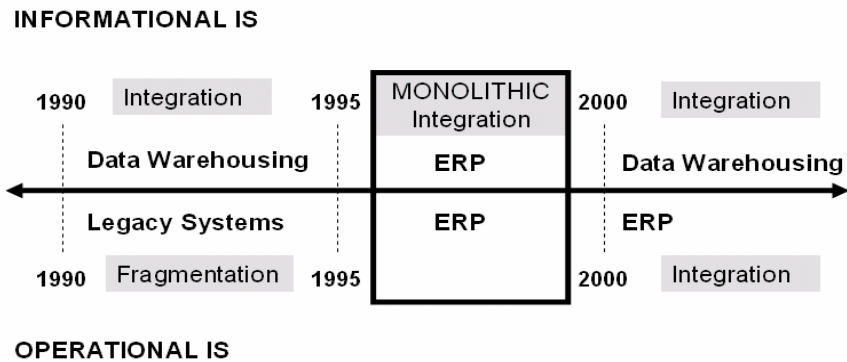


Figure 1: IS Integration Approaches

To overcome the problems with traditional approaches of accessing large amounts of data in heterogeneous, autonomous distributed systems, the emergence of Data Warehousing introduced the concept of a ‘logically centralised data repository’. Therefore, the concept of Data Warehousing emerged due to the evolution of IS objectives within organisations (emerging from a wide range of managerial concerns from operational efficiency to considerations of market competitiveness), and further due to the growing demand within organisations to analyse (internal and external) business information. However, by the mid-to-late 1990s ERP provided an alternate operational solution to the operational integration problem, and, as ERP systems also promised to deliver on the informational requirements of an organisation, the perceived need and along with it, the rate of Data Warehousing project implementations, was reduced. As further illustrated in Figure 1, and referencing the insights of Wood and Caldas (2001, p.387), ERP can be described as “a comprehensive information technology package built on the promise that all critical information should be totally integrated in one single information database”.

Unfortunately, as organisations moved toward the post-implementation phase of ERP project implementations, the real issue of benefit realisation emerged and with it came the re-emergence of the need for Data Warehousing, as illustrated in Figure 1. Due to the monolithic style integration of the mid-to-late 1990s, many organisations are now discovering that the solution to leveraging investment decisions in, and retrieving useful data from, an ERP system is to undertake a Data Warehousing initiative in conjunction with the implemented ERP system (Sims 2001, Raden 1999, Inmon 2000, Radding 2000, Hewlett-Packard 2002). As pointed out by Inmon (2000), ERP only gets data into the system, it does not prepare data for use and analysis.

To our way of thinking this creates a ‘double learning curve’ for an organisation, undertaking in quick succession both an ERP project and a DW project, in an attempt to finally achieve the benefits expected but never realised.

### 3 UNDERSTANDING ORGANISATIONAL PREREQUISITES IN THE CONTEXT OF DATA WAREHOUSING

Organisational Prerequisites are generated through an examination of critical factors throughout the lifecycle of an IS project (planning, implementation, post-implementation). However, in use, organisational prerequisites are concerned with the ‘pre-planning’ or ‘intelligence’ phase of a project implementation life-cycle. Finnegan and Sammon (1999, 2000, 2002) proposed the concept of organisational prerequisites in their study of Data Warehousing (DW) project implementations. Finnegan and Sammon (1999, 2000, 2002) proposed that every organisation that initiates a Data Warehousing project encounters its own unique ‘set of issues’ around a common set of factors. Therefore, Finnegan and Sammon (1999, p.183) defined organisational prerequisites as “necessary

elements existing within the organization, which are examinable [internally] by the implementing organisation, prior to the organisation undertaking the initiation of a data warehousing project”.

Finnegan and Sammon (1999, 2000, 2002) highlighted a number of factors which legitimised the need for a model of organisational prerequisites in relation to DW project implementations (see Table 2). Evidently, many of the factors identified for DW projects also apply to ERP projects.

FACTOR	DESCRIPTION
[1] Every organisation that initiates a Data Warehousing project encounters its own unique ‘set of issues’ around a common set of factors	Given that, there are numerous similarities in all Data Warehousing projects and given that 50% of all Data Warehousing projects undertaken have experienced some degree of failure and for remarkably similar reasons, if this common set of factors can be identified and their occurrence sign-posted in a structured format, then organisations could determine their suitability for Data Warehousing project initiation
[2] High number of Data Warehousing project failures	Even though all of the causation factors associated with Data Warehousing project implementation failure are not concerned with the initial stages of the project directly, they can lead to failure at some stage of the implementation, and should be taken into account at the start of the project
[3] The level of clarity and understanding of the Data Warehousing project initiative that exists within the organisation needs to be determined	If the causes of likely future problems can be identified in advance, then they can be addressed, or at least sign-posted and worked around, thus improving the Data Warehousing projects chances of success, prior to implementation initiation
[4] The use of a corporate readiness model in a Data Warehousing project implementation, is incorporated into the ‘preparatory stage’ of an implementation methodology.	The organisation cannot assess its readiness, prior to the initiation of the project, due to the fact that the project has been initiated once the readiness tests are introduced. Furthermore, these models are complex and not suited to use internally within the organisation
[5] The format of the model does not lend itself to internal use, within the implementing organisation	The existing readiness models are specifically related to external consultancy use in Data Warehousing implementations and requires the external consultants to interpret the meaning of each readiness check and identify the areas of focus for the organisation. The structural meaning and interpretation of the models is complex, and involve a lot of computation in use. The lack of academic research in the area of enterprise readiness for the successful implementation of a Data Warehousing project is evident in the lack of methodological ‘scholarly rigour’ being applied to the existing models

Table 2: *The Need for Organisational Prerequisites in DW Project Implementations*

Therefore, an organisation should be empowered to assess its readiness/preparedness for the successful implementation of a Data Warehousing system prior to project initiation, in a vendor/consultant independent, methodology independent, and pre-implementation thought process. As a result, Finnegan and Sammon (2000, p.83) stated “there is a need to identify a method of assessment that is structured in an easily understood and interpretable format, and is directed at use internally by the implementing organization”.

#### 4 THE STRUCTURE OF THE ORGANISATIONAL PREREQUISITE MODEL FOR DATA WAREHOUSING

The critical areas of the Finnegan and Sammon (1999, 2000, 2002) research model are structured around five key factor: Systems Factors, Data Factors, Skills Factors, Organisational Factors, Project Management Factors. The factors are not mutually exclusive in relation to their influence on a Data Warehousing project implementation. The ‘multiplicative effects’ of these factors combine to drastically affect the implementation of the Data Warehousing system, beyond the intentioned plan at the initial phase. Each of these factors contains certain issues, which have been documented and

refined from existing readiness models; other advocates proposed research models; previous causes of documented failures; along with factors critical to the successful implementation of Data Warehousing projects.

Each of these factors must be examined within the organisation through the examination of the logical process of going through three conceptual stages (Existing, Planned, Implemented). The 'Existing' stage relates to what the organisation had in place prior to the initiation of the Data Warehousing project. The 'Planned' stage identifies what the organisation felt they needed (and planned for) to achieve the successful implementation of the Data Warehousing system. Finally, the 'Implemented' stage identifies what the organisation ended up with, in the successfully implemented warehousing system. This progression highlights the organisation's diversity of experiences in a Data Warehousing project implementation, and the 'lessons learned' through the initial and subsequent warehousing initiatives within the organisation. The framework enabled Finnegan and Sammon (1999, 2000, 2002) to identify 'how' and 'why' certain factors are critical to a Data Warehousing project implementation, and in effect sign-posted their occurrence within organisations. As a result, a set of organisational prerequisites was generated, as illustrated in Table 3, through an analysis of the degree of criticality of each of the factors to an organisations Data Warehousing project implementation.

<b>CRITICAL AREAS</b>	<b>ORGANISATINAL PREREQUISITES FOR DATA WAREHOUSING</b>
SYSTEMS FACTORS	Hardware / Software 'Proof of Concept' Knowledge of DW Compatibility with Existing systems A Long Term Plan for Automated Data Extraction Methods / Tools
DATA FACTORS	Attention to Source Data Quality A Flexible Enterprise Data Model Data Stewardship
SKILLS FACTORS	Project Team with Access to Cross-Functional Project Management and Implementation Experience
ORGANISATIONAL FACTORS	Executive Sponsorship and Commitment
PROJECT MANAGEMENT FACTORS	A Business Driven Data Warehousing Initiative Funding Commitment (Budgeted and Unexpected) Based on Realistically Managed Expectations

*Table 3 Organisational Prerequisites for Data Warehousing Project Implementation*

The research objective of the Finnegan and Sammon (1999, 2000, 2002) study attempts to address issues in relation to Data Warehousing project implementation that are of significant practical value to organisations, who for the first time attempt to internally evaluate the plausibility of implementing a Data Warehousing project. This need for such a framework is reinforced by the most recent developments in Data Warehousing, namely the advent of the convergence of Data Warehousing and ERP (Inmon 2000).

## **5 REALITY OF ERP IMPLEMENTATION: AN EXTENSION ON CURRENT THINKING**

Lucas (1981) defined implementation as the whole process of introducing a system into an organisation, from conception of an idea, to analysis, design, installation and operation. The inclusion of 'conception of an idea' is something which seems to be overlooked throughout current research in ERP implementation, highlighting the issue that the decision-making process prior to ERP software

selection is not considered within the scope of the implementation process models (Shanks et al. 2000). The analysis step of most ERP projects seems to skip the early stages and to focus on a package evaluation exercise (Kelly et al. 1999). The phase of problem finding (Pounds 1969), where organisational actors identify stimuli in the environment which they come to perceive as problems requiring their attention, has not been a feature of any reported ERP projects, due in reality, to the very strong sales discourse existing in the ERP market. Sammon and Adam (2004) concluded that few research projects have examined the first phase (intelligence phase), however, this stage of the decision making process is crucial in ERP projects as noted by Pomerol (1994), because ideas and alternatives not considered at this stage are very unlikely to be considered in the later stages. Thus, decision making processes in relation to ERP selection are inherently weak in many organisations. This is highlighted in Figure 2, using Simon's (1977) four stage decision making process (normative) model as a guide to locate the focus of existing research in ERP.

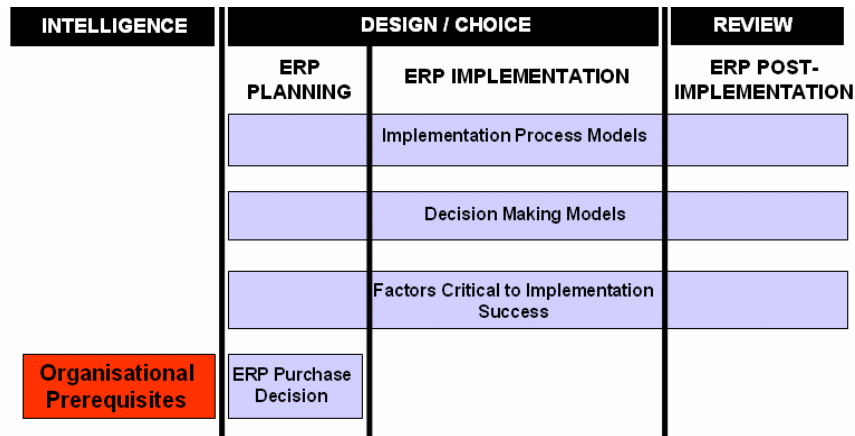


Figure 2: A Classification of Organisational Research in ERP

Several researchers have developed process models for ERP implementation (Bancroft et al. 1998, Ross 1999, Markus and Tanis 2000, Shanks et al. 2000, Parr and Shanks 2000, Shakir 2000) and from a synthesis of these models, planning is identified as the first phase, as illustrated in Figure 2, and the key activities undertaken can be identified as; assembly of a steering committee; development of a business case for ERP; ERP package selection; choosing a consultant; selection of a project team manager; creation of a project plan. However, adopting these implementation processes has returned a high rate of failure, both in terms of project implementation and the delivery of expected benefits. In addition, according to Somers and Nelson (2001, p.1) "broad-based empirical research in the CSFs that impact implementation is still very limited". Furthermore, Nah et al. (2001) report that despite well identified difficulties with ERP implementations, research on critical factors for initial and ongoing ERP implementation success is rare and fragmented. We contend that this is due to researchers simply classifying their Critical Success Factors into the phases of existing ERP implementation process models and, in effect, excluding the critically important factors in the 'Intelligence' phase in Simon's model. To further illustrate this point we have identified a number of 'issues of concern' around the current implementation of ERP, as illustrated in Table 4.

The 'issues of concern' identified in Table 4, mirror those identified for Data Warehousing project implementation in Table 2, and support our contention that a model of organisational prerequisites could help managers engaged in ERP implementations. This is also consistent with Markus et al. (2000, p.245) observation that while organisations experience problems at all phases of the ERP system life-cycle, many of these problems experienced in later phases originated earlier but remain unnoticed or uncorrected, therefore, researchers and organisations "will do well to adopt broad definitions and multiple measures of success and pay particular attention to the early identification and correction of problems".

Issues of Concern	Description	Reference
[1] The planning phase of an ERP implementation project	The scale of ERP projects has rarely been tackled by most organisations highlighted by an inadequate organisational analysis at the beginning of the project	Kelly et al. (1999)
[2] The complexities of the ERP market	This issue is illustrated through the concept of the ERP Community and the role of each actor (ERP vendor, ERP consultant, and implementing organisation) in the ERP project implementation	Sammon and Adam (2002) Esteves and Pastor (2001) Wood and Caldas (2001) Hossain and Shakir (2000)
[3] Complex implementation	Many ERP systems implementations fail, to a degree or completely, to meet project constraints due to their complexity  An ERP package is so complex and vast that it takes several years (lengthy) and millions of dollars (expensive) to roll out	Sammon and Adam (2004)  Davenport (1998) Martin (1998) Bingi et al. (1999) Holland et al. (1999) Shanks et al. (2000) Koch et al. (2000) Saint-Leger and Savall (2001)
[4] High rates of failure in ERP project implementation	The combined effect of [1], [2] and [3]  The high failure rate of ERP implementation calls for a better understanding of its CSFs	Somers et al. (2000)
[5] Failure to deliver expected benefits	As a result of [4]  On average, ERP projects deliver only 30% of the promised benefits  Only around 10% to 15% of ERP implementations deliver anticipated benefits	Bingi et al. (1999) Stefanou (2000) Saint-Leger and Savall (2001)  Krumbholz et al. (2000)  Rutherford (2001)
[6] Level of dependence	Once an ERP system is implemented, going back is extremely difficult; It is too expensive to undo the changes ERP brings into an organisation  Due to the all-encompassing nature of all ERP offerings, a level of dependence is created that far surpasses the dependence associated with prior technological regimes	Bingi et al. (1999)  Markus and Tanis (2000)

*Table 4: Issues of Concern in ERP Implementation*

These observations indicate that there is a need for research into the ‘Intelligence’ phase of the decision making process for ERP software selection, highlighting the critical factors for both selection and implementation of an ERP package in a ‘pre-planning phase’ environment, therefore, facilitating a vendor/consultant independent, methodology independent, and pre-implementation thought process. In support of this argument, Stafyla and Stefanou (2000, p.293) state that “given the cost and the permanent nature of ERP investments, an understanding of the way decisions are taken concerning the adoption, evaluation and selection of ERP software can be very useful for both academic research and practice”. However, Esteves and Pastor (2001) go one step further by highlighting the important issue

concerning the definition of ‘those decisions’ organisations face prior to implementing an ERP system. Caldas and Wood (1998) and Wood and Caldas (2001, p.5) called for “the utilisation of a broader [alternative] perspective to its [ERP implementation] comprehension, one that would challenge the reductionism and information technology biases that have characterised the prevailing approach to the subject”. Therefore, we propose that a key milestone in, and radical approach to, enterprise-wide systems integration research will involve the identification and development of an organisational prerequisites model for project implementation.

## 6 CONCLUSIONS: TOWARDS AN ORGANISATIONAL PREREQUISITES MODEL FOR ENTERPRISE-WIDE SYSTEMS INTEGRATION PROJECTS

To conclude, the current focus and requirement for organisations is to undertake Data Warehousing to complement ERP systems implementations that have failed to deliver the benefits promised. Although organisational prerequisites have been previously generated for Data Warehousing (Finnegan and Sammon 1999, 2000, 2002), we believe that this model for enterprise-wide systems integration projects could potentially be used by organisations to internally assess the likelihood of ERP and Data Warehousing project success, and to identify the areas that require attention prior to commencing implementation.

		EXISTING	PLANNED	IMPLEMENTED
CRITICAL AREAS		CRITICAL FACTORS FOR ERP		
SYSTEMS FACTORS		Appropriate Business & Legacy Systems Business Process Reengineering (BPR) & Software Configuration		
DATA FACTORS				
SKILLS FACTORS		ERP Project Team Composition		
ORGANISATIONAL FACTORS		Top Management Commitment & Support Effective Communication Change Management Culture & Program		
PROJECT MANAGEMENT FACTORS		Business Plan & Vision Project Management		

**DEGREE OF CRITICALITY**

Figure 3: Organisational Prerequisites Research Model Design for Enterprise-Wide Systems Integration Projects

Some of our early observations in studying the organisational prerequisites research model have proved worrying. For example, in presenting the organisational prerequisites research model, the critical factors for ERP implementation are matched to the organisational prerequisite critical areas, as illustrated in Figure 3. As presented in the organisational prerequisites research model for Data Warehousing, this research model for ERP is structured along the same dimensions, facilitating the examination of the ‘degree of criticality’ of the factors across the three conceptual phases (Existing, Planned, Implemented). Due to the fact that the critical factors for ERP implementation are generated based on a synthesis of existing literature on ERP project implementation, one noticeable area of omission is that of the DATA FACTORS, highlighting the lack of focus being placed on the importance of data for the implementation of an ERP project. In no small part, this is one of the main

reasons in many organisations to legitimise undertaking a Data Warehousing project. However, in the case of Data Warehousing, DATA FACTORS would be considered one of the most important and critical areas of research focus. With ERP, unlike Data Warehousing, an in-depth knowledge of the organisational data is not perceived as being important, due to the fact that [a] the positioning of an ERP system requires an understanding and examination of an organisations business processes, and [b] the organisation adopts the business model and data model of the ERP package and therefore, does not have to invest in the establishment of a sound enterprise-wide data model.

There is no doubt in the authors minds that initially, when organisations commenced the implementation of ERP systems they did not expect to have to invest in future Data Warehousing solutions to leverage their ERP investments. As a result of this, the early lessons learned by organisations, in relation to Data Warehousing, should not be dismissed. This new era of enterprise-wide systems integration projects introduces an increased level of complexity to an already complicated organisational initiative. In the past, in relation to ERP systems, organisations have been too accepting of the promises of the sales discourse. Therefore, an implementing organisation needs to be empowered and made aware of the increasing complexities of the ERP market and strengthen their needs discourse in relation to enterprise-wide systems integration project requirements.

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