Decision Support Systems 55 (2013) 98–109

Contents lists available at SciVerse ScienceDirect

Decision Support Systems

journal homepage: www.elsevier.com/locate/dss

Defining value-based objectives for ERP systems planning ☆

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ARTICLE INFO

Article history:
Received 17 March 2010
Received in revised form 30 October 2012
Accepted 30 December 2012
Available online 31 January 2013

Keywords:
Value-focused thinking
Stakeholder values
ERP objectives
Strategic planning

ABSTRACT

The planning and subsequent implementation of Enterprise Resource Planning (ERP) systems still present a significant challenge for most organizations. Although consulting firms and customer enterprises have been aquiring more experience and expertise in the field, the level of sophistication of these systems and their wide organizational and social impact frequently leads to failed ERP implementations. In an attempt to minimize these failure rates, this paper defines a set of value-based objectives that could be used to enrich the ERP systems planning process. ERP systems planning objectives grounded by stakeholder values can be used as a conceptual guide for enhancing the decision making processes involved in ERP projects. Using Keeney's value-focused thinking approach, a set of means and fundamental objectives was identified using data collected via in-depth interviews in three large European firms. The relationships and interdependancies among these objectives are also presented and provide a starting point for further research.

Published by Elsevier B.V.

1. Introduction

ERP software promises significant benefits to organizations. Some of these benefits include lowering costs, reducing inventories, increasing productivity [39], improving operational efficiency [6,20], attaining competitive advantage [4], and bettering the reorganization of internal resources [51]. However, even with these reported benefits, the level of overall success for ERP projects has oftentimes been questioned [42,48]. For example, Kwahk and Lee [29] have estimated failure rates above 60% for ERP projects.

The literature suggests that one notable reason for these high failure rates is the lack of organizations being able to properly align existing business processes with packaged ERP processes [57,59]. This paper argues that to ensure successful alignment [3] between organizational and ERP processes, a rich and exhaustive set of objectives that truly represent the stakeholder values of the enterprise must first be identified. While the literature agrees with the notion that ERP objectives are in fact an important critical success factor [1,2,23,32], it falls short of proposing clear, value-driven objectives and how they could be articulated for a given organizational context. Hence, the goal of this research is to create a rich set of objectives for enriching the ERP systems planning process where the ultimate aspiration is to minimize ERP failure rates in organizations.

To develop these objectives, data from 3 ERP implementation case studies were analyzed. Methodologically, this study is grounded in Keeney's value-focused thinking (VFT) approach [26]. Keeney [27] argues that for a given decision context, values of decision makers must first be identified rather than allowing existing alternatives (in this case ERP software) to constrain the thinking of decision makers. In other words, without first determining stakeholder values prior to selecting a specific ERP solution, project objectives tend to become limited by the bounds that are placed on organizations as a result of the technical implementation. And as will be elaborated further in the following sections of this paper, the notion that values should be the key driver for developing objectives is held by other IS researchers as well [22,41,52].

2. Theoretical and methodological considerations

As mentioned, this research employs Keeney's value-focused thinking (VFT) approach [26] to define a set of deep-rooted objectives for enriching the ERP systems planning process. Any objectives created using this approach could then be used as a framework for creating value-driven tasks and alternatives for the purpose of aiding decision makers in the ERP selection process. The literature suggests several different approaches to ERP selection that include ranking methodologies such as swing weights [40] and the analytical hierarchical process [8,58]. Important as these works may be, we believe that a clear definition of value-driven objectives is required prior to any ranking attempts [26]. Thus, in this paper we have undertaken extensive research to define a set of value-driven objectives. Our future research will then address how to determine alternatives from our objectives framework

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0167-9236/$ – see front matter. Published by Elsevier B.V.
http://dx.doi.org/10.1016/j.dss.2012.12.036

along with ranking their relative importance for a specific organizational context.

To determine objectives for any decision context, Keeney [27] argues that the values of decision makers must first be identified. For several decades researchers have recognized that values form the basis for sound decision making [35,46,47]. However, the literature suggests that because of their implicit nature, values are difficult to identify and often times are disregarded [11]. Meglino and Ravlin [33] indicate that values have been characterized using a range of descriptors such as needs, personality types, motivations, goals, utilities, attitudes, interests, and nonexistent mental entities. Keeney [26] comments that values can range from ethical principals that must be upheld to guidelines for preferences among choices.

More specifically, Keeney [26] comments that, "ethics, desired traits, characteristics of consequences that matter, guidelines for action, priorities, value tradeoffs, and attitudes towards risk all indicate values." For example, an ethical value might be, "do not share sensitive information with others." Similarly, an example of a value that deals with an attitude toward risk might be, "even though the ERP solution may cause some short-term profit losses for the firm, we still plan to implement a new system."

Past researchers have used values as a basis for understanding various Information Systems phenomena. For example, Phythian and King [44] used the values elicited from manager-experts to identify key factors and rules influencing tender decisions. Hunter [24] extracted values from 53 interviews in two organizations to better understand the behaviors of information system analysts. Keeney [27] interviewed over 100 individuals to elicit their values to develop objectives related to Internet purchases. Dhillon and Torkzadeh [14] interviewed over 103 managers over a broad spectrum of firms to identify stakeholder values for the purpose of creating an exhaustive list of security objectives for managing IS security.

Past researchers have also used values as the basis for creating objective heriarchies for other decision making contexts not related to IS. For example, Chambal et al. [9] used a similar methodology to provide decision makers with a decision aid for choosing a new municipal solid waste management strategy. Merrick and Garcia [34] used a similar approach to provide decision makers with the best alternatives for improving a particular watershed.

To identify the values and subsequent objectives hierarchy for enriching the ERP systems planning process, this research used the data from three independent case studies that dealt with ERP planning and selection. The process we used to identify and organize these values along with developing the objectives hierarchy is shown in Fig. 1 and will be discussed in the following sections.

2.1. Case studies

The data derived from three organizational case studies was used for determining the values that drive ERP systems planning. The organizations used in this study are identified as Alpha, Beta, and Gamma (pseudo names to maintain confidentiality). A brief synopsis of each of these case studies is presented in this section.

The use of case studies, based on in-depth semi-structured interviews, seemed to be an appropriate research method given the exploratory nature of this study. Case studies enable asking penetrating questions and provide a richer undertanding of organizational behavior

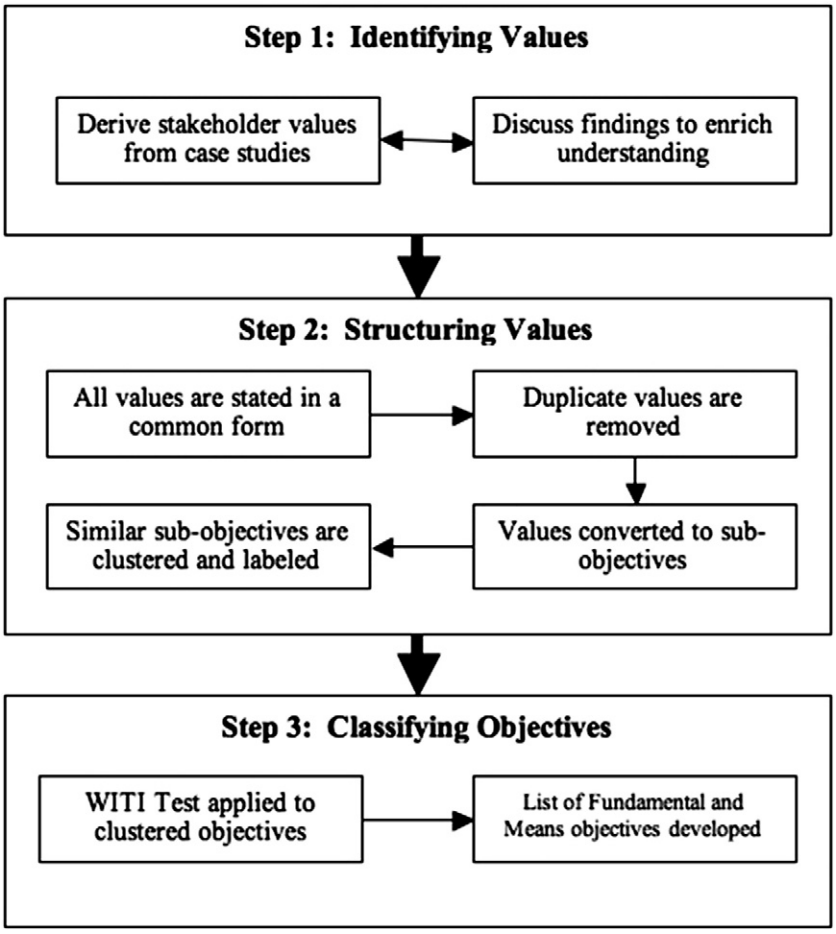

Fig. 1. Research approach.

providing more complete explanations about the phenomena under research.

It should be noted that these three case studies were conducted within organizations located in Southern Europe. The original intention of these case studies was to understand the various implications of ERP implementations. The case studies were designed to follow Yin [61] and careful attention was given to ensure the validity and reliability of the findings. That is, key stakeholders were systematically identified; interview strategies were developed prior to discussions; ethical guidelines were strictly followed; data was collected and stored in a systematic manner; and the final results were revised and verified via the solicitation of sound feedback procedures.

We used in-depth interviews with key actors as our main research method. This method of data collection was complemented by analysis of documents about the project provided by the various firms. Some examples of the documents we used for analysis included: project plans; information systems analysis and design draws; hardware configurations; internal reports; and meeting notes. Via in-depth interviews, we were able to generate rich data that allowed an understanding of the research topic according to the perspectives of 16 key actors. All of our respondents were spread across different levels within each of the case study organizations. At Alpha data was collected from among 5 key stakeholders. These included the CEO, the IT Director, the Shop floor supervisor and two production executives. At Beta we interviewed the CEO, the Master Brewer, the IT Director and the HR Manager. At Gamma, we interviewed the CEO, the IT Director, the Maintenance Manager, the Sales & Marketing Manager and two junior-level executives.

2.1.1. Alpha organization

Alpha is a European group of enterprises in the coffee manufacturing industry. The company was created in 1961 and employs over 1800 employees with an annual turnover of approximately 170 million Euros. In 1998, Alpha decided to begin implementing an ERP system for several reasons. Some of these included: reorganizing existing business processes; the obsolescence of any existing computer-based information system; problems in software maintenance; and the desire to operate in new markets and to develop a new set of products.

The Alpha case demonstrates that to achieve success in an ERP project, enterprises need to look at several factors before, during and after software implementation. One important factor before implementation was that top managers should be clearly aware of the characteristics of an ERP and to identify the organization's real needs to decide which ERP modules to implement. Additionally, top management support and commitment were also critical to motivate users' involvement in the project [55]. And although some problems were identified at the beginning of the implementation, the change management attitude of top managers, reinforcing that ERP use was important for the organization, was also critical to overtake these problems and reduce users' resistance to change. During the implementation phase, it was important for Alpha to consider the impact that the ERP project may have on users and business processes. Knowledge transfer and clarification of objectives were stressed as important factors for the success of the project. Additionally, user training and involvement in the project and the existence of ERP competencies in-house was seen as critical. After implementation, the Alpha case study demonstrated that a closer relationship with ERP consultants was required to develop in-house competencies and to further assist in training users.

2.1.2. Beta organization

Beta is a European-based wine manufacturer with approximately 165 employees. In the mid-1990's, due to the need to integrate administrative and manufacturing processes, Beta determined the need for an ERP system.

Several issues emerged from the Beta case study that resulted in a low level of satisfaction via the adoption and use of their ERP system. Some of these issues included: the software was developed by a US-based software house and did not fit the legal requirements of European accounting standards; the manufacturing module was not being used properly because the firm did not have expertise to adapt the software to its manufacturing processes; the European local consulting agent representing the ERP did not have adequate expertise to provide technical support; adequate technical support was too expensive; the CEO did not have IS expertise and was not adequately involved in the entire ERP adoption and use process; and there was no up-to-date information available to understand the manufacturing business processes of the firm.

2.1.3. Gamma organization

Gamma is a medium sized firm in the real estate industry that employs approximately 160 employees. Gamma determined the need for an ERP system due to the requirement for better information flow and the desire to grow their business.

Some of the more specific requirements that Gamma desired via a new ERP system included: to better understand which products are selling better; to provide online availability of information across various divisions; to have better control over raw material management; and to improve customer relationship management. Initial results via the Gamma case study showed that this particular project was successful where the benefits provided by the new ERP were estimated to be approximately 3 million dollars in cost reduction in the first two years. Gamma also reported that their ERP system has a strong potential to enable the future growth strategy of the firm.

2.2. Identifying values

An exhaustive set of objectives for the purpose of enriching the ERP planning process requires considerations that transcend solely technical perspectives. That is, rather than allowing ERP software to naturally bound the development of objectives into a techno-centric arena, we argue that the values of stakeholders must first be identified via the discussion or examination of people's underlying assumptions [41,52]. In other words, values are the basis on which meaningful objectives can be created. As noted by Keeney [26] "bringing … values to consciousness allows one to uncover hidden objectives, objectives you didn't realize you had."

The process of identifying the values pertinent to this research began with each member of our research team independently deriving the various stakeholder values from each of the individual case study organizations. For example, due to the need for reorganizing its business processes, Alpha determined that they needed an ERP system. Thus the value statement that was derived was, "Alpha requires the reorganization of its business process." Once each member of our team developed their own independent list of values, the team then came together to discuss their findings. Via these discussions, new values then emerged.

2.3. Structuring values

The process of structuring values and developing objectives helps in a deeper and a more accurate understanding of what decision makers actually care about in a given decision context. As a first step in structuring the values, all statements are declared in a common form, thus allowing for the identification and removal of duplicates. This is followed by considering each of the values and converting them into sub-objectives. Keeney [26] defines an *objective* as a statement of something that one wants to strive towards and is characterized by three distinct features that include: a decision context, an object, and a direction of preference. For example one objective found in this research was "maximize business process effectiveness." For this example, the decision context is enriching the ERP systems

planning process, the object is business process effectiveness, and the direction of preference is greater business process effectiveness.

All of the various value statements (See Appendix A) were systematically reviewed and converted into sub-objectives by the research team. Naturally, there were a number of sub-objectives dealing with a similar issue. By carefully reviewing the content of each sub-objective, clusters were then developed. Each cluster of sub-objectives was then labeled. The cluster label then becomes the main objective. In this study, 17 main objectives were identified.

For this research, the decision context was enriching the ERP systems planning process. Some examples of the values identified by this research included: "Beta requires that existing ERP processes be adapted to already existing organizational processes", "Alpha desires quick/efficient accounting reports", "Gamma desires that the IS department be capable of handling the restructuring of organizational divisions", "Beta desires that non-IS individuals be able to use the ERP system with minimal IS interaction", "Alpha desires an ERP system with minimal redundancy in terms of data and procedures", and "Gamma desires more and better information than existing systems can provide." After the values are stated in a common form, the corresponding sub-objective for "Beta requires that existing ERP processes be adapted to already existing organizational processes" became "ensure system processes fit existing business processes", "Alpha desires an ERP system with minimal redundancy in terms of data and procedures" became "Minimize procedural redundancy" and so forth.

2.4. Organizing objectives

After an initial list of sub-objectives and their corresponding cluster labels or main objectives is found, the next step is to distinguish between the fundamental and means objectives. To separate the means and fundamental objectives, Keeney [26] recommends applying the "Why is this important" or WITI test to each identified objective.

In identifying the fundamental objectives for this research, we asked the question as a research team, "Why is this objective important for enriching the ERP systems planning process?" If the answer was that current objective of interest is one of the essential reasons for this particular decision context, then the objective was a candidate for a fundamental objective. However if the current objective was found to be important because of its implications for some other objective, it became a candidate for a means objective.

To illustrate the process used to identify means and fundamental objectives for this research, consider as an example the objective, "maximize system process effectiveness." Why is this objective important? Because maximizing system process effectiveness directly leads to attaining the objective, "maximize business process effectiveness." Why is maximizing business process effectiveness important? Because this objective directly leads to attaining the objective, "enhance product development." Why is it important to enhance product development? Given our decision context of enriching the ERP systems planning process, it is simply important to enhance product development. When we reached this type of conclusion or end, a fundamental objective was then validated and the various other objectives that lead to this discovery were identified as means objectives.

While the WITI test has largely been proposed by Keeney [26] to establish a means–ends objective hierarchy, other techniques can be used as well. For example, Wei [57] and Wei and Chien [58] used the question, "How can you achieve this?" However, in this research we remained purest to Keeney [26] and exclusively used the WITI test to differentiate between fundamental and means objectives.

3. Value-based fundamental objectives for ERP systems planning

Among the 17 main objectives found in this research, 4 fundamental or end objectives were identified. As shown in Table 1, these objectives included: "minimize cost;" "ensure benefits realization;" "enhance product and service improvement;" and "maximize customer relationship effectiveness." As mentioned previously, a fundamental objective is one that is essential to a particular decision context. In other words, the four fundamental objectives shown in Table 1 are the objectives that this research indicated are absolutely essential to enriching the ERP systems planning process. The sub-objectives then serve to more clearly define the fundamental objective.

Table 1
Fundamental objectives.

Strategic objective: Enriching the ERP systems planning process	
Fundamental objective	Sub-objective
1. Minimize cost	Minimize startup costs
	Minimize implementation costs
	Minimize maintenance costs
2. Ensure ERP benefits realization	Ensure knowledgeable and proactive upper management support
	Ensure proper change management controls
	Minimize adaptation constraints
	Ensure clarity in investment objectives
	Allocate responsibility for benefits realization
3. Enhance product and service improvement	Ensure system supports new product development
	Ensure system supports growth of existing product lines
	Ensure system enables identification of new product opportunities
4. Maximize customer relationship effectiveness	Create customer oriented system processes
	Ensure ability to understand customer desires
	Ensure efficient marketing channel design

When considering these four objectives, it is interesting to note that the objectives found in this study reflected performance of two core ERP systems planning activities — top management business analysis and ERP specific development review. Any ERP systems planning activity needs to provide services that are cost effective, besides helping with realization of promised benefits [21]. At the same time, ERP packaged processes need to provide an ability for product and service enhancements along with providing a means for developing effective customer relationships [10].

3.1. Minimize cost

Minimizing cost emerged as one of the fundamental objectives for ERP systems planning. Cost reduction is referenced many times as a major objective in ERP adoption [17,37,57]. Via this research, we found that focus should be placed on minimizing startup, implementation and maintenance costs. The extant ERP literature has also considered minimizing cost as a fundamental objective. For example, Wei, Chien and Wang [58] note that in selection of an ERP system, emphasis should be placed on price, maintenance costs, consultant expenses and infrastructure costs. Wei, Chien and Wang [58] argue that placing focus on these four attributes will help in minimizing the total cost. One of our respondents from the coffee manufacturing industry also noted:

> Cost is an important consideration for us. What is the purpose of an ERP system if the costs are high. The only reason we began investing ERP was cost reduction. Yes I do understand that there will be other related benefits as well, but cost is the real driver, honestly.

3.2. Ensure ERP benefits realization

Clearly, benefits realization is an important objective for enriching the ERP systems planning process. Most of the sub-objectives in this

category focused on 'behind the scene' activities that seem essential to gaining benefits from ERP implementations. To ensure benefits realization, we found five key areas of focus. First, the organization should ensure knowledgeable and proactive upper management support. Second, the organization needs to ensure proper change management controls. Third, adaptation constraints need to be minimized. Fourth, the organization needs to ensure the clarity of investment objectives. And finally, the organization needs to allocate responsibility to individuals in the organization who would be responsible for ensuring benefits realization. The ERP literature has also noted the significance of these characteristics. McGinnis and Huang [32] for instance notes:

> IS research for ERP projects generally analyzes critical success factors for new systems implementations. Seldom does it address perpetual support for the final success of ERP systems; in fact, many ERP systems fail shortly after they are completed. Techniques to capitalize on the knowledge created during the development process are not widely in use. Many organizations do not manage any of the knowledge they are creating.

A similar sense emerged in our case study interviews as well. One senior manager from Gamma commented:

> It is absolutely critical to ensure that *knowledge* that resides in the minds and processes of the organization is understood and articulated. ERP systems can very quickly get out of control. It is the ability to leverage information that supports business activities and hence the knowledge that is fundamental to it's [*ERP's*] success (emphasis added).

3.3. Enhance product and service improvement

Enhancing product and service improvement was found to be a fundamental objective. Gatticker and Goodhue [18] mention that ERP systems can have a significant impact on manufacturing firms and how products get produced and supply chains optimized. In terms of enhancing product development, this research found three key areas of focus. First, planners should ensure that the system supports new product development. Second, planners should ensure that any system that may be considered for adoption will support the growth of existing product lines. And finally, ERP planners should ensure that the system enables the identification of new product opportunities.

A manager from firm *Beta* noted:

> It is indeed important to ensure that any of our implementations support our constant efforts to ensure that our products are of high quality. In our case the time at which the grapes are plucked and the temperature at which they are stored etc. have an important bearing on the quality of our products. Hence any computer based system that links various aspects of our supply chain to ensure high quality of our wines is most sought after.

3.4. Maximize customer relationship effectiveness

In our research, maximizing customer relationship effectiveness emerged to be a fundamental objective. A majority of ERP systems do have customer relationship modules [16]. Most organizations that implement ERP systems that have a customer focus aspire to provide good customer services. As a manager from *Gamma* enterprise noted:

> We do not produce any goods. Our business has to do with providing excellent services to our clients — may these be other businesses or individuals. If we can provide good information, we make our customers happy. ERP systems are indeed central to providing such data.

Fang and Lin [17], among others, also note the role customer relationship modules in ERP systems play in retaining customers. If the customers get the feeling that they are not getting a 'good deal', the chances of these customers deflecting to other suppliers or businesses increases. Therefore, as this research suggested, there are three areas that need critical attention. First, the ERP system should be able to create customer oriented system processes. Second, the ERP system should be able to ensure the ability to understand customer desires. And finally, the ERP system should be able to ensure efficient marketing channel design.

4. Value-based means objectives for ERP systems planning

Separating the 4 fundamental objectives from the 17 main objectives left us with 13 means objectives as shown in Table 2. As mentioned previously, a means objective is one that provides a way to achieve the ends objectives. In other words, the thirteen objectives shown in Table 2 were all considered means objectives as they all had some type of relationship that led to the fundamental objectives shown in Table 1. The sub-objectives for these 13 means objectives can be found in Appendix B.

When considering these 13 objectives together, it becomes apparent that the first five objectives that deal with maximizing working relationships, maximizing trust, maximizing organizational IT competence, ensuring technical support and minimizing information dispersion deal with issues that should be considered via organizational analysis rather than ERP-system-specific analysis. The last eight objectives shown in Table 2 that deal with maximizing system use, maximizing system process effectiveness, maximizing business process effectiveness, ensuring business continuity, maximizing compliance, maximizing data analysis, maximizing information richness, and maximizing information security are objectives that should be considered by ERP selection teams when considering the adoption of a new ERP system.

4.1. Maximize productive working relationships

The objective "maximize productive working relationships" deals with upper level management issues that surround the creation of an organizational culture that promotes effective and efficient working relationships for the purpose of ensuring ERP acceptance. The literature refers to interdepartamental communication and cooperation as a critical success factor for ERP implementation [1] and the relevance of ERP systems to improve and integrate organizational processes [12,13]. Newman and Westrup [38] mention the importance of the ongoing interaction between the ERP system, different groups in the organization

Table 2
Means objectives.

Means objective
1. Maximize productive working relationships
2. Maximize trust
3. Maximize organizational IT competence
4. Ensure technical support
5. Minimize information dispersion
6. Maximize system use
7. Maximize system process effectiveness
8. Maximize business process effectiveness
9. Ensure business continuity
10. Maximize compliance
11. Maximize data analysis
12. Maximize information richness
13. Maximize information security

and external groups such as vendors, consultants and shareholders. Improving and integrating organizational processes may imply the establishment of new or better working relationships.

For maximizing productive working relationships, this research found four key areas of focus. First, upper level managers need to create an environment that promotes agreement among functional divisions. Second, upper-level managers need to promote an environment that maximizes the working relationships of external consultants and in-house IT project teams. Third, upper level managers need to minimize the negative cultural impact of system introduction with respect to people. And finally, upper level managers need to create an environment that promotes agreement among functional divisions.

4.2. Maximize trust

Maximizing trust deals with issues that surround ensuring trusting relationships between the organization and any outside consultants/vendors who may be involved in an ERP implementation [19]. Indeed, a trusting relationship is important in ensuring success of ERP implementations largely because solid and faithful relationships help in gaining benefits from the technological implementation. A manager from the real estate firm affirmed the importance of trust when he observed:

> I see that without significant amount of trust between the firm and the vendor, the full potential of the ERP system can perhaps never be accomplished.

In this research we found three key areas of focus. First, the trustworthiness of outside consultants needs to be ensured. Second, the trustworthiness of internal IT staff needs to be established. And finally, all business activities that concern the ERP implementation need to be made visible to the entire organization.

4.3. Maximize organizational IT competence

Murphy and Simon [37] argue that increasing the capability of IT infrastructure and IT cost reduction are the primary benefits of an ERP system. Clearly, as has been argued in the literature [49], IT management expertise and good technical skills help in achieving the ERP objectives. In our research we found maximizing organizational IT competence to be a relevant objective for enriching the ERP systems planning process with seven key areas of focus. First, upper-level managers need to ensure organization-wide knowledge of ERP. Second, functional managers need to ensure adequate systems specific knowledge of the ERP system. Third, the selection team needs to ensure the competence of outside consultants. Fourth, upper-level managers need to ensure the competence of the ERP selection team. Fifth, upper-level managers need to ensure the competence of the ERP implementation team. Sixth, upper-level managers need to ensure the organizational ability of strategic system use [31]. And finally, upper-level managers need to ensure in-house competency for handling any restructuring of organizational divisions that may need to be done. A manager from the wine disteling company commented:

> What is required is an ability to link *know-how* with context. That is a skill that needs to be developed.

4.4. Ensure technical support

Undoubtedly, technical support is a key element of ensuring the success of an ERP implementation and this research uncovered multiple issues that need to be addressed in this context. First, the availability of external technical support must be ensured. Second, the availability of internal technical support must be ensured. And finally, once an ERP solution has been implemented, upper level managers need to minimize the need for technical dependence on individual IT experts.

The literature frequently refers to the relevance of vendors' support in ERP projects [1,49] and to the knowledge transfer from consultants to clients in ERP system implementations [7,28]. The importance of technical support was also voiced by one of the managers from *Gamma* organization. He noted:

> I cannot underestimate the importance of good technical support for ERP systems. Oftentimes the implementation team begins focusing on issues that deal with organizational aspects, but tend to ignore the fact that if people cannot use the ERP system or if their problems are not addressed in a timely manner, it kind of defeats the purpose.

4.5. Minimize information dispersion

Minimizing information dispersion also emerged as an important objective for ERP success. In organizations, information tends to be dispersed in different functional areas and it is virtually impossible to use it effectively for any business purpose. It is therefore important to ensure that information dispersion is minimized. An executive from *Alpha* commented:

> One of the biggest advantages of the ERP system is our ability to look at information collectively. Previously there was a lot of information, but it was all over the place.

For minimizing information dispersion, this research found two key areas of focus. First, information repositories must be consolidated in one place. And second, the reliability of vendor–client business critical data must be ensured. As has been noted in the literature, information integration has been a major driver for ERP implementations [12,20].

4.6. Maximize system use

Maximizing system use is also considered an important objective. This objective deals with issues that surround the creation of an organizational environment and choosing the correct ERP solution that will result in optimal use of the new ERP system [48]. For maximizing system use, this research found five key areas of focus. First, ERP selection teams need to ensure that the ERP solution is easy to use. Second, upper level managers need to create an environment that promotes organization-wide system use. Third, ERP selection teams need to ensure that the ERP system is flexible. Fourth, ERP selection teams need to ensure that information can be retrieved in a timely manner. And finally, once organization-wide ERP use is established, upper level managers need to ensure continuous system use.

4.7. Maximize system process effectiveness

This objective deals with issues that ensure that ERP system processes are a good fit for the organization [12,42]. For maximizing system process effectiveness, this research found two key areas of focus. First, ERP selection teams need to ensure that the ERP system processes fit organizational requirements. And second, ERP selection teams need to ensure that the ERP system processes fit existing business processes.

4.8. Maximize business process effectiveness

This objective suggests that existing business processes in an organization are handled efficiently by the ERP system [13,25]. For maximizing business process effectiveness, five aspects were considered important. First, ERP selection teams need to ensure that administrative processes are sufficiently integrated. Second, ERP selection teams

need to ensure that manufacturing processes are sufficiently integrated. Third, ERP selection teams need to ensure that the real time control of manufacturing processes can be altered to maximize performance. Fourth, ERP selection teams need to ensure that business processes fit system requirements. And finally, ERP selection teams need to ensure that procedural redundancy is minimized.

4.9. Ensure business continuity

Business continuity has emerged as a major concern for organizations [50,56]. This objective deals with issues that ensure that the overall business goals of an organization are not altered via the introduction of a new ERP system [30]. For ensuring business continuity, two critical areas were identified. First, ERP selection teams need to ensure that the ERP system does not alter or break existing business processes. And second, upper level managers need to ensure that any ERP system selected would not alter the course of business for a given organization. Wright and Wright [60] analyze the risks associated with ERP implementation projects in assuring enterprise services. Their research reiterates the need for configuring business processes with ERP customizations. In particular Wright and Wright state:

> Risks may be significantly greater when ERP modules are integrated with existing legacy systems or systems from other vedors, referred to as 'bolt-ons'.

4.10. Maximize compliance

Maximizing compliance ensures that the ERP system will not break any existing regulations and professional standards. Compliance is a frequent major concern in enterprise systems implementations [36]. For maximizing compliance, three key areas were found to be important. First, ERP selection teams need to ensure that the ERP system conforms to existing professional standards given a particular organization. Second, ERP selection teams need to ensure that the ERP system conforms to legal requirements. And finally, ERP selection teams need to ensure that the ERP system complies with all known existing regulations.

4.11. Maximize data analysis

This objective deals with issues that ensure that the ERP system will be efficient in handling the various techniques of data analysis. In this regard three areas were considered important. First, ERP selection teams need to ensure that the system can efficiently handle the data analysis techniques of a given organization. Second, ERP selection teams need to ensure that the system can efficiently handle data conversion situations [1]. And finally, pattern recognition capabilities need to be ensured. An executive from the real estate firm commented in one of the interviews:

> We need to build data analytic skills. These are so important if ERP systems are to become successful or if their full potential is to be realized.

4.12. Maximize information richness

The maximizing information richness objective ensures the capture of business critical information in a timely manner. Benders et al. [6] state that access to enterprise-wide data on a controlled basis and providing information sharing across business processes is a major objective for the implementation of ERP systems. For maximizing information richness, this research found two key areas of focus. First, ERP selection teams need to ensure that any real-time information given to users is up-to-date and correct. And second, ERP selection teams need to ensure that any ERP system selected will capture business critical data.

4.13. Maximize information security

The maximizing information security objective deals with issues that ensure that the basic constructs of IS security namely confidentiality, integrity of data, and availability (CIA) are adequately addressed by the ERP system [43,53]. Von Sohns [53] argues that it can be difficult, time consuming and costly to implement and maintain security within ERP systems but high levels of security are paramount to the success of an ERP implementation.

For maximizing information security four key areas emerged. First, ERP selection teams need to ensure that the system will make information available to the appropriate users. Second, ERP selection teams need to ensure that the system will minimize data redundancy. Third, ERP selection teams need to ensure that the system will maximize data integrity. And finally, ERP selection teams need to ensure that the system will minimize unauthorized access to business critical data.

5. Discussion

Focusing on the analytical dimensions of the theory of the phenomenon being studied, the means and fundamental objectives presented in this paper are indeed generalizable. In this case the theory pertains to Keeney's [26] value focused thinking. Analytical generalization, as opposed to statistical generalization, is well accepted in the literature [5,54,61]. The purpose of analytical generalization is not to generalize to a defined population of cases that have been sampled, but to the theory (see Yin [61] pp 31–33). The means and fundamental objectives, grounded in stakeholder values, provide a better opportunity for a specific organization to understand the complex social and technical issues related to ERP projects. In other words, because objectives form the basis for any strategic planning exercise, an individual organization should view our framework as a guiding point for defining their own strategic plans with respect to ERP implementations. An ERP strategic plan would then not only help in the strategic choice of an ERP, but also help in identifying alternatives to achieve the core purpose (as suggested by Keeney [26]). The relationship between the means and the fundamental objectives would then help in sketching the paths of change as shown in Fig. 2.

According to Keeney [26], the means–ends objectives network is a value model representing both quantitative and qualitative relationships. The purpose of such a model, like most models, is to gain insight into a complex situation and thereby complement intuitive thinking [26,45]. The best way to describe the utility of the value model is to consider the various fundamental objectives as being O_1, …O_n and m_1 (sub-objective) as a fundamental measure for a fundamental objective O_1. It follows therefore that the vector $m = (m_1, m_2, \ldots, m_n)$ would provide a description of a particular path in the diagram in which a fundamental objective is delivered. The accumulative value of m would then serve as a measure (quantitative or qualitative) of the idiosyncratic resources and abilities, that is ERP.

In considering one example from our research, O_1 could be "ensure ERP benefits realization" where m_1 would then be "ensure knowledgeable and proactive upper management support," m_2 "ensure proper change management controls," m_3 "minimize adaptation constraints", m_4 "ensure clarity in investment objectives" and m_5 "allocate responsibility for benefits realization." Vector m would then provide a measure of the unique resources and abilities that are necessary in ERP benefits realization. Managers and users can then prioritize the objectives and specify values linked with the overall desirability of that service. Based on the preferred value proposition, a number can then be assigned to

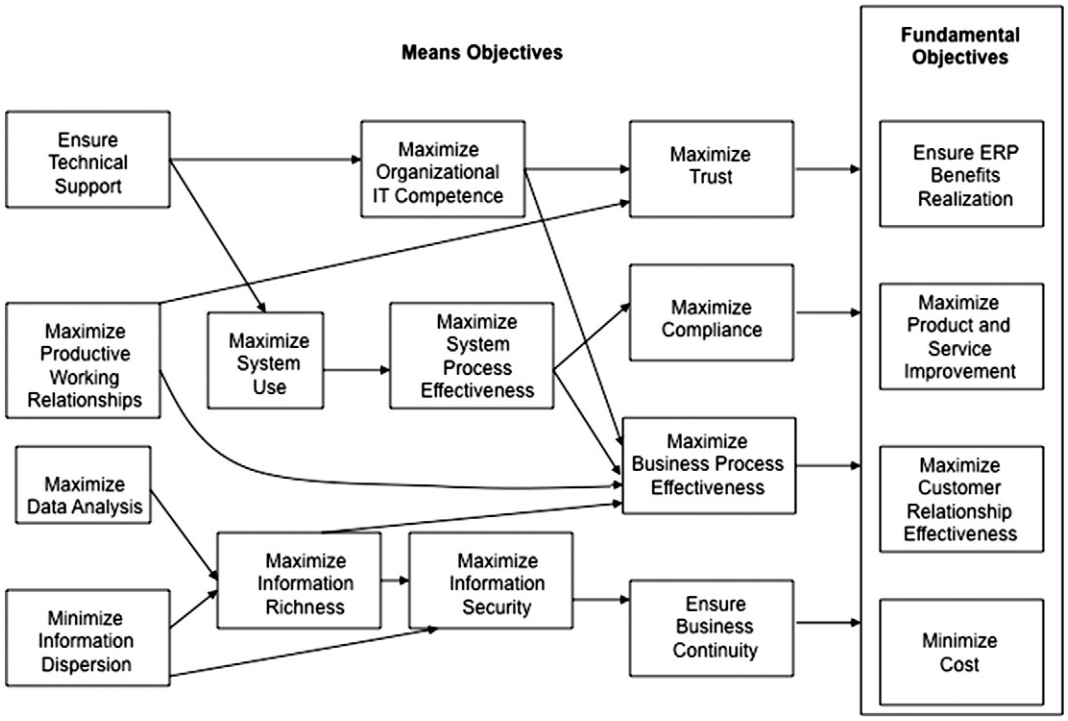

Fig. 2. Network of ERP objectives.

the vector m. Therefore, a common value model will take the form shown in Eq. (1) [15,26]:

$$v = \left(m_{1,} m_{2,\ldots,} m_n\right) = \sum_{i=1}^{n} k_i v_i(m_i) \quad (1)$$

Where k_i is the weight ascribed to the objective O_i and v_i is the relative desirability scaling.

The value for enriching the ERP systems planning process can be assessed based on the value model presented in Fig. 2, where the value of $v = (m_{1,}\ m_{2,\ \ldots,}\ m_n)$ represents the benefits of the product/service to the user. A point to remember is that a specific numerical value needs to be ascribed. For example, poor ERP systems planning within an organization would mean that m is 0 and ideal or top-notch planning could have a value of 1.0. It could therefore be argued that in cases where v is greater than 0, some end users have received some benefits. Since the value ascribed by one end-user is going to be different from another, there are going to be different value models for different users. The discussion below suggests how the value model could be used in either creating new, or reconfiguring existing planning processes. Examples are drawn from the value network diagram presented in Fig. 2.

The inherent argument, based on Keeney [26], is that opportunities to improve or change ERP system plans exist only when an adequate gap has been found in the various measures of $m_{1,}\ m_{2,\ \ldots,}\ m_n$. If one is able to find a suitable slot where the value proposition can be increased, the enterprise is enhancing its position by filling this identified slot. By directly addressing those gaps that end-users highly value, the business enterprise can achieve improvements in ERP system plans.

For example, "ensure technical support" contributes to "maximize organizational IT competence" and "maximize systems use." If internal and external technical support is poor, the system is likely to be less used, since any failure will take longer to be solved. On the other hand, "maximize systems use" leads to an improvement in "systems process effectiveness," which is important for "maximizing compliance with IT standards" and "maximizing business process effectiveness," particulary those business processes that significantly depend on the use of IT.

Looking at another example, "maximizing data analysis" is important for "maximizing information richness" because data analysis enables a better undertanding of organizational data requirements. Additionally, the literature and data collected in the cases show that information richness also has an impact on "maximizing information security" which then contributes to "ensuring business continuity."

6. Conclusion

Objectives provide a road map for strategic planning. ERP systems planning objectives are "guide points" to ensure that ERP projects stay on course. They also help in assessing where projects are now and where they are heading, thus guiding the decision making process. To ensure the successful alignment between organizational and ERP processes, a set of means and fundamental objectives was defined using the data collected from three case studies. However, these organizational objectives for ERP systems should not be independently analyzed. Evidence shows that there are relationships and interdependencies among them. In conclusion, using the notion of ascribing values to ERP system plans, we were able to develop a model for interlinked objectives (combination of unique resources and abilities) that could result in improved planning. Research presented in this paper identifies various value propositions (the means–ends objectives network) that provide a precursor to measure the relative success or failure of ERP strategic planning.

It should be noted that the objectives found in this research can be used by organizations as a starting point for determining their own context-specific objectives and corresponding value networks. Adding context-specific objectives to our original framework could then provide a means for determining value driven tasks and alternatives for the purpose of maximizing ERP selection and implementation processes. Based on our findings in this research, these tasks and alternatives would be better aligned with a particular organization's strategy thus maximizing the probability of success for ERP projects. However, further research in this light is needed.

Appendix A. Values and objectives derived from case study data

The tables below show the values and the emergent objectives from the values, as derived from the case studies.

Value	Objective
Maximize system process effectiveness	
Beta requires that the administrative processes of the ERP fit their needs and be easy to use (i.e. balance sheet, financial statements)	• Ensure that system processes fit organizational requirements
Beta requires that existing ERP processes be adapted to already existing organizational processes	• Ensure that system processes fit existing business processes
Maximize business process effectiveness	
Beta desires integrated administrative and manufacturing processes	• Ensure integrated administrative processes • Ensure integrated manufacturing processes
Beta requires real time manufacturing control	• Maximize real time control of manufacturing processes
Alpha requires the reorganization of its business processes	• Ensure that business processes fit system requirements
Alpha desires an ERP system with minimal redundancy in terms of data and procedures	• Minimize procedural redundancy
Maximize customer relationship effectiveness	
Alpha wants to continue establishing a strong relationship with its customers	• Create customer oriented system processes
Gamma wants to know its final customers' wishes and needs	• Ensure ability to understand customer desires
Alpha wants to establish a strong communication channels with its customers	• Ensure efficient marketing channel design
Alpha wishes to improve customer service	• Maximize customer service
Maximize system use	
Beta requires that the administrative processes of the ERP fit their needs and be easy to use (i.e. balance sheet, financial statements)	• Maximize ease of use
Beta desires an environment that fosters the use of the ERP system by all employees in the organization	• Create an environment that promotes organization-wide system use
Alpha desires an ERP system that is less rigid than existing platforms	• Maximize system flexibility
Alpha desires quick/efficient accounting reports	• Maximize speed of information retrieval
Alpha desires an ERP system that provides product continuity	• Ensure continuous system use
Maximize organizational IT competence	
Beta desires that non-IS individuals be able to use the ERP system with minimal interaction with IT experts	• Ensure organization-wide knowledge of ERP
Beta desires strong and efficient ERP training	• Ensure adequate systems knowledge
Gamma desires proper in-house competencies for ERP selection/implementation, otherwise, Gamma requires a competent and trustworthy ERP consultant	• Ensure competence of outside consultants • Ensure competency for ERP selection • Ensure competence for ERP implementation • Ensure organizational ability of strategic system use
Gamma desires that the IS department be capable of handling the restructuring of organizational divisions	• Ensure in-house competency for handling restructuring of organizational divisions
Minimize cost	
Alpha wishes to reduce ERP startup and implementation costs	• Minimize startup costs • Minimize implementation costs
Gamma wants to reduce IT maintenance costs	• Minimize maintenance costs
Ensure technical support	
Beta desires that non-IS individuals be able to use the ERP system with minimal IS interaction	• Minimize dependence on technical support
Beta requires sufficient external technical support	• Ensure availability of external technical support
Beta requires sufficient internal technical support	• Ensure availability of internal technical support
Gamma wants to avoid technical dependency from a particular IT expert	• Minimize need for technical dependence on individual IT experts
Maximize information security	
Beta wishes that information was made available to the right people at the right time	• Ensure availability of information
Alpha desires an ERP system with minimal redundancy in terms of data and procedures	• Minimize data redundancy
Alpha desires an ERP system that maximizes data integrity/security	• Maximize data integrity
Gamma desires to protect data against unauthorized access	• Minimize unauthorized access
Maximize trust	
Alpha desires a trustworthy consulting team	• Ensure trustworthiness of outside consultants
Gamma desires a system that is independent from internal or external IT staff that can be further developed by any major ERP consultancy firm or experts. They don't want to depend on one IT person or supplier.	• Ensure trustworthiness of internal IT staff
REM's top managers want to be able to fully understand firm's business processes	• Ensure transparency of business activities (candidness)
Minimize information dispersion	
Alpha desires minimizing dispersed information	• Ensure consolidation of information repositories
Gamma wants a system that enables its customers to interact by computer with the firm, to have a better control of customer's sales	• Ensure the reliability of vendor–client business critical data
Enhance product development	
Alpha desires to develop new products	• Ensure that system supports new product development
Gamma wishes to grow and build new shopping centers	• Ensure that system supports growth of existing product lines
Alpha and Gamma want to know better the wishes and needs of their final customers, in order to develop better products.	• Ensure that system enables identification of new product opportunities

Appendix A (*continued*)

Value	Objective
Maximize data analysis	
Alpha desires an ERP system that will provide efficient data analysis and conversion	• Maximize the efficiency of data analysis techniques • Ensure efficient data analysis conversion • Ensure pattern recognition abilities
Maximize information richness	
Gamma desires more and better information than existing systems can provide. Understand which products are selling better Online availability of information from various divisions. Control over maintenance activities — control raw materials	• Maximize real time information richness
Gamma wants a system that enables its customers to interact by computer with the firm, so that they can have a better control of customer's sales (a percentage of the rent the firm receives from its costumers depends on customer's sales).	• Ensure the capture of vendor–client business critical data
Ensure ERP benefits realization	
In Beta, a knowledgeable and proactive CEO is desired	• Ensure knowledgeable and proactive upper management support
Alpha emphasizes the importance of change management techniques be implemented	• Ensure proper change management controls
Alpha desires minimal adaptation constraints	• Minimize adaptation constraints
Alpha wants clear objectives for the adoption of the ERP system	• Ensure clarity in investment objectives
Gamma wants people to be responsible for the ERP benefits in the area where they work	• Allocate responsibility for benefits realization
Maximize productive working relationships	
Beta desires mutual agreement between the manufacturing and IS managers	• Create an environment that promotes agreement among functional divisions
Alpha desires an environment that maximizes the working relationships of external consultants and the in-house IT project team	• Promote an environment that maximizes the working relationships of external consultants and in-house IT project teams
Alpha does not want people to be affected by the introduction of the ERP system in the organization (the company has a strong social responsibility policy)	• Minimize negative cultural impact of system introduction • Minimize negative cultural impact of system introduction with respect to people
Ensure business continuity	
Gamma wants to ensure business continuity	• Ensure that business processes are not broken • Ensure that system provides business continuity

Appendix B. Means objectives and their various sub-objectives

Means objective	Sub-objective
1. Maximize productive working relationships	Create an environment that promotes agreement among functional divisions
	Promote an environment that maximizes the working relationships of external consultants and in-house IT project teams
	Minimize negative cultural impact of system introduction with respect to people
	Create an environment that promotes agreement among functional divisions
2. Maximize trust	Ensure trustworthiness of outside consultants
	Ensure trustworthiness of internal IT staff
	Ensure visibility of business activities (candidness)
3. Maximize organizational IT competence	Ensure organization-wide knowledge of ERP
	Ensure adequate systems specific knowledge
	Ensure competence of outside consultants
	Ensure competency for ERP selection
	Ensure competence for ERP implementation
	Ensure organizational ability of strategic system use
	Ensure in-house competency for handling restructuring of organizational divisions
4. Ensure technical support	Ensure availability of external technical support
	Ensure availability of internal technical support
	Minimize need for technical dependence on individual IT experts
5. Minimize information dispersion	Ensure consolidation of information repositories
	Ensure the reliability of vendor–client business critical data
6. Maximize system use	Maximize ease of use
	Create an environment that promotes organization-wide system use
	Maximize system flexibility
	Maximize speed of information retrieval
	Ensure continuous system use
7. Maximize system process effectiveness	Ensure that system processes fit organizational requirements
	Ensure that system processes fir existing business processes
8. Maximize business process effectiveness	Ensure integrated administrative processes
	Ensure integrated manufacturing processes
	Maximize real time control of manufacturing processes
	Ensure that business processes fit system requirements
	Minimize procedural redundancy
9. Ensure business continuity	Ensure that critical business processes are not broken
	Ensure that system provides business continuity
10. Maximize compliance	Ensure that system matches professional standards
	Ensure that system conforms to legal requirements
	Ensure that system complies with existing regulations

(*continued on next page*)

Appendix B (*continued*)

Means objective	Sub-objective
11. Maximize data analysis	Maximize the efficiency of data analysis techniques
	Ensure efficient data analysis conversion
	Ensure pattern recognition abilities
12. Maximize information richness	Maximize real time information correctness
	Ensure the capture of vendor–client business critical data
13. Maximize information security	Ensure availability of information
	Minimize data redundancy
	Maximize data integrity
	Minimize unauthorized access

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