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ERP Benefits Maturity Model Assessment Tool

1. Abstract

ERP benefits is a hotly debated topic in academia. How, and based on what, organizations can deliver ERP benefits? This research adopts ERP orchestration theory and IT business value literature to develop ERP benefits maturity model to enable organizations assessing their capabilities to realize different benefits from the system. In order to do so, the benefits of ERP are identified and classified, the ERP technological and organizational complementary resources required to deliver each group of benefits are mapped out. The ERP benefits are automating, planning, and innovating benefits. The required organizational resources are users' attitudes and skills and organizational characteristics. It has been found, based on 63 organizations, the most important enablers for automating benefits are users' attitudes towards the ERP. For innovation, the most important enablers are the organization characteristics.

2. Introduction

ERP is defined as an IT infrastructure that integrates different information systems and technological artifacts into a single system (Badewi et al, 2018). It is designed mainly for addressing the problem of islands of information (Muscatello et al, 2003) and "systems do not talk to each" issues so that organization-planning capabilities are expected to improve. According to a survey conducted by Panorama (2017), out of 342 ERP adopters 11%, 10%, and 12%, of the respondents perceive ERP improved the data reliability, improved decision making, improved the availability of information, respectively. I.e. about 90% of the respondents do not perceive such information benefits from a system designed to improve the planning process of the resource utilization. Although at the end of the twentieth century there was a debate of the IT investment impact on organizational performance (Carr 2003), it becomes now a matter of fact that IT creates value to organizations (Kohli, Grover 2008). However, we do not know clearly "how" and "why"

organizations achieve different types of benefits than others (Staehr, Shanks & Seddon 2012).

An ERP system is not merely an information system; rather, it is an information system that enables an organization to integrate various information systems and technologies into a single harmony system. From this perspective, ERP benefits, assets, and capabilities are required to be clearly identified. Although ERP benefits identification and classification are not new in literature (Shang, Seddon 2000), few papers were directed to give insights into how to manage these benefits (Shang, Seddon 2002).

In order to realize benefits from Information Technology (IT) projects, certain capabilities are required (Ashurst, Doherty & Peppard 2008). Likewise, ERP system, as an information system, needs organizational capabilities to utilize its abilities. It is not clearly known from literature what are capabilities required to achieve benefits of ERP systems. Since ERP is an infrastructure for other information technologies, it is not clearly known when an organization should deploy more technologies to leverage the benefits of the whole system. Furthermore, which resource, e.g., technology, should be acquired or developed and based on what. Asset orchestration, in general, gives us a very general guideline for that (Helfat et al. 2007, Sirmon et al. 2011). However, integration and harmony among sub information systems and technologies, for instance, pose a special look at ERP systems. This research adopts ERP orchestration framework (Badewi et al, 2018) and IT business value (Melville et al, 2004) to develop ERP maturity assessment model so that organizations can benchmark themselves against these measures.

3. Literature Review

1.1.1 ERP Business Value

IT business value is the impact of IT investments on organizational performance (Melville, 2004) and organizational capabilities through different levels of organization (Schryen 2013). Likewise, ERP is perceived to have positive impacts on organizational performance includes productivity improvement, and profitability improvement (Nicolaou 2004, Nicolaou, Dehning & Stratopoulos 2003). ERP has been noted to improve cost reduction, competitive advantage (Stratman 2007, Romero et al. 2010), inventory reduction, and other measures of performance (Shang, Seddon 2000).

Therefore, ERP business value could be defined as the impact of ERP on organizational performance and organizational capabilities in terms of financial benefits and non-financial benefits. Benefits of ERP system, as any other information system's benefits, come as output from "a complex web of influences that interact over time" (Staehr, Shanks & Seddon 2012). Furthermore, Shang and Seddon (2002) illustrate the behavior of benefits realization through four case studies. However, little research investigated the factors that affect this behavior (Staehr, Shanks & Seddon 2012).

2.1. ERP Organisational Complementary Resources (OCRs)

Since ERP is not implemented in a vacuum, the existence/lack of the various Organisational Complementary Resources (OCRs) is argued to be critical for the variation in the levels of success (Albu et al., 2015). OCRs that are found in the literature to be necessary are the organizational factors such as the strategy, structure (Albu et al., 2015), a control system (Kallunki et al., 2011), and compensation system (Silveira et al., 2013). Also, people factors are found to be the demographics (age, cognitive style, education, gender and work experience) (Jasperson et al., 2005; Sammon and Adam, 2010)), peer advice ties (Sykes, 2015) and their psychological factors (e.g. readiness to change in attitude (Stratman and Roth, 2002). Management mentality also found to contribute to assimilation of the ERP such as top management roles (Law and Ngai, 2007; Zhong Liu and Seddon, 2009; Dezdar and Ainin, 2011b) (e.g. their role in the continuous alignment between the organisation's strategic objectives and the long-term capabilities of the ERP (Chou and Chang, 2008a)).

2.2. ERP Blueprint

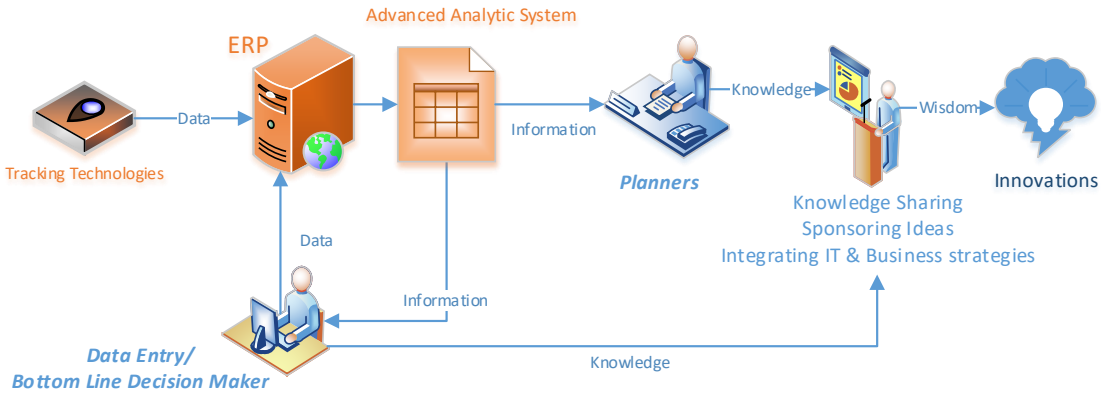
The term "blueprint" has not been used academically but is used in professional life because one element of ERP implementation by SAP is to "prepare a Blueprint" (Dolmetsch et al., 1998; Gibson et al., 1999; Vernon, 1999). Indeed, in the present research, this concept is used because it is used in programme management guides (OGC, 2011) and benefits management guides (Jenner and APMG, 2014) to reflect the capability (i.e. the business operating model required for recouping the benefits). This research adopts the definition from the guide 'Managing Successful Programmes' (MSP) which highlights the future picture of an organization (a business operating model) and consists of POTI (Process, Organisation, Technology, and Information) (OGC, 2011; OGC,

2003). This term is inherited from other certificates and accreditations such as The Open Group Architecture Framework (TOGAF) and Business Architecture Management (Tao et al., 2015; Ahmad and Odeh, 2014). Nevertheless, TOGAF is about the designing of databases and web services for cloud ERP to assist business people; it has nothing to do with organizational perspectives (Scherer and Wimmer, 2012; Gunawan and Surendro, 2014). Thus, 'blueprint' is defined in the present research as the required operating business model for delivering benefits.

ERP benefits are classified into automating (AB), planning (PB), and innovating (IB) benefits (Badewi et al, 2018; Badewi et al, 2017). ERP benefits scaffolds in levels. They depend on each other. Automating benefits (AB) help to enable an organization to plan better because all the data are recorded from its origin on a real-time basis that makes data accurate, reliable and timely. Being able to understand the environment and thus plan better could enable an organization to unleash new opportunities in developing new products, ways of producing current products or new business models for introducing the product to the market (i.e. to innovate.)

For each benefits category, there are certain requirements. These requirements are conceptually the same but operationalized differently, as illustrated in Figure 0-1. In other words, all the benefits need certain enabling ERP technologies, an IT department to link users with technologies (either by their technical skills for supporting technologies or their business skills to translate technical language into business language for users), attitude toward technologies, skills to use technologies and organisational characteristics enabling the users and organisation to optimize the use of technology. The operationalization of each factor is different for each category of benefits.

IT HR competencces	Ability to maintain the system reliability	Ability to help planners to plan through Data in ERP	Ability to add to value creation process and be integrated with business strategies



Users' Attitude	Little/no resistance to ERP	ERP is necessary for planning	ERP is necessary for innovation
Users' Skills	Users are able to deal with data entry and basic reports	Users are able to know the planning processes of ERP	Users are able to use advanced statistics
Organisation Characteristics	jobs should be well defined and everyone understands his position after ERP	there is an organisational structured planning system using ERP	Existence of sponsorship, Knowledge Share and Benefits accountability
ERP Benefits	Reduction in purchasing and selling time	Improved production scheduling, improved quality of decisions and better forecasts	Continuous Innovation, developing new products and differentiating the products

Figure 0-1: ERP Benefits Blueprint

3. Research Methodology

3.1.1. Data Collection Methods

The items and relations of each tool are developed from Badewi et al (2018). However, these items are validated (evaluating the importance of each factor) by interviewing seven experts for between one and two hours, from different backgrounds and specializations in ERP (HR, CRM, MM, and Basis), as set out in Table 0-1. The experts were from Egypt and the UK. The effect of the interviews was to modify the wording of the items and make them more understandable and to remove non-essential items.

Table 0-1: Interviewees List for enhancing the tool

Company	Position	Country	Experience
ERP Company	ERP Project Manager	Egypt	8 Years
ERP Company	ERP HR SAP Consultant	UK	15 Years
ERP Company	ERP Project Manager	UK	7 Years
Pharmaceutical Company	Materials Management (MM) SAP ERP Consultant	Egypt	7 Years

Business Consultant	Business Analyst (ERP systems)	Egypt	8 Years
Food Company (1)	ERP Basis Manager	Egypt	6 Years
Food Company (2)	ERP CRM Oracle Consultant	Egypt	8 Years

After this, the tool was distributed among ERP managers on LinkedIn, a UK manufacturing Database, and a US ERP Manufacturing Database. About 100 participants started the questionnaire but relevant results were yielded by only 63 of them and completed questionnaires, as illustrated in Table 0-2. All 63 were used in factor analysis and reliability analysis, although it should be noted that 63 is not a large enough number to declare insignificant relations. However, it can be used as evidence to support significant relations in "what is found".

Table 0-2: Sample characteristics for validating the tool

Answer	Response	Country	
Retailing	2	Arab	15
Manufacturing of Slow Moving Consumer Goods (e.g. Cars, TVs, Computers)	5	Europe	14
Manufacturing of Fast Moving Consumer Goods (FMCG) (e.g. Food industry, Grocery items)	17	US	8
Oil and Gas	2	Australia	3
Construction	2	Others	
ERP Consultation	4		
Missing	22	Missing	22
Total	63	Total	63

3.1.2. Analytic models

The aim of this survey was to ensure that the factors in measuring different aspects of ERP resources were valid. The items' constituting factors were categorized through Exploratory Factor Analysis using Varimax rotation. The aim of the factor analysis was not only to classify the items of the factors but also to reduce the number of items. From Badewi et al (2018), 122 items needed consideration. This was a challenging total for inclusion in a single questionnaire. After meeting experts, the total was reduced to 82. Following factor analysis, the total was reduced to 68 items only. This research considers only what was perceived to be valid and reliable by all participants and the survey results. Based on the Qualtrics report (the software provided by the university and used to administer the tool), the average time needed to answer the questions of the assessment was within a range of 30 – 40 minutes, which was accepted by most of the respondents. After ensuring its reliability, the constructs were built on an average of the factors constituting the construct. It was not found by the experts that there were significant

relative weights among the items constituting the factors/constructs. Therefore, the normal average was taken in building the constructs.

Bivariate correlational analysis and simple regression were used to confirm and test the relationships between different constructs to validate the tool empirically. Multiple regression could not be used because the sample size could not be used to test more than two factors. Thus the tool was validated in a positivist epistemological and axiological approach. In other words, it was assumed that nobody knows reality, but it exists and can be discovered through objective numbers and relations supported by rationale or theory. Finally, the radars of the tools are presented to show out the relative importance of the different factors for each blueprint.

3.2. ERP Benefits

Operationalising benefits is crucial for the validation process. Thus, after conducting interviewees with experts, it was agreed that there were 3 indicators for measuring the automation benefits, four indicators for planning benefits and four indicators for the innovating ones. In fact, indicators must be generic and capable of use in any industry if this tool is to be validated across different industries from different countries. After conducting the validity analysis and reliability analysis, all the items reported in this research were found valid for building the constructs (e.g. automating, planning and innovating benefits). The results of factor analysis and reliability analysis are reported in Table 0-3. In addition, all the factor loads were over 0.6 and they were located in the right place. In other words, all the benefits relevant to a single level were located in the same column. Furthermore, the Cronbach's alpha for the three constructs is more than 0.6, which means that the constructs are reliable (J. C. Nunnally, Bernstein & Berge 1967, J. Nunnally, Bernstein 1994).

Automating benefits are normal benefits which do not need much effort. Thus, they are measured by their reduction of the time needed for the purchasing and selling cycle. Any normal organisation is involved in buying and selling products (perhaps as raw material, as work in progress or as a finished product for trading). Additionally, they are measured by the saving in operational time. The reliability of the construct, based on Cronbach's Alpha, is 83.1% which means that it is a reliable construct.

In planning, questions arise about production scheduling, the improved quality of decisions, improved accuracy of forecasts and enhanced cash planning. All of these items, except improving the production scheduling for production industries, are used by any industry. However, improving production scheduling is critical for indexing complicated and integrated planning procedures such as production planning (i.e. those which involve demand (from the marketing department), supply (from warehouses and purchasing departments) and capacity planning (maintenance and facility departments)). The internal consistency, i.e. the reliability, of this construct is 87.6%, which means it is a reliable construct.

Innovation benefits are indexed by three factors: the degree to which the ERP enabled the organization: 1) to differentiate its products from competitors' products; 2) to continuously improve the ways of producing new products; 3) to continuously develop new successful products and services. The Cronbach's alpha is 0.812 which means that the construct is reliable for use.

Table 0-3: Benefits validity and reliability tests

Rotated Component Matrix[a]

Items	Component		
	1	2	3
Cronbach's Alpha	.812	.876	.831
Auto_1 ERP-Reduced purchasing cycle time.			.851
Auto_2 ERP-Reduced selling cycle time.			.655
Auto_3 ERP-Saved operational time			.736
Plan_1 ERP-Improved production scheduling		.612	
Plan_2 ERP-Improved quality of decisions		.823	
Plan_3 ERP-Improved accuracy of forecasts		.705	
Plan_4 ERP-Enhanced Cash Planning		.795	
Innov_1 Enabled building business innovations	.774		
Innov_2 Enabled your organization to successfully differentiate its products from the competitors'	.736		
Innov_3 Enabled your organization to continuously improve the ways of producing/delivering products and services	.767		
Innov_4 Enabled your organization to continuously develop new successful products and services	.703		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

3.2.1. Maturity in ability to realize ERP benefits

After building the constructs by taking the average of the constituent items, correlational analysis was conducted between benefits to find whether there were a relationship between them. As illustrated in Table 0-4, all the benefits were found to be highly correlated. This could indicate that achieving automating benefits can lead to planning benefits because they are highly correlated by 70.4% with P<0.00. Furthermore, because the correlation between PB and IB is 68.3% with P<0.00, achieving planning benefits can enable the organization to innovate. In other words, the organizations that are not able to achieve automating benefits from ERP are struggling to gain planning benefits. Additionally, without achieving automating and/or planning benefits, it would be difficult to use ERP for innovation.

Table 0-4: Correlational Analysis of ERP benefits

		Benefits		
		AB	PB	IB
Benefit	AB	1	.704**	.626**
	PB	.704**	1	.683**
	IB	.626**	.683**	1

3.2.2. Automating Benefits (AB)

Automating benefits are not difficult to recoup. Once the system is implemented successfully, these benefits are obtained. The sample results support this argument. As illustrated in Figure 0-2, the average, which is 3.6, is more than 3.00 (the middle point) and most organizations, about 86.5% as set out in Table 0-5, do better than 3.00. This can be interpreted to mean that automating benefits are not difficult to realize. Indeed, as reported in Table 0-5, about 50% of organizations score 4 out of 5 in automating benefits from ERP systems.

Table 0-5: Automating Benefits- Frequency Table

Score	Frequency	%	Cumulative %
1.00-1.99	3	4.7	4.7
2.00-2.99	5	7.9	13.5
3.00-3.99	23	36.5	50
4.00:5.00	32	50	100
Total	63	100.	

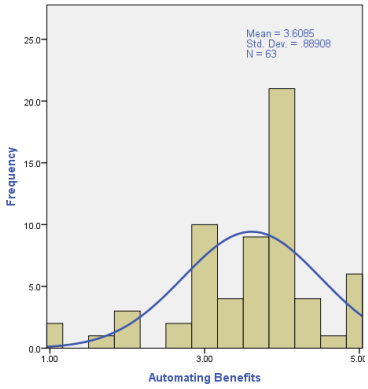


Figure 0-2: Automating Benefits - Descriptive Data

3.2.3. Planning Benefits Index (PB)

Few organizations, based on this sample, are struggling to recoup the planning benefits of the ERP system. The average score is 3.7 with a standard deviation of 0.81, which means that the coefficient of variation (standard deviation/ average) is 21.8%. This indicates that the dispersion (the variation) in the planning benefits is relatively low and it is clustered around a few scores. This can easily be visualized in Figure 0-3. Most organisations are clustered between 3 and 5 to take a negative skewness by -.928 because there are two organisations which score only between 1 and 2, while 16 organisations (25% of the total) score from 4 to 5 and 50% score between 3 and 4, as illustrated in Table 0-6. Although the average score of the sample for planning benefits is higher than for automating benefits, in the latter 50% of the sample score more than 4 out of 5 in contrast while for PB it is only 25 %. This indicates that it is not so difficult to do very well in planning but it is challenging to do this when planning benefits.

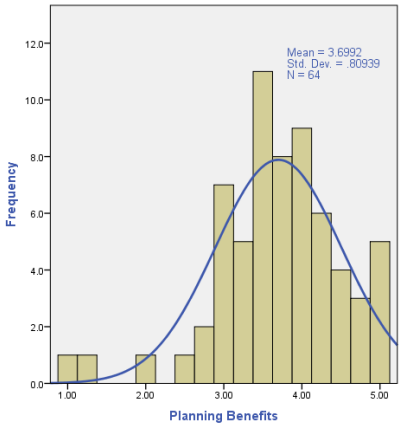


Figure 0-3: Planning Benefits - Descriptive Data

Table 0-6: Planning Benefits- Frequency Table

Score	Frequency	%	Cumulative %
1.00-1.99	2	3.2	3.2
2.00-2.99	14	21.8	25
3.00-3.99	32	50	75
4.00-5.00	16	25	100
Total	64	100	

3.2.4. Innovating Benefits (IB)

ERP as an enabler of innovation is a debatable concept in the literature. The present research found, as illustrated in Figure 0-4 and reported in Table 0-7, that 25% of the organizations surveyed believe that ERP is a source of innovation to them, while 50% of the sample either merely agree with this statement or are neutral about it. Only 25% have a tendency to disagree with it. However, the average score is 3.33, which is significantly below the average scores for other benefits (they are around 3.7). This reflects that recouping innovating benefits from ERP systems is less probable or needs more effort than organizations might easily surmise.

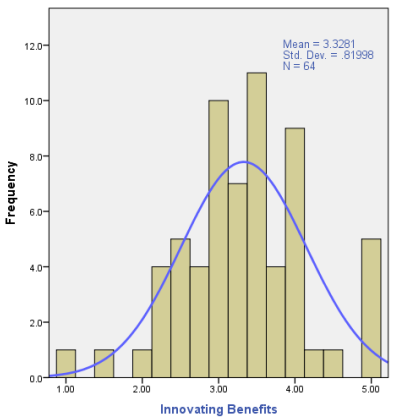


Figure 0-4: Innovating Benefits - Descriptive Data

Table 0-7: Innovating Benefits- Frequency Table

Score	Frequency	%	Cumulative %
1.00 – 1.99	2	3.2	3.2
2.00 – 2.99	14	21.8	25
3.00 – 3.99	32	50	75
4.00 – 5:00	16	25	100
Total	64	100	

Unlike ERP automating benefits, which come with less effort, innovating benefits (IB) are more difficult to recoup. Indeed, after comparing the mean score of AB and IB using a paired t-test, as the output report in Table 0-8 shows, there is a significant difference of 0.279 between the two means (P<0.00).

Table 0-8: Paired samples test

Paired Samples Test

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	AB - IB	.27910	.74357	.09368	2.979	62	.004

3.3. Factors affecting Benefits

3.3.1. Organisational Complementary Resources (OCRs)

OCRs are classified into users' factors (abilities and attitude) and organizational factors. As illustrated in Figure 0-5, OCRs are interwoven into the effects. From the qualitative analysis in Badewi et al (2018), the users' abilities are key to determining their attitude. The main reason for resistance (anxiety) is the inability to cope, which comes mainly from the inability to do. Furthermore, the organization characteristics affects and is affected by, this attitude. For instance, the existence and routinization of structured planned methodology across departments (e.g. if production planning starts by demand planning followed by inventory planning and production plans start on the basis of these plans,) will make users believe in the viability of the planning process. Therefore, organisations which have such a methodology are believed to outperform (in the planning dimension, at least) others which have neither a structured planning system nor positive attitude towards planning.

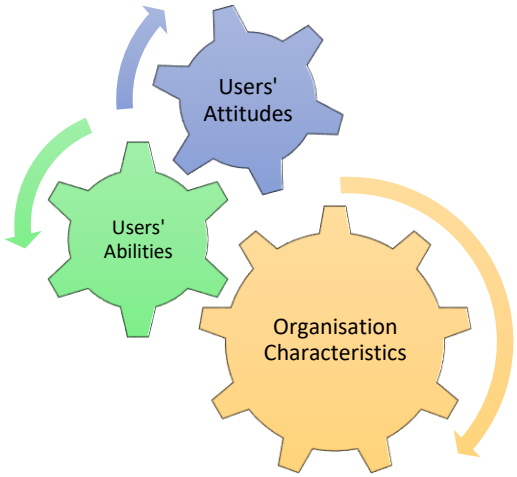


Figure 0-5: Organisational Complementary Resources (OCRs)

3.3.1.1. Users Attitude

3.3.1.1.1. Attitude definitions, validity, and reliability

Attitudes are classified into the attitude toward the ERP as a technology, that towards planning and the ERP technologies used in planning and that towards innovation and its ERP technologies. Attitude toward the technology determines the level of organization use and finally the benefits (Badewi et al 2013). Factor analysis and reliability analysis of the items constituting the attitude factors were conducted. The reported items are valid and reliable because all the factor loads of the items are more than 0.6 and Cronbach's alpha, the reliability index, is higher than 0.6, which means that the constructs are valid and reliable. The operationalization of the required attitudes toward ERP was adapted from the literature and from the findings. Three items were used for measuring the attitude (AA) required for automating benefits (AB). The items were the users' belief that ERP is easy to use, that it is helpful and useful and the positive attitude toward the ERP. All of these items are found to be valid and reliable because Cronbach's alpha is 0.87.

The attitude toward planning and its technologies (PA) was operationalized by 4 items: the positive belief that planning is critical for organizational success, the positive belief that ERP is helpful in planning and the users' belief that planning technologies are helpful and reliable. There are factor loads for the statement 'ERP is helpful in planning' and believing that planning technologies are helpful, with the AA construct. However, the load is lower than 0.6. Still, being above 0.5 can indicate that the two constructs share similar characteristics - the attitude toward technology – but they are different in another aspect, the "planning". Besides its validity, it is reliable also because its Cronbach's alpha is 0.892, which is higher the cut-off point of 0.6.

Regarding innovation, employees should be oriented toward a passion for innovation and should also believe that ERP can be the mechanism for innovation. The attitude required for innovation (IA), according to this research, is operationalized into the belief that innovation is critical for the organization, belief that there is a need for innovating in products and believing in ITs as innovation enablers. The validity and reliability in Table 0-9 show that the construct is valid and reliable because all the factors are more than 0.6 and the Cronbach's alpha is 0.861

Table 0-9: Users' attitudes: validity and reliability tests

Rotated Component Matrix

	Component

	1	2	3
Cronbach's Alpha	.87	.861	.892
Users believe the system is easy to use	.889		
Users believe the system is helpful and useful	.764		
Users have a positive attitude toward the ERP system	.790		
There is a positive belief that planning is critical to organisational success			.764
There is a positive belief that ERP is helpful in planning	.592		.638
Users believe that planning technologies are useful, helpful and reliable	.530		.613
There is a positive belief that innovation is critical to the organisation		.858	
Planning technologies are required for innovation		.753	
Users believe that there is a need to innovate in products		.829	
Users believe that Information Technologies are innovation enablers	.507	.672	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

3.3.1.1.2. The maturity of attitudes

Attitudes are believed in this research to look like a stepping up the process. In other words, the attitudes grow steadily more mature from the attitude toward basic ERP to a higher level of the positive attitude toward its planning technologies and finally to positive attitudes toward the more sophisticated tools of ERP. This argument is supported by the correlational analysis reported in Table 0-10. The automating attitude (AA) is highly correlated with the planning attitude (PA) at 80% with P<0.00. This indicates that the positive attitude toward ERP is critical and represents 64% of the reasons for having a positive attitude toward ERP planning technologies. Because innovation requires more sophisticated ERP technologies, the attitudes toward ERP are less correlated with innovating benefits (45.5%). Nevertheless, the planning attitude (PA) is the middle point because it is correlated by 63.3% with P<0.00.

Table 0-10: Attitudes: correlational analysis

		Benefits			Attitudes		
		AB	PB	IB	AA	PA	IA
Benefit	AB	1	.704**	.626**	.420**	.444**	.391**
	PB	.704**	1	.683**	.375**	.377**	.336*
	IB	.626**	.683**	1	.399**	.220	.303*
Attitude	AA	.420**	.375**	.399**	1	.800**	.455**
	PA	.444**	.377**	.220	.800**	1	.633**
	IA	.391**	.336*	.303*	.455**	.633**	1

1.1.1.1.1 The regression analysis of attitudes on ERP benefits

Attitudes toward ERP and its technologies have different impacts on different categories of benefit in different ways, as illustrated in Figure 0-6. According to simple regression analysis (i.e. one independent on one dependent), the impact of AA on AB is the highest by 0.43, with an explanatory ratio of 17.7%. Nevertheless, the lowest is the impact of IA on IB, by 0.31 with an explanatory ratio of 9.2%. This indicates that the impact of attitudes declines by stepping from a lower benefits category (i.e. automation benefits) to a higher one (i.e. planning or innovating).

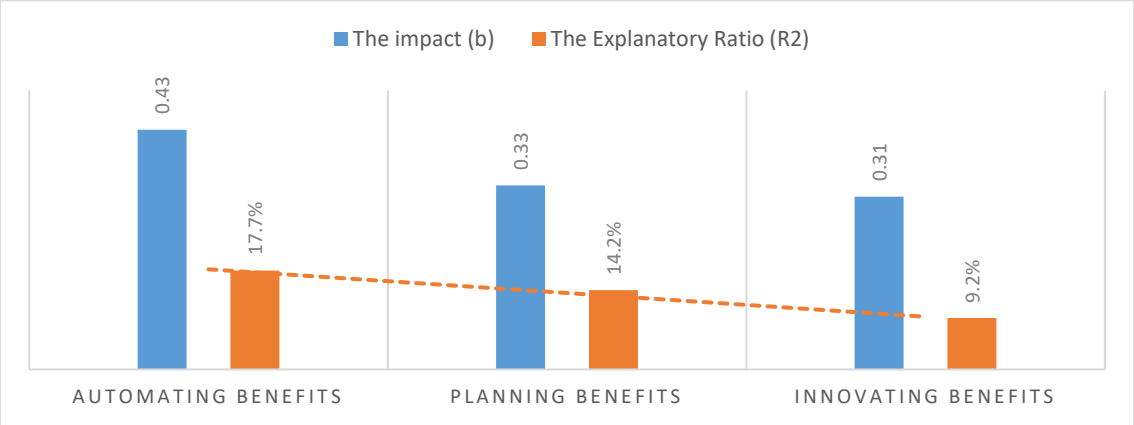


Figure 0-6: The impacts (b) and explanatory ratio (R2) of attitudes on different benefits

3.3.1.2. User Skills

3.3.1.2.1. Skills definition, validity, and reliability

ERP benefits will not be realized until the users have the ability not only to make best use of it but also to integrate data from ERP into the innovation processes. Skills are classified into three types: ERP technical skills, planning techno-business skills, and innovation techno-business skills.

The automating ERP technical skills (AS) are operationalized into five items: a. ability to use the basic features of ERP (data input), b. ability to jump between forms and screens easily and smoothly, c. ability to use the basic reports, d. knowing which reports they want to use, and e. ability to reach the desired reports easily and smoothly. This construct is valid and reliable because all factor loads are more than 0.6 and the Cronbach's alpha is 0.819.

The planning techno-business skills are an understanding of the planning processes of the ERP system, planning reports within the system, using planning reports of the system and the ability to customize the reports to fulfill different planning needs. In other words, without having professional business knowledge about planning (for instance, knowing the Material Requirement Model (MRP) and Capacity Requirements Planning (CRP), these planning models available in ERP will not make any sense to users. This construct is valid and reliable because all the factor loads of the constituting items are more than 0.6 and the Cronbach's alpha is 0.909.

The innovating techno-business skills are operationalized into 2 main skills: quantitative abilities (understanding their importance, understanding and using advanced statistics) and quantitative technical abilities (using business warehouse analytic models, using artificial intelligence available in the analytic systems supporting ERP (e.g. business intelligence) and developing and customizing reports to do advanced statistical analysis). This research shows that the importance of statistical ability diminishes by the increase in the adoption of data analytics (i.e. the users do not need to know much about statistics because the system does everything for them), understanding the importance of using numbers in decision making is still a critical factor for understanding environment in an objective way. The construct is valid because, as reported in the factor analysis in Table 0-11 all the factors are more than 0.6 and are also reliable because Cronbach's alpha is .853.

Table 0-11: Users' Skill validity and reliability tests

Rotated Component Matrix

	Component		
	1	2	3
Cronbach' Alpha	.853	0.819	0.909
Users are able to use the basic features of ERP (data input)		.683	
Users are able to jump between forms and screens easily and smoothly		.630	
Users can use the basic reports		.839	
Users know which reports they want to use		.761	
Users are able to reach their desired reports easily and smoothly		.735	
Users understand the planning process of the ERP system			.694
Users understand the planning reports of the system			.865
Users use the planning reports of the system			.856
Users are able to customize the reports to fulfill different planning needs			.673
Users understand how using statistics can enhance their job performance	.799		

Users use an advanced level of such as correlational analysis, regression, and multi-regression	.832		
Users use ERP business warehouse analytic models to an advanced statistics level	.689		
Users use the artificial intelligence capabilities of ERP (such as Genetic Algorithms & Neural Networks)	.877		
Users are able to develop their reports to do the calculations of advanced level statistics	.816		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

3.3.1.2.2. The maturity of skills

The maturity of skills goes from the ability to use the system for entering and reporting basic data (i.e. purely technical) to the ability to customize the reports for planning scenarios to be held from these data (between technical skills for customizing reports and business skills for understanding best planning models). Once users master the data management and are able to plan using the data, the importance shifts to quantitative business skills for understanding the data behavior in such a way as to unleash new opportunities (innovation).

The correlational analysis in Table 0-12 shows that all the skills are correlated. Furthermore, the correlations are higher between AS and PS (47.9%) and between IS and PS (54.1%) than between AS and IS (40.4%). This indicates that the existence of PS can be the mediating factor between AS and IS. This can be underlined as a representation of the maturity concept of the skills in the organizations, from AS which is dominated by technical abilities, to IS, which is dominated by the ability to apply business knowledge to ERP technology (i.e. ERP Business quantitative skills).

Table 0-12: Skills correlational analysis

		Skills		
		AS	PS	IS
Skills	AS	1	.479**	.404**
	PS	.479**	1	.541**
	IS	.404**	.541**	1

3.3.1.2.3. The regression analysis of skills on ERP

Unlike the inverse proportion of the attitude which accepts 'the higher the benefits category, the lower the importance of attitude', skills run in direct proportion, as set out in Figure 0-7. In other words, the higher the benefits category targeted, the higher and more sophisticated the required skills are. Hence, the impact of technical skills (AS) on

automating benefits (AB) (b=.32, r2 =5.8%) is lower than the impact of innovation techno-business skills (IS) on innovating benefits (IB) (b=.35, 15%). However, the planning techno-business skills (PS) is in the middle in the explanatory ratio (r^2= 10.9) but the impact is the lowest b=0.2.

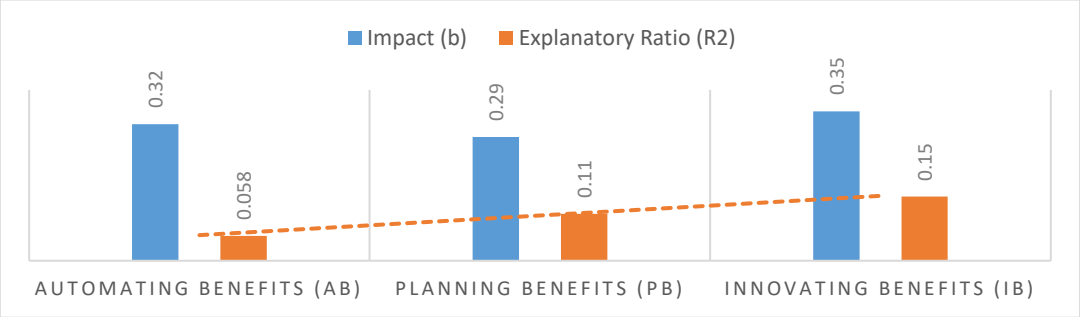


Figure 0-7: The impacts (b) and the explanatory ratio (R2) of skills on different benefits

3.3.1.3. Organisation Characteristics

3.3.1.3.1. Organisation characteristics: definition, validity and reliability

Integrating practices into business processes to be routine matters (the institutionalization of practices) has a significant impact on the benefits. Therefore, the structuration (making something structured and part of the organizational practices) of the organizational requirements for benefits is believed to be necessary.

For automating benefits to be realized, business processes should be well structured and defined. Therefore, three items are used to measure the organizational characteristics required for making automation benefits possible. They are a proper definition of the job description and roles, clear flowcharts of business processes after ERP implementation and an understanding by users of their positions and their roles in the business process. This construct is valid and reliable because all factor loads are more than 0.6 and Cronbach's alpha is 0.872.

Regarding planning benefits, if the planning process is not integrated into the organization culture and people's ways of doing their job (routinisation of the planning process), benefits will not be forthcoming. Therefore, the presence of the structured planning system is a requirement for realizing ERP benefits. Thus, the organisational characteristics for planning (PO) are operationalised into the following: a clear planning methodology used in the organisation, the application of a planning methodology and the

organisation's structured planning system that fits the ERP system, and having standardized definitions of concepts used in the organisation (for enabling users to customise reports freely without troubles from misunderstandings when different uses are given to words in the organisation by different departments). The validity and reliability of the construct is assured because the factor loads are more than 0.6 and Cronbach's alpha is 0.875

Finally, Innovation needs certain organizational requirements such as the existence of innovation sponsorship, testing new ideas and organizational flexibility. Thus, five items were used to operationalize and measure the organizational characteristics required for perceiving innovating benefits from ERP. They are the organisation's ability to change its process structure efficiently and effectively, ability of the organisation to change easily to reflect unforeseen changes in the market, having a benefits accountability position to follow up the benefits realization process from the implementation of new ideas, and the existence of a sponsoring unit to pick up new ideas from knowledge sharing systems and sponsor them. After validating the concept and measuring its reliability, the factor loads of all items are more than 0.6 and the Cronbach's alpha is 0.882, as illustrated in Table 0-13.

Table 0-13: Organisation Characteristics validity and reliability tests

Rotated Component Matrix[a]

	Component		
	1	2	3
Cronbach's Alpha	.882	.875	.872
There is a proper definition of job descriptions and roles			.825
There are clear flowcharts of business processes after ERP implementation			.823
Users understand their position and their role in their business processes			.923
There is a clear planning methodology used in the organization (applying to process, batch, or repetitive production systems)		.825	
Planning methodology is applied in the organization		.882	
The structured planning system fits the ERP system		.834	
There are standardized definitions of the concepts used in the organization		.605	
Your organization is able to change its process structure easily and efficiently	.821		
Your organization changes easily to reflect unforeseen changes in the market	.732		
There is a benefit accountability position to follow up the benefits realization process from the implementation of new ideas	.718		
There is a sponsoring unit (senior manager(s) or department) to pick up new valid ideas from the knowledge sharing system in the organization	.836		
There is a sponsoring unit to implement/sponsor the new ideas	.695		

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

3.3.1.3.2. Characteristics of the Maturity of the Organisation

Efficiency and innovation are always contradictory objectives. Whereas efficiency seeks to minimize slack and increase the use of resources, innovation needs slack resources for trials and errors, for experiments and for having the time to think and to do unusual tasks. Thus, it could not be claimed that the organization characteristics take the form of maturity as other factors do (e.g. attitude and skills). Inefficient organizations (i.e. highly automated ones), the role of sponsors in innovation becomes critical and is extremely important for innovation. Sponsors, having the organizational characteristics for achieving automating benefits (AO) as the first step, increase the importance of having organization characteristics for innovation (AI) to increase innovation capabilities. Regarding the organizational characteristics for planning (PO) is acknowledged to be necessary for having a shared vision and point of view which could improve the organization's ability to innovate.

3.3.1.3.3. The regression analysis of organization characteristics on ERP benefits

The importance of organizational characteristics is roughly similar for all benefits within a range of 10% difference. As illustrated in Figure 0-8, the impact of organizational characteristics for automation (AO) on automation benefits (AB) is 0.4 whereas the impact of the organizational characteristics for innovation (IO) have a slightly higher impact on innovation benefits (IB) by 0.03 (scale of 5). However, the impact of PO is slightly lower, at 0.38. Nevertheless, the variation is slightly higher and takes an upward trend for the explanatory power of the organization's characteristics on benefits. From 13.3% to 19.2% the explanatory ratio increases from AO to PO on the AB and PB, respectively. Indeed, IO alone explains about 20% of the variation in the organization's ability to innovate through ERP, in contrast to only 13.3% for AO on AB.

Figure 0-8: The impact of organization characteristics on ERP Benefits

3.3.2. ERP Resources

Investment in ERP resources has two dimensions: investing in, or making possible, technologies and investing in IT human resources competences. For each benefits level, a particular set of technologies and IT human resources competences is required, as illustrated in Figure 0-9. While automating benefits require tracking technologies and the IT department's ability to maintain the data flow smoothly between systems without bugs or system failure, planning and innovating benefits require the business knowledge of the IT department and an advanced reporting system. This is because it is assumed that automating benefits are recouped because the system is working well and employees accept it in use because it simplifies their work.

Benefits Level	Automation Benefits (AB)	Planning Benefits (PB)	Innovating Benefits (IB)
ERP Technologies	Tracking Technologies	Flexible Reporting	Statistical Enabling Reports (Data Analytics)
IT Human Resources	IT Technical Competences	Understanding Business Planning Process	Understanding business value creation process

Figure 0-9: ERP Resources required for ERP Benefits

3.3.2.1. ERP Technologies

3.3.2.1.1. ERP Technologies: Definition, Validity, and Reliability

ERP Technologies are classified into data entry technologies (such as tracking to capture data in a fast and convenient way) and output technologies (such as an advanced data analytics system to enable users to get the best of the data captured by ERP).

Tracking technologies are the hardware and software applications for tracing the movement of the material across storage locations. ERP as a software programme has this feature, but the question is about whether the organization has purchased the complementary hardware (e.g. barcode scanners or RFID scanners). The existence of such technology presents the data on time with a high level of accuracy and minimum effort. Therefore, two questions are asked about the existence of such technology within the organisation (between its storage locations) or externally (having tracking technologies for tracking moving inventory items between organisations) and one question about having a unified coding system across the supply chain so as to exchange data about the flow of material between stores and organisations. This construct is found to be valid, since all factor loads are more than 0.6, and reliable because Cronbach's alpha is more than 0.6.

Data are useless without having the proper technologies to process them. Reports are the mechanisms by which to process these data. Reporting power is based on two dimensions: statistical power and flexibility power. The planning technology (PT) is operationalized by item to determine the level of flexibility and customizability available which lets users create their own plans freely. These items are the customizability of the layout of the report, the customizability of the report contents, and having a unified dictionary to enable users to customize without problems from conflicting meanings being used by different departments for the same terms. The validity of the construct is assured because all factor loads are more than 0.6, and the reliability is guaranteed because the Cronbach's alpha is 0.856

When the reporting features of ERP enable the user to construct quantitative models (e.g. forecasting models, inventory models), the user can discover new patterns in the data which help to create an innovative organization. Therefore, the four factors in indexing the reporting statistics power of the data analytics are a. whether the current reporting system enables the user to do calculations; b. aggregating figures into meaningful graphs; c. doing statistical analysis such as regression models (i.e. for forecasting, estimating inventory usage); and d. Analysis of Variance (ANOVA) (i.e. for finding out the differences between the different group of customers, vendors or stock items). This

construct is validated and the reliability of it is assured because all factor loads are more than 0.6 and Cronbach's alpha is 0.837, as illustrated in Table 0-14.

Table 0-14: ERP IT validity and reliability tests

Rotated Component Matrix[a]

	Component		
	1	2	3
Cronbach's Alpha	.837	.856	.833
Enables users to make some basic calculations (such as calculating Average, Standard Deviation, Median)	.828		
Enables the users to customize their reports freely	.756		
Enables users to aggregate figures in meaningful graphs.	.780		
Enables the users to do analysis using advanced statistics (Regression, ANOVA, Correlational Analysis)	.762		
Change layouts of the reports		.798	
Change the contents of reports with taking into consideration the unified definition of terms		.801	
Customize their report layout		.852	
Is there are any technology that enables your organization to track the flow of material across storage locations such as RFID, Barcode?			.895
Your organization has a unified coding system with its supply chain to track the flow of materials between organizations			.761
Your organization uses scanners to read Barcodes to track the movement of the material between storage locations in different organizations in the supply chain			.851

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

3.3.2.1.2. The impacts of ERP technologies on ERP benefits

The demand for more sophisticated technologies to recoup higher levels of ERP benefits is increasing. Whereas tracking technologies are not a serious issue for achieving automating benefits, the statistical power of the reporting system is vital for enabling organizations to innovate using the ERP system. As illustrated in Figure 0-10 , the explanatory ratio increases from just 10.7% for automating benefits to 27.5% for innovating benefits. Likewise, the impact is increasing to almost double from 0.27 to 0.49. This can imply that ERP is already automating technology by default and thus attaching a new tracking technology will lead to a little incremental impact on automating benefits. However, few organizations are able to understand the power of statistics for realizing innovating benefits. Thus, those organizations which have deployed business analytics systems increase significantly their ability to innovate as a result.

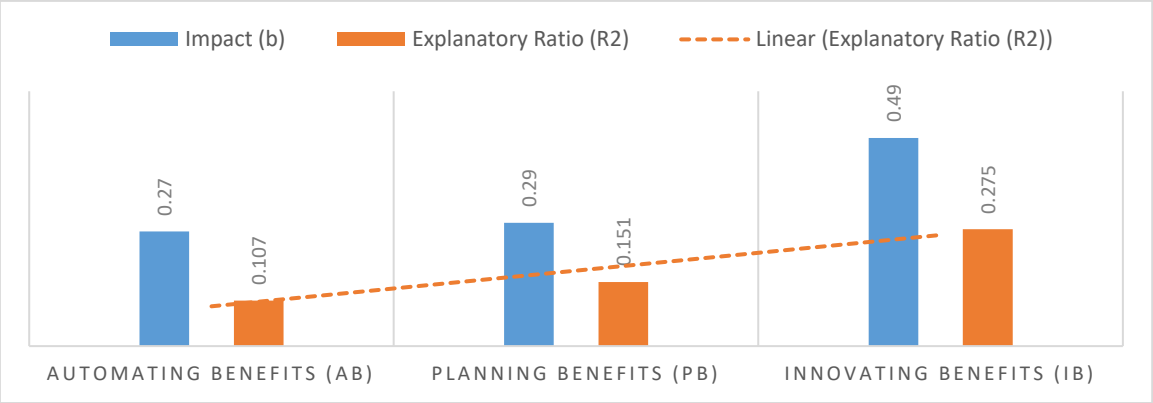


Figure 0-10: The impacts of ERP technologies on ERP Benefits

3.3.2.2. ERP Human Resources

3.3.2.2.1. ERP Human Resources: Definition, Validity, and Reliability

IT department skills are necessary for maturing an organization in the use of ERP. The skills range from technical competences to understanding business processes. Competencies are classified as either technical competences or business competencies. Technical competencies are mainly required for automating benefits but planning and innovating benefits need the IT department to be more involved in the business in a way that promotes the planning features of ERP with business users and aligns the IT department strategy with business strategy to leverage the organizational strategy.

The IT Department competence required for planning (PIT) is operationalized by 3 items: namely, the IT department's ability to understand the planning requirements of the planners so that permission is given efficiently for data access, its ability to advise business users how to use ERP for planning their activities, tasks, and jobs, and the holding of seminars and workshops for users to promote good planning practices using ERP.

The IT department's competence in recouping ERP innovating benefits (IIT) is operationalized into the ability of the IT department to understand and add value to business operations by its recommendations to users, its development of strategies aligned with the organisation's strategy, its identifying of new technologies in the market and ways to use them to improve the business, and its close relationship with business users. Actually, all constructs are valid and reliable because all factor loads are more than 0.6 as illustrated in Table 0-15.

Table 0-15: IT Resources validity and reliability tests

Rotated Component Matrix[a]

	Component		
	1	2	3
			.889
Synchronise the ERP system with all its modules effectively			.567
Synchronise the ERP system with other non-ERP systems, such as CRM and SCM, effectively			.910
Identify which technologies can be integrated into the current integrated platform			.688
Integrate and maintain the integration of the current ERP system with an advanced Data Repository System			.727
Understand the planning requirements for each decision maker to give them timely permission for data access.	.824		
Give advice about the way in which advanced reporting technology could enhance their business planning process	.682		
Promote good planning practices through organizing seminars or workshops (on ERP or any planning technologies)	.809		
Understand business practices and add value to it (by recommendations)	.617	.545	
Develop strategy aligned with the organisation's changing strategy		.633	
Identify new technologies in the market and how to use them		.816	
IT staff have a very strong relationship with business functions managers		.861	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

3.3.2.2.2. The impacts of ERP HR resources on ERP Benefits

In contrast to the impact of other factors on ERP benefits, ERP HR has no clear pattern of impacts on different levels of ERP benefits. IT technical competences have the strongest impact (0.35) on ERP benefits of all ERP HR competencies, as contrasted in Figure 0-11. However, ERP HR competence in understanding and helping business users to understand business-planning processes through ERP has the highest explanatory power (15.6%) of all ERP HR competencies to explain the variations in ERP benefits. Indeed, it has been found the lowest impact (b=0.3) and lowest explanatory power (r^2=9.9%) of all ERP HR competences on ERP benefits are the ability to understand business value creation processes and the ability to integrate business strategies with IT strategies.

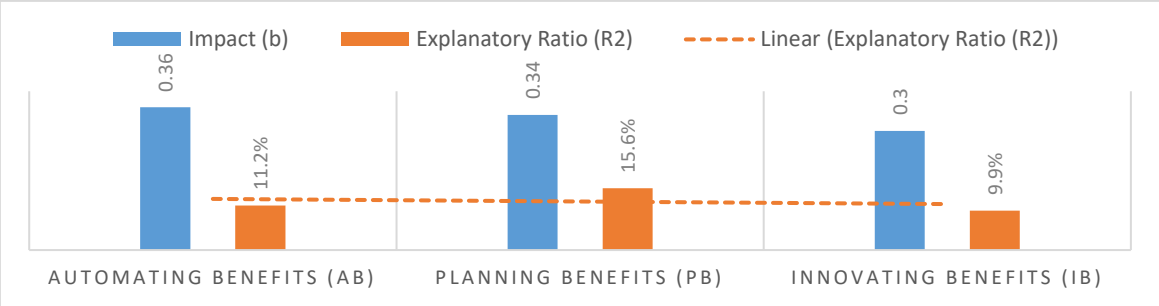


Figure 0-11: The impact of ERP HR on ERP Benefits

These results make sense since planning is the focal point of the Enterprise Resource Planning system. Automating benefits needs IT technical competences to give an impression of the reliability of ERP in the eyes of users. This perception of reliability is important but not sufficient. For this reason, the impact is high but the explanatory ratio is not as high as it is for ERP planning competences (PIT). However, planning needs change depending on the way in which the users look at the data and how they can be synchronized across departments so as to make enterprise planning possible. The role of IT is critical for changing users' behavior and their perspectives on the data. This is a very difficult task if the IT human resources cannot absorb and understand the planning process in ERP and its application to real-life scenarios. This is why ERP consultants are positioned and named according to their area of experience in business and their technical competences (e.g. SAP Materials Management, SAP Sales and Distribution).

3.4. Examining the factors affecting different levels of ERP benefits

3.4.1. Regression Analysis on automating Benefits (AB)

3.4.1.1. Impacts of proposed automating blueprint's factors on Automating Benefits

From studying the direct impacts through regression analysis, it appears that the only significant impact with $P<0.00$ is the attitude. All other factors have a significance power of 95% confidence, except skills, which have no significance for attitude. This gives an indication that being skillful in using ERP does not necessarily lead the organization to do well in automating benefits. However, having a disciplined organization with well-defined positions and job descriptions are found to have a significant impact on recouping automating benefits ($P<0.05$) with an explanatory ratio of 13.3%.

As the correlational analysis shows in Table 0-17, the perception of recouping automating benefits (AB) is highly correlated with the attitude toward the system (r =42 %, P<0.00). In other words, attitude alone can explain about ($42\%^2 = 17.6\%$) of the change in attitude. Nevertheless, the correlational analysis shows that other factors are less significant and low in value with AB. However, all of them, except for Automating Technologies (AT), is highly correlated with attitude. This suggests that the impacts of other factors on AB are mediated by attitude.

Indeed, although skills are insignificantly correlated with the automating benefits, they are highly and significantly correlated with attitude (39.2%, P<0,00). This indicates that skills can have an impact only when they are accompanied by a positive attitude. The mediating analysis was conducted using Structure Equation Modelling (AMOS) software. The mode is insignificant because the sample size is too small to be used for such analysis; three parameters would need 90 responses because each parameter needs 30 (Hayes 2013, Field 2013). Thus, it can be proposed that attitudes mediate the relationship between skills and automating benefits. Nevertheless, according to the current sample size, it cannot be argued that skills have a direct impact on automating benefits (i.e. Accepting H0).

It is important to spotlight that the attitude toward ERP and organization characteristics is significantly correlated by 64%, as illustrated in Table 0-17. This indicates that the organizations that are fitted with ERP can induce a positive attitude toward ERP. This consistency in the organization motivates the users to accept the ERP, unlike those in which there are conflicts between the ERP functions and their own current functions.

The ability of the IT department to integrate and synchronize the ERP subsystems and work with other external systems such as CRM and SCM to be important for stabilizing the ERP and making it work with few noticeable bugs or problems. This argument was found to be valid in this research, as illustrated in Table 0-17; these competencies are highly correlated with users' skills and attitudes (60.5% and 37.5% respectively). Thus, in Table 0-16, these competencies are found to have a significant impact on automating benefits (b=0.36 with P<0.05). Indeed, they are less significant and have less impact than attitude. Since they correlate with attitude, it can be proposed that the impact of IT competences on automating benefits is partially mediated by attitude. However, this could not be tested, because the sample size with the valid answer is far less than 90.

Table 0-16: Analysis of the impacts of each factor on automating benefits

Factor	Average	StDev	B	Rsquare
Benefits	3.61	0.90		
Attitude	3.4	0.86	0.42**	17.7%
Skills	3.7	0.73	0.28	5.8%
Organisation	3.5	0.35	0.36*	13.3%
IT Competences	3.6	0.85	036*	9.2%
Assets (Tracking)	3.0	1.13	0.27*	10.7%

ERP in itself always tends to be illustrated as automating software, as underlined in the literature and by the interviewees. However, the automating technologies in this section are meant to be tracking technologies, such as the barcode or RFID as detailed elsewhere. Indeed, as illustrated in Table 0-16, the existence of such technologies is found to explain 10.7% of the change in realizing ERP benefits ($P<0.05$) without needing to be mediated or affected by other factors, because there are no significant correlations with other factors. Thus,10.7% is a relatively significant percentage. However, the impact is not as high as some others ($b=0.27$) with a confidence of 95%.

Table 0-17: Correlational analysis of factors affecting automating benefits

Correlations

Pearson Correlation

	AB	AS	AA	AO	AT	A_IT
AB	1	.241	.420**	.364*	.327*	.335*
AS	.241	1	.392**	.285	.123	.605**
AA	.420**	.392**	1	.645**	-.031	.374**
AO	.364*	.285	.645**	1	.092	.323*
AT	.327*	.123	-.031	.092	1	.202
A_IT	.335*	.605**	.374**	.323*	.202	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

3.4.1.2. Synergetic analysis

Conducting a mediating or moderating analysis would be difficult in view of the constraints of the sample size. Therefore, all factors together in a single construct using multiplications (to measure when all the factors are in play at the same time) were combined to investigate the interaction between these factors by having a single parameter. All the factors were multiplied and then standardized to give meaningful results. The synergetic impact explains 38.9% of the change in automating benefits from the ERP systems.

The impact of attitude is 0.42 but none of the remaining factors exceeds 0.36. The results support the argument that all the factors together at the same time have a synergetic

impact. The synergetic effect is significantly higher than the attitude impact, as spotlighted in Figure 0-12. This proves that the existence of the proposed automating blueprint does lead to automating benefits.

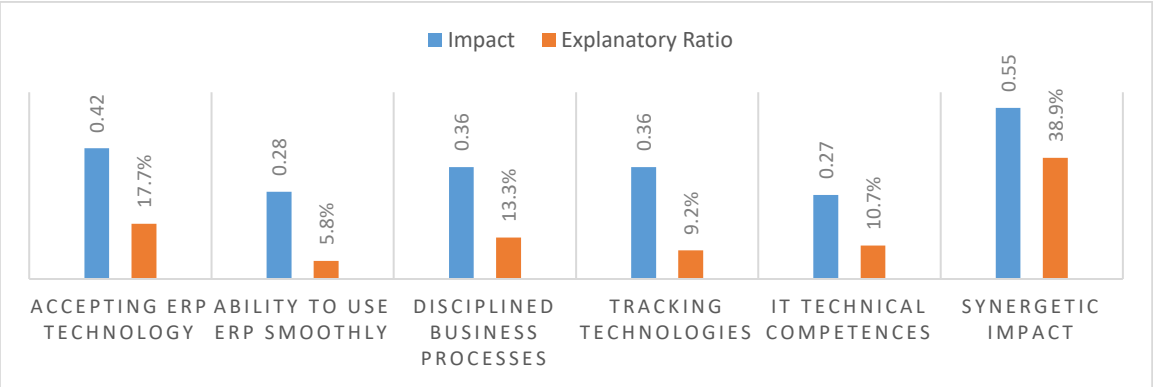


Figure 0-12: Factors affecting ERP Automating Benefits (AB)

3.4.2. Regression analysis of planning benefits

3.4.2.1. Impacts of the proposed planning blueprint's factors on Planning Benefits (PB)

Planning benefits is associated significantly with all the proposed factors. Indeed, its organisational characteristics are the highest, with a score of 43.9% (P<0.00). This reflects that the organisation's characteristics are more important for planning than merely the users' attitudes. This makes sense because planning is an organisational activity and needs the involvement of several different departments. If there is no clear planning system, even with a very high attitude factor and strong belief in the power of planning and its technologies, the planners or decision makers will not get the best use of ERP for planning their activities. Although the attitude toward planning is correlated with planning benefits with only 37.7%, it is correlated with the organisational characteristics by 70.2% (P<0.00). This confirms the view that the organisation's characteristics are the key player in securing ERP planning benefits. In other words, having a good planning system integrated in the organisation's daily activities is more critical than simply believing in the importance of the system.

The lowest correlation among the factors, but still significant at p<0.05 is with the users' skills. Again, the players' skills in themselves are not a key factor without an enabling environment. Thus, there is a correlation between users' skills and the organisational

characteristics (59% with P<0.00). This proposes that the existence of planning organisation characteristics may partially mediate the relationship between skills and planning benefits.

The technical features of reporting, its being customisable and flexible, are also associated with planning benefits. This is also associated with the users' planning skills (59%, P<0.00). This makes sense because, without planning skills, there is no need to use the customisation features of the ERP reports. Having such options in the ERP is in fact significantly correlated with users' positive attitude toward the system (48.5%, P<0.00) because of their freedom to customize their report as they wish without needing to go back to the IT department to create or change a new report.

Designing their own reports is more closely associated with the planning benefits than IT department competencies. IT department competencies can lead to planning benefits (r= 36.7%, P<0.05) and giving the users a positive attitude toward the ERP system (r=28.5%, P<0.05), as illustrated in Table 0-18. However, it is not correlated with the organizational characteristics or the customizability of ERP reports. In other words, the customizability of ERP reports depends more on ERP vendor based features than on the IT department's ability to create a customizable reporting system. For instance, SAP and Oracle have their own reporting design system (sometimes called a business intelligence system or Crystal report). In other words, the role of the IT department is to give the users access to reporting designing tools, instead of being used to create their reports for them.

Table 0-18: Correlational analysis of factors affecting planning benefits

Correlations

Pearson Correlation

	PB	PS	PA	PO	PFT	IIT
PB	1	.330*	.377**	.439**	.388**	.367*
PS	.330*	1	.389**	.581**	.590**	.315*
PA	.377**	.389**	1	.702**	.485**	.285*
PO	.439**	.581**	.702**	1	.596**	.087
PFT	.388**	.590**	.485**	.596**	1	.187
IIT	.367*	.315*	.285*	.087	.187	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

In this sample, all organizations are scoring above the middle point of 3 in all factors, as illustrated in Table 0-19. In other words, it could not be claimed that any of these factors are unique or difficult to obtain. Furthermore, all of the factors have a positive significant

impact on planning, the highest being the organizational characteristics. Indeed, PO is the main factor in terms of explanatory power (r^2) and impact (b) with the highest significance level. This can be understood in terms of the vitality of PO. Nevertheless, on average, all factors have more or less the same b of around 0.3. Furthermore, all the explanatory powers of all the factors are roughly the same (15%) except for skills (PS) with 10% and OC with 11%. This gives an indication that all the factors are important and could be complementing each other.

Table 0-19: Analysis the impacts of each factor on planning benefits

Factor	Average	StDev	B	Rsquare	Sig (P)
Attitude	3.7050	.80129	0.33	14.2%	0.008
Skills	3.3571	.77145	0.29	10.9%	0.016
Organisation	3.5109	.81642	0.38	19.2%	0.003
IT Competences	3.5490	.82684	0.34	15.6%	0.007
Planning technologies	3.3889	.91057	0.29	15.1%	0.006

3.4.2.2. Synergetic Analysis

When all the factors are multiplied (to get the commonality in the interaction) (Alkein, 1991) and standardized for the regression analysis (Preacher, Rucker & Hayes 2007, Hayes 2013), the explanatory ratio, as illustrated in Figure 0-13, increases to 23.8%, which is higher than any other factor alone. In other words, the interaction between factors explains 23.8% of the variation in an organization's perception of the planning benefits from ERP. However, the impact is limited to 0.34, which is very close to that of any other factor alone (except the impact of skills). The limited sample size precludes an easy understanding of the interaction between factors, but it is not the aim of this research to measure the impacts and analyze the interactions; rather it aims to validate whether or not the factors affect the verifying of the tool.

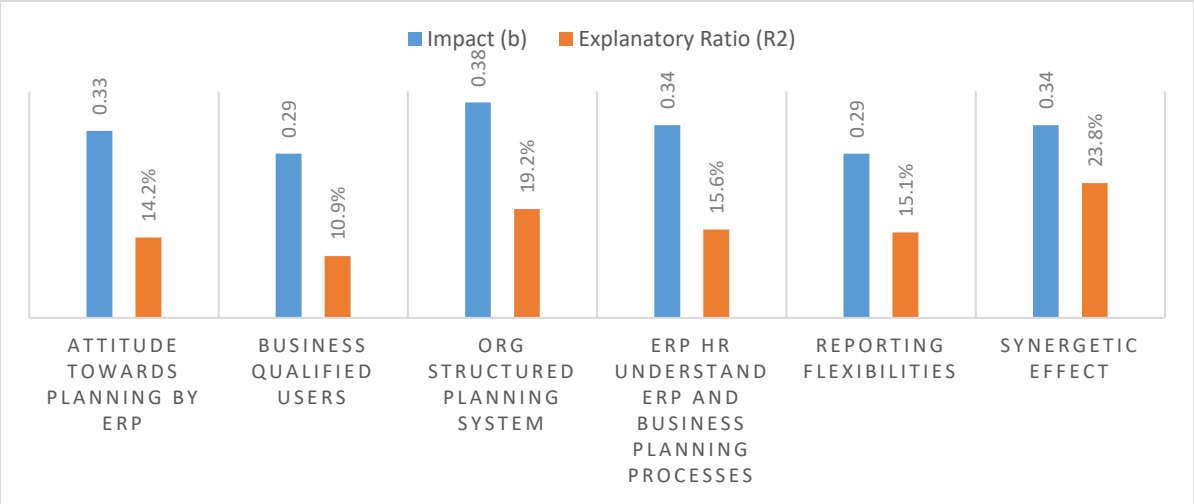


Figure 0-13: Factors affecting ERP Planning Benefits (PB)

3.4.3. Regression analysis on innovating benefits

3.4.3.1. Impacts of the proposed planning blueprint's factors on Planning Benefits (PB)

Unlike other benefits, which are dominated by attitude (automating benefits) and organizational characteristics (planning benefits), innovating benefits are correlated mainly by the statistical abilities of the reporting system (IST) available to users (52.4%). As visualized in Table 0-20, the second most important factor is the organization characteristics (IO) with r = 44.2%. However, the highest impact is made by organizational characteristics and not technological factors, as reported in Table 0-21 and visualized in Figure 0-14. The third significant factor (P<0.00) is the Innovating Skills (IS) with a correlational ratio of 38.7%, whereas attitude (IA) and IT department competencies (IIT) are less correlated and less significant (P<0.00). Indeed, IA has the lowest correlation with innovating benefits. In other words, attitude is not as important for high-level benefits (planning and innovating benefits) as it is for low-level benefits (Automating).

Table 0-20: Correlational analysis of factors affecting innovating benefits

Correlations

Pearson Correlation

	IB	IS	IA	IO	IIT	IST
IB	1	.387**	.303*	.442**	.315*	.524**
IS	.387**	1	.263	.519**	.450**	.478**
IA	.303*	.263	1	.330*	-.010	.371**
IO	.442**	.519**	.330*	1	.165	.242
IIT	.315*	.450**	-.010	.165	1	.394**

IST	.524**	.478**	.371**	.242	.394**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Planning benefits need more organizational characteristics (PO) to perceive the value from planning benefits. Likewise, the main enabler is the IT (such as big data and business analytics) that is available to users in terms of statistical abilities (IST). IST is significantly correlated with all factors (skills by 47.8%, attitude by 37.1 and IT department competencies by 39.4%) except for organizational characteristics (IO). However, IO in itself is highly correlated with the perception of innovation from ERP systems. This implies that innovation has two mechanisms: one in the form of centralized innovation that comes because of IO, and the other in the form of decentralized innovation that comes from users' skills.

Furthermore, as always noted in technological diffusion theories, skills and attitudes are highly correlated by 51.9%. In other words, the more employees feel capable of using the technology, the more their attitudes toward it improve. What is interesting is the correlation between the attitude (IA), and the fact that organizational characteristics (IO), and IT department competencies are not correlated at all. This may indicate that IT department competencies do not affect attitude but do affect skills (r=45%) which boils down to the attitude in the end. In other words, without translating the IT department competencies in transferring ERP business knowledge, they can affect attitude only if it affects the attitude. This cannot be claimed by the present research; it is more in the nature of a proposition because mediating analysis could not be conducted with such a small sample. However, it is clear that IT department competencies are correlated with the perception of ERP as a source of innovation.

The average score of IA for this sample is 3.7 (see Table 0-21). The average is high which means that belief in innovation is not a critical resource, at least, for perceiving the innovating benefits from the ERP system. The average IO score for the sample is 3.2, which indicates that having IO is not as easy as having an attitude. The PS is 2.8, less than the middle point. This reflects that not all organizational processes require these skills, which can be considered a relatively scarce and valuable resource for innovation.

Table 0-21: Analysis the impacts of each factor on innovating benefits

Factor	Average	StDev	B	Rsquare	P Value
Attitude (IA)	3.7850	.76267	0.31	9.2%	0.036

Skills (IS)	2.8810	.85912	0.35	15%	0.004
Organisation (IO)	3.2087	.80769	0.43	19.5%	0.003
IT Competences (IIT)	3.5637	.86724	0.3	10%	0.033
Assets (IST)	3.2361	.85149	0.49	27.5%	0.000

3.4.3.2. Synergetic Analysis

When all the factors are multiplied, the impact of the synergetic parameter is tested on the innovating benefits. The impact, as shown in Figure 0-14, is the second after the organizational characteristics. Nevertheless, its explanatory power is the highest. Indeed, the synergetic impact alone explains 23.8% of the variation in an organization's ERP innovating benefits. This indicates that the proposed innovating blueprint designed in this research is valid.

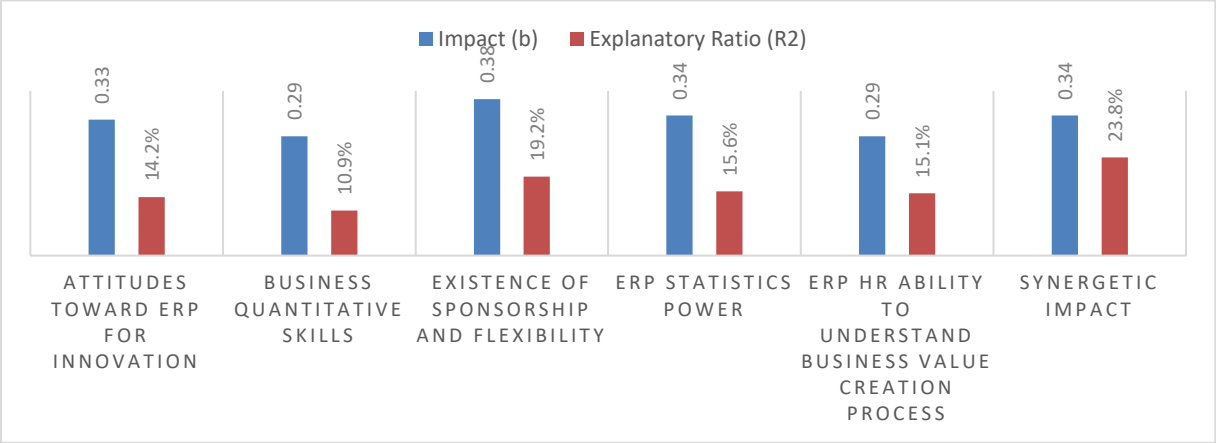


Figure 0-14: Factors affecting ERP Innovating Benefit

3.4.4. Discussion and Conclusion

This research verified Badewi et al (2018; 2017) ERP orchestration framework. ERP has different types of benefits automating, planning, and innovating benefits. There are three scaffolding blueprints are required to deliver such benefits. Based on Melville et al (2004) business value framework, the blueprint is designed based on required resources to deliver each group of benefits. Since groups of benefits are found to be scaffolding, the blueprint design is elaborative and scaffolding. For automating benefits, the most critical resource is the people acceptance towards the ERP. For planning benefits, the most important resource is the organizational structure that enables the planning process. But innovation requires more technological resources than just standardized ERP system.

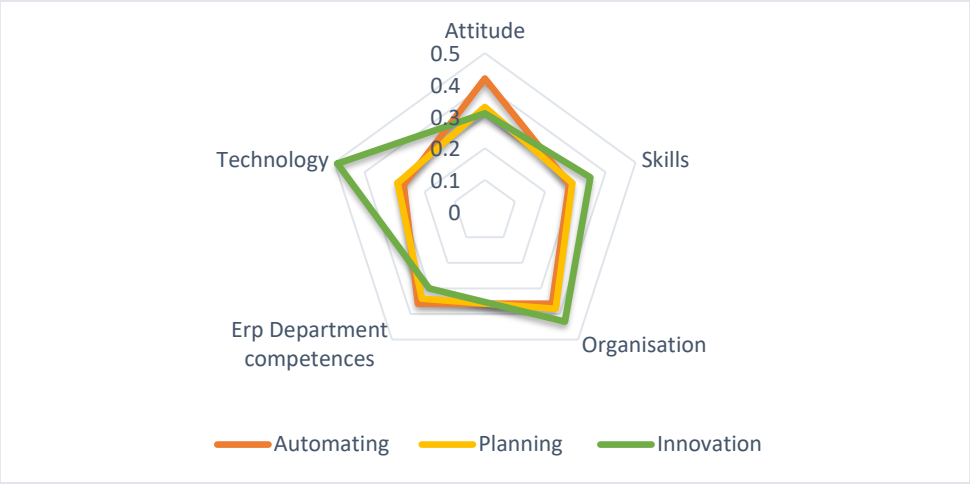


Figure 0-15: The relative importance of each factor in ERP Benefits

The final roadmap for realizing different levels of ERP benefits is conveyed in Figure 0-16. The radar shows the average scores for each factor in relation to each level of benefits. These average scores are considered benchmarks (cut-off points) for recouping different levels of ERP benefits. It could not be claimed that these cut-off points are constant; they would be altered by considering more organizations over time. The larger the sample size, the more replicable the results that could be achieved; thus, the more reliable the indications.

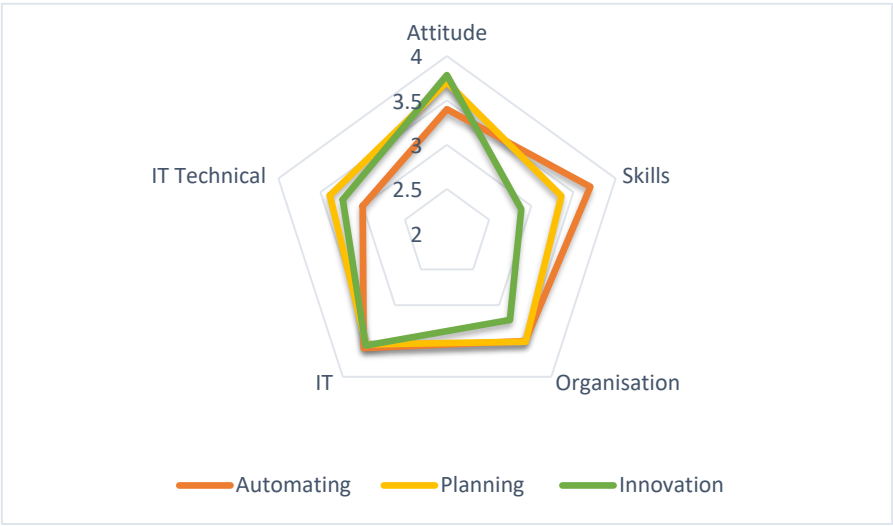


Figure 0-16: The benchmark radar for different blueprints for recouping different levels of ERP benefits

All these research findings are seen purely from the management perspective, not the technical perspective. Indeed, it is believed that if aspects that are more technical have been considered in designing the blueprint, it would have been more helpful to the ERP

vendors. In other words, if the ERP resource side of the blueprints of this research is translated into aspects that are more technical by considering TOGAF methodology, it might leverage the importance of this research.

Moreover, the blueprint is meant to map organizational characteristics, users' skills and abilities and business processes. This research failed to design the processes required to realize each group of benefits. Indeed, it was found that it is too difficult to map all the processes required to realize all the possible benefits. Furthermore, process design is more an organization-based activity than something can be generalized. Therefore, case studies are proposed for scrutinizing each group of benefits and designing the business processes using modeling tools such as system dynamics, agent-based modeling and IDEF0 for designing blueprints.

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