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The Relationship between BPR Strategy and Change Management for the Sustainable Implementation of ERP: An Information Orientation Perspective

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Abstract: Enterprise resource planning (ERP) is an IT system that supports the business functions that firms adopt to gain advantages and development possibilities. However, some firms do not show positive financial performance after implementing ERP. Why is this the case? An ERP is an information system (IS) that brings about radical changes within organizations, changing both the IS environment and overall corporate business process, which may cause resistance from the organization's members. Thus, change management is crucial, in operating a successful ERP, to addressing organizational changes after the adoption of ERP. The objective of this study was to examine the influence that the depth of business process reengineering (BPR) and change management have on ERP performances. To this end, KOSPI companies with more than a year of experience using ERP were analyzed using the structural equation method. This study confirmed mutual relationships between ERP success factors and its performance. In future research, it would be helpful to determine if companies with higher IT performances actually have better financial results.

Keywords: depth of BPR; change management; ERP performance; adaptation to business change; information orientation; sustainable implementation; strategy implementation; innovation

1. Introduction

Modern business organizations face dynamic changes in their management environments, and many firms actively consider adopting information technology (IT) to adapt to these changes. enterprise resource planning (ERP) is a type of IT system that supports business functions and was first proposed in the mid-1990s. Statista (2018) [1] projected that revenue from ERP application adoption would increase annually, rising from $82.12 billion in 2015 to $84.72 billion in 2021 [2]. Galy & Sauceda (2014) [3] compared the financial performance of firms with and without ERPs and found that adopters outperform non-adopters in terms of return on asset (ROA) and return on investment (ROI). However, while firms adopt ERPs to gain advantages, in terms of efficiency and development possibilities, some do not show positive financial performance [4]. A survey of ERP project managers reports that 40% of ERP projects fail to meet firms' pre-project goals [5].

ERP brings changes to the organizational business process and information environment and, thus, the adoption of ERP causes drastic changes within the organization [6]. The change management activities supporting organizational changes are indispensable for a successful implementation of ERP management. Additionally, there have not been adequate studies on how to manage changes at the organizational level and measure their effects. Therefore, this study aims to explore working-level changes, due to the introduction of ERP, among companies with an ERP experience of more than a year. How do organizations change after adopting an ERP? Post-ERP business process reengineering (BPR) accounts for both depth and breadth [7].

Thus, conducting BPR after adopting ERP is a crucial factor that affects the success of ERP. However, existing studies focus on the main ERP critical success factors (CSFs) [8], classified into several categories. In addition, few studies aim to identify the effects that the depth of BPR have on the results of adopting an ERP system.

Change management is another important issue in ERP adoption. The statistics above show that adopting an ERP does not ensure corporate success. Some researchers [9] argued that failure in change management is the main cause of unsuccessful ERPs. Accordingly, some studies [10,11] emphasize change management as a critical success factor in IS implementation. While members may resist system adoption and organizations should undergo change management to gain successful performance, few studies on ERP examined change management. Moreover, researchers should study both change management and the depth of BPR, indicating organizational changes and, simultaneously, accurately identifying the effects of change management. Therefore, this study analyzes the effects of the depth of BPR and change management on the success of ERP.

This study examines the increase in the information capabilities of organizations through ERP adoption. The well-known DIKW hierarchy (data–information–knowledge–wisdom) [12] states that, when data are collected and analyzed for a certain purpose, they become valuable information. When users receive a greater amount of more accurate data through ERP adoption, they analyze and refine the data. In this regard, ERP enhances the information capabilities of both users and firms. Previous research measured the performance of ERP adoption based on financial (sales, ROA, ROI) and non-financial performance. However, when users adapt to the system, the capabilities of users and firms to apply and manage information increase. Despite the significance of this fact, previous research does not address it. Information performance is clearly one of the benefits that firms are willing to derive through IS implementation [5].

Thus, this study proposes the concept of information orientation (IO) to measure corporate information competence based on information, people, and technology in order to effectively determine organizations' information-related performance. This measure includes (1) information technology practices (ITP), (2) information management practices (IMP), and (3) information behavior and value (IBV). This measure was first introduced by Marchand et al. (2000) [13] and was adopted in several IS studies [14,15]. The range of measurement is not limited to a certain department but rather applies to the entire organization.

It is with this backdrop that we devised a conceptual research model made of three constructs, as shown in Figure 1, and conducted a study to investigate how the performance of an ERP is influenced by the two major factors: depth of BPR and change management.
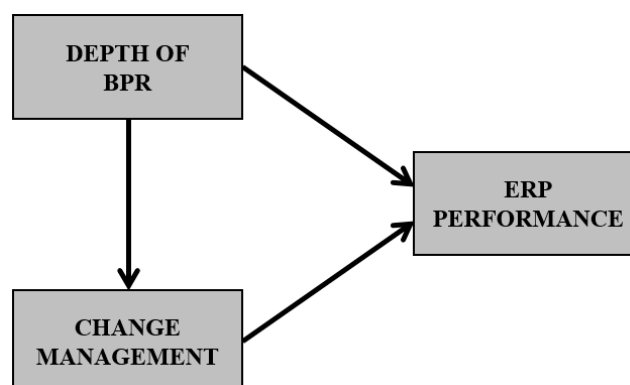

Figure 1. Conceptual research model.

Additionally, it answers the following research questions:
Q1: Is an organization's information capability enhanced through ERP adoption?
Q2: Do depth of BPR and change management affect ERP performance?

This study answers the questions above by focusing on firms listed on the Korea Composite Stock Price Index (KOSPI) of the Korean stock market. The listed firms on KOSPI are representative firms, selected by the Korean government based on market representation, industry representation, and flexibility.

Most studies on IS use data for American companies because the U.S. plays a leading role in various social and business fields. The U.S. has the most advanced IS, although there is a need for international studies. Some countries have developed to the same degree as the U.S. through IT and internet advancement. An IT industry competitiveness index from the Economist Intelligence Unit [16] in the U.K. ranks South Korea third, following the U.S. and Japan. South Korea also ranks first, based on the Digital Opportunity Index (DOI), one of the standards for evaluating IT infrastructure [17]. In addition, the Internet Data Center (IDC) in South Korea estimates that the Korean ERP market will maintain a constant growth rate of 6.2%, despite global recession (IDC Corporate Korea 2012).

Thus, this gradually globalizing market should be studied from the global perspective. Furthermore, researchers need a more comprehensive approach to examine companies that currently engage in international business. The result of analyzing CSFs for ERP and its expected effects will help companies that are planning to adopt, or have adopted, ERP to seek ways to effectively improve performance.

In the remainder of this paper, we review the relevant literature, set forth the research model and hypotheses, describe the research method, and report the findings. In the final section, we discuss the findings as well as the implications and limitations of the study.

2. Literature Review and Hypotheses

2.1. Depth of BPR

Firms adopt ERP to innovate existing tasks and the organization by adopting advanced processes built into the ERP package [18]. To this end, firms should also develop a strategy to conduct BPR according to its unique environment [19]. BPR is a change in the processes within various departments, rather than a change in the tasks of individuals or certain departments. This also applies to entire sectors, such as task processing, task processing support, policies, organizations, culture, and the deployment of personnel. There are several main strategies to connect ERP and BPR [20,21].

First, a firm can implement an ERP project, without performing BPR, to fully adopt advanced processes built into ERP, which have effects on BPR. This strategy can minimize ERP customization and significantly reduce the time and costs involved, though it is typically accompanied by significant user resistance. Second, firms first conduct BPR and then customize ERP based on their processes. This strategy is the most objective method to establish a task process. However, there is a risk that the process will design a task process that is already provided by the ERP package. Third, organizations conduct BPR and implement ERP simultaneously. This strategy solves the problem of redundant process design because the firm performs BPR while examining the ERP process. However, this increases the overall project time. Fourth, firms can implement ERP as a part of BPR. As this strategy is based on BPR, the organization may use ERP merely to establish a backbone system.

These strategies use BPR to innovate all organizational processes, rather than each department. When firms conduct BPR based on a process, they should pay attention to the breadth and depth of the redesigned process [21]. The breadth of BPR indicates the number of activities included in a process and determines the range of processes to achieve innovative performance and enhancements, such as cost reduction and increased value for customers, in terms of the entire organization. If the range of BPR widens, the entire organization might change or opportunities for change that did not appear in the narrow process could emerge [22]. The depth of BPR serves as the core in a firm's redesign and implies the pursuit of practical changes, including roles and responsibilities, performance measurement and rewards, organizational structure, IT, shared values, and skills, all of which are

fundamental factors that change the behaviors of an organization's members. The relationship between the depth and breadth of BPR is illustrated in Figure 2 [23].
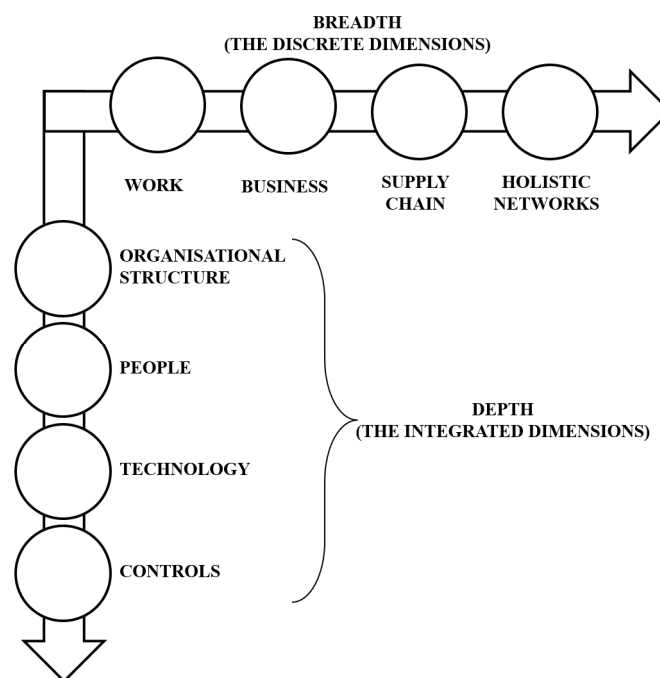

Figure 2. Depth and breadth of BPR.

Accordingly, a firm may require a greater range of change management tactics if the BPR significantly changes the organization. When the degree of BPR is higher, a greater range of change management activities enables departments to cooperate more easily [19]. Moreover, they can resolve conflict more quickly because departmental egoism is somewhat diluted. This study thus proposes a hypothesis related to how much organizational tasks and structure change through ERP implementation and how much the organizational tasks and structure are changed through ERP implementation. Thus, this study proposes that depth of BPR affects the level of change management.

Hypothesis 1. *The depth of BPR affects the level of change management.*

2.2. Change Management

Change management indicates an organization's effort to minimize its members' resistance to change [24]. Because an ERP system requires more changes than other ISs, members' attitudes toward adapting to these changes are crucial. Firms that fail to perform change management cannot properly use the ERP system, which is designed for all corporate processes because the changes extend beyond the IS environments and relevant tasks to include related organizations, people, and processes [5]. Thus, failure to address these areas during change management often leads to failure in ERP management [9].

As summarized in Table 1, many studies exist on change management, and several are particularly significant and relevant to our study. These form the basis of our research model and instrument. Most of these studies address one or more of three major issues: (1) awareness and acceptance, (2) communication, and (3) training and education.

Table 1. Major literature on change management and issues covered.

Change Management Issues and Topics Addressed		
Awareness & Acceptance	Awareness of the necessity of the change	[25]
	Cultural assimilation	[26]
	Goal-setting of executive	[27]
	Incentives and motivation	[27]
	Redesigning of the duty system	[28]
Communication	Working-level meeting	[29]
	Understanding and supporting requirements	[30]
	User involvement	[31]
Training & Education	Continuous management of educational result	[32]
	Adequate level of education and training	[33]

As the breadth and depth of change in the organization increases, resistance to such change also increases. This is why managers must prepare and execute a plan for change by mediating between the demand for change and the factors of resistance; this is a crucial element in change management for supporting a successful ERP implementation [34]. Thus, this study proposes that change management affects adaptation to business change.

2.3. Adaptation to Business Change

Adaptation to business change refers to the extent that members successfully adapt to an environment that changed due to the implementation of an ERP system [35]. This study also considers adaptation through change management activities. Minimizing organizational members' resistance and encouraging high adaptation to the IS in the changed environment is a CSF in IS adoption [36,37]. User adaptation to a new process includes ease of use and perceived usefulness.

Ease of use means that users will accept a system or a process more easily when they think they can use it more conveniently [38]. Perceived usefulness is the degree of belief that using the system will help them accomplish tasks [39].

As such, when task methods and processes change after IS implementation, the task details also change. Firms can integrate segmented work units into a larger unit and remove existing work units, depending on the new IS or the reduced approval paths.

Adaptation to changed tasks and the ease of use of ERP affects ERP adoption [34]. When users have a high degree of adaptation to the task process and have less difficulty using the ERP system, the ERP can enhance organizational management performance, decision-making, and the task process through information exchange between departments. In this regard, adapting to the business change is essential to a successful ERP implementation, as is adaptation to the changed task.

An IS that maintains the current tasks and merely incorporates automation can highlight inappropriate tasks. In particular, an ERP is a package, developed based on advanced and verified task processes. Thus, the implementation should also include drastic innovation, such as improving business processes and redesigning the organizational structure.

Members who are directly or indirectly related to this process undergo changes in their authority, roles, and tasks due to BPR. This in turn affects their adaptation to the system [40]. For these reasons, this study proposes that BPR affects adaptation to business change.

Hypothesis 2. *The depth of BPR affects the level of adaptation to business change.*

Hypothesis 3. *The level of readiness for change management affects the level of adaptation to business change.*

2.4. ERP Performance: Information Orientation Perspective

Studies measure ERP performance based on financial and non-financial performance [41]. While these two metrics are crucial, this study proposes an additional performance benefit from ERP adoption. When users adapt to the system, the information application and management capabilities of the user and the firm increase. This is very important, although it is not addressed in previous studies. However, it is certain that firms are willing to achieve information performance, along with other effects, through IS implementation [42].

Information orientation (IO) refers to a firm's ability to effectively use information, people, and technology to increase business performance. Since Marchand et al. (2000) [13] introduced this perspective, other studies have applied it to various ISs—such as supply chain management [43], customer relationship management [44], and knowledge management [45,46]—to measure non-IS performance variables, such as leadership [47], educational effectiveness [45], and corporate governance [15].

As Figure 3 illustrates, there are three classifications of IO: (1) information technology practices (ITP), (2) information management practices (IMP), and (3) information behaviors & values (IBV).
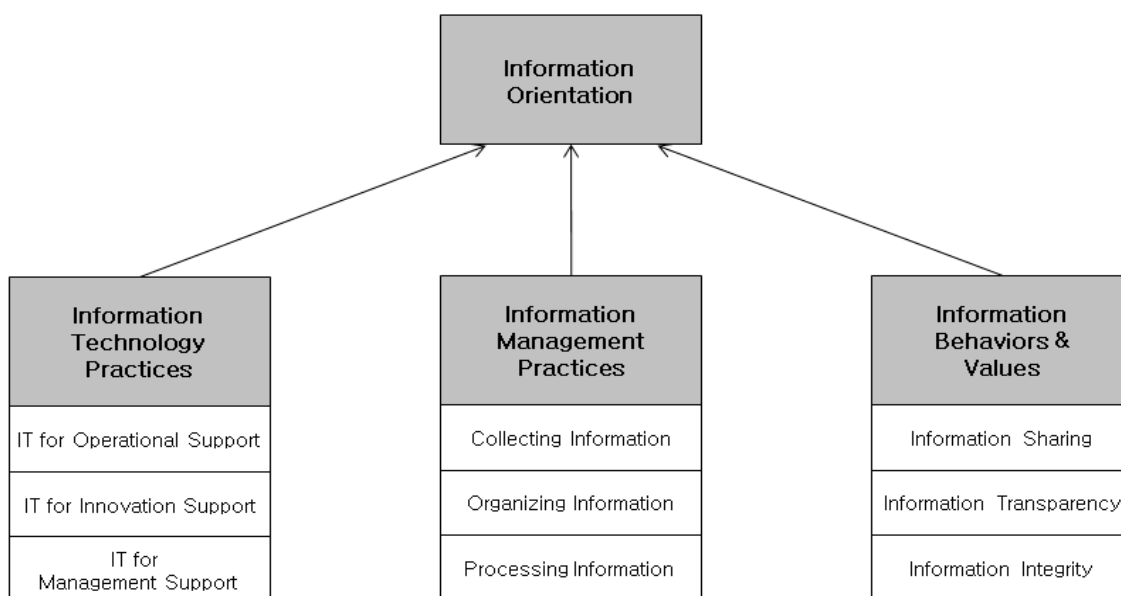

Figure 3. The IO approach [13].

First, ITP indicates the corporate capabilities of establishing and using an appropriate ERP to support decision-making and communication processes. Ensuring these capabilities gives firms the ability to analyze internal and external business issues, make decisions effectively, and exchange new ideas. IMP refers to the corporate capabilities of effectively managing information through ERPs, which enable a firm to effectively obtain, systematize, maintain, and manage information. The last perspective, IBV, refers to firms' capabilities of establishing and securing an information culture conducive to the promotion of desirable actions and values among its members.

As BPR changes processes in the entire organization, it also affects members' information capabilities [19]. Thus, a hypothetical statement that BPR affects IO is proposed in this study. Therefore:

Hypothesis 4. *The depth of BPR affects the level of information orientation.*

Change management includes user training, communication within a project team, and various activities across the organization. Members can use information and make decisions more efficiently through change management activities, such as education and training [44]. Therefore:

Hypothesis 5. *The level of readiness for change management affects the level of information orientation.*

When the user adapts to a task change, individual task productivity, using the system, increases, as does the efficiency of decision-making and individual task performance [5]. In addition, the accuracy of task completion increases enough to prevent user mistakes or data errors. The number of repeated or redundant tasks decreases, thereby reducing unnecessary tasks, such as data redundancy, re-input, and overtime work. To determine whether adaptation to business change affects IO, this study proposes that adaptation to business change affects IO.

Hypothesis 6. *The level of adaptation to business change affects the level of information orientation.*

3. Research Model

3.1. Research Model and Constructs

The overall research model to investigate the role of the depth of BPR and change management in ERP system performance from the IO perspective is illustrated in Figure 4. The research model has been defined in more detail than in the conceptual research model, which is shown in Figure 1.
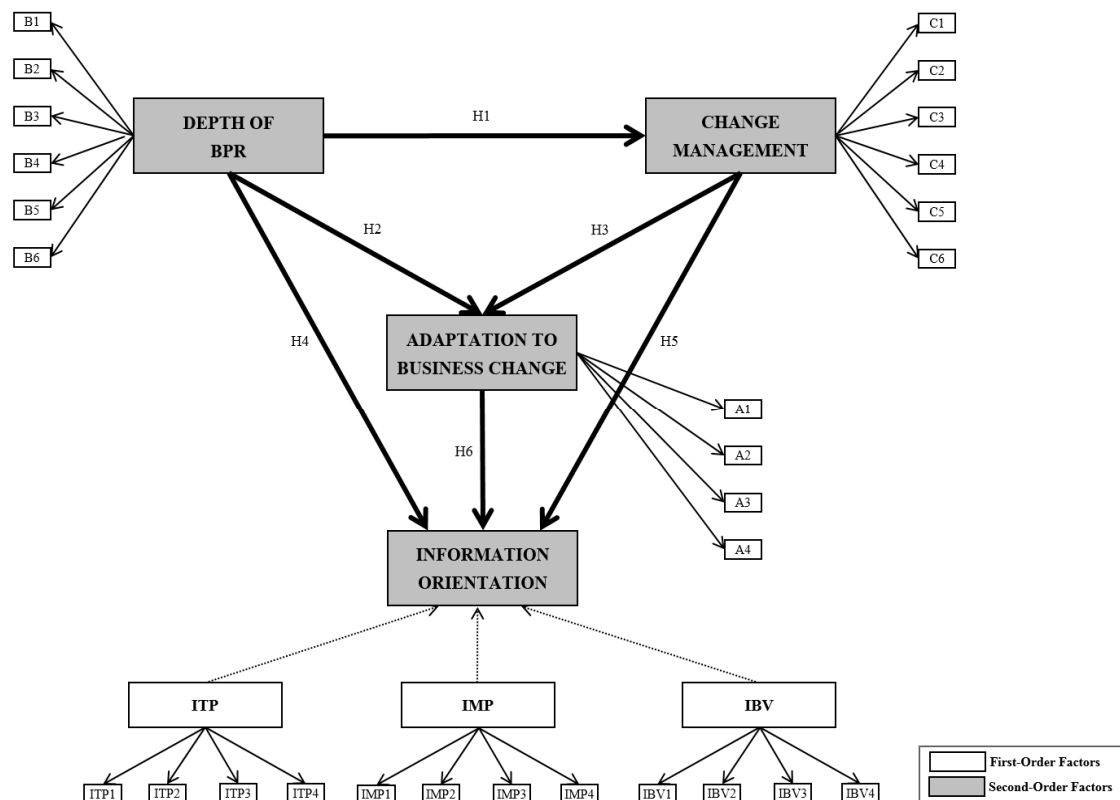

Figure 4. Research model.

In addition, this study uses several items to measure the six constructs in Table 2 below.

Table 2. Research constructs and operationalization.

Construct	Items	References
Depth of BPR	The organizational structure has widely changed through ERP adoption.	[19,21,22,40]
	Individual task processes have significantly changed through ERP adoption.	
	The role of IS in the organization has significantly changed through ERP adoption.	
	The role of each member has significantly changed through ERP adoption.	
	There have been significant changes in the method of measuring employee performance or the incentive system through ERP adoption.	
	Members' shared values have significantly changed through ERP adoption.	
Change Management	Our company made the members recognize the necessity of the ERP.	[4,26,27,29,32,34,44]
	Our company has an established communication system related to the ERP.	
	Our company carried out sufficient education and training related to the ERP for the members.	
	The company has established standards and regulations for the ERP.	
	Our company held a working-level meeting for change management.	
	Our company tries to establish an appropriate organizational culture for the ERP.	
Adaptation to Business Change	I have successfully adapted to the task processes, changed through ERP adoption.	[5,34,40]
	I have successfully adapted to the IS environment, changed through ERP adoption.	
	ERP sufficiently provides the necessary functions for processing tasks.	
	I will constantly use ERP for processing tasks.	
Information Technology Practices	It has been easier to make decisions related to task activities since ERP was adopted.	
	It is possible to execute more innovative tasks with the adoption of the ERP because information utilization has improved.	
	Task management and member management improved with the adoption of ERP.	
	Adopting the ERP enabled uniform and efficient task management.	
Information Management Practices	Necessary information is collected through a systematic process with the adoption of ERP.	[5,13,47]
	Necessary information is managed by appropriate classifications with the adoption of ERP.	
	Necessary information for task-related decision-making became possible through the adoption of ERP.	
	The adoption of ERP has facilitated the maintenance of the latest information without repeatedly collecting the same information.	
Information Behaviors and Values	An environment of opening or proposing information was promoted by the adoption of ERP.	
	Information was transparently provided to internal and external members within the organization with the adoption of ERP.	
	Information about organizational performance has been constantly provided to the teams or department managers since ERP was adopted.	
	Users entered exact information into the system to maintain integrity with the adoption of ERP.	

This study uses a survey, based on an existing study listed in Table 2, to verify the research model and hypotheses. Questionnaires were sent to ERP experts in a pilot test. Subsequently, questionnaires were sent to target firms in the primary process to acquire recommendations for the managers or other employees who can respond to survey questions. The respondents were selected based on the recommendations from the primary process and included those who are clearly aware of IS operation across the firm. The sample includes firms listed on KOSPI that have implemented and used ERP for a year or more. To collect survey data, survey invitations were offered by phone, email, or in person, and 700 questionnaires were distributed between March and May 2018. Among the responses, 162 questionnaires were used for the analysis. Statistical analysis was conducted using SPSS 21.0 and AMOS 21.0. The profiles and demographics of the companies that participated in the study are summarized in Table 3.

Table 3. Profiles of companies and respondents.

	Number	**Percent**
Industry		
Information and Communication	14	8.6
Manufacturing/engineering	37	22.8
Transportation and logistics	67	41.4
Services and utilities	16	9.9
Retailing and wholesale	28	17.3
Number of employees		
Less than 1000	40	24.7
More than 1000	122	75.3
Age of ERP (years)		
1–5	52	32.1
Over 5	110	67.9
Title of respondent		
Assistant manager	86	53.1
Manager	52	32.1
General manager	20	12.3
Executive director	4	2.5

3.2. Measurement Model

A confirmatory factor analysis was carried out to verify the validity of the model proposed in this study. The analysis results, as well as the means and standard deviations for each variable, are summarized in Table 4. The shaded values of all variables exceed the standard value of 0.5 [48].

The goodness of fit for a model is determined based on composite reliability (CR) and average variance extracted (AVE). Convergent validity is ensured if the CR value is 0.7 or over, or if the AVE value is 0.5 or over [49]. The CR values exceed the standard value of 0.7 and the AVE values exceed the standard value of 0.5, as indicated in Table 5; thus, convergent validity is ensured. The Cronbach's α also exceeds the standard value of 0.7.

Table 4. Results of factor analysis (each item is measured with a five-point Likert type scale).

Construct	Item	Information Management Practices	Change Management	Depth of BPR	Adaptation to Business Change	Information Technology Practice	Information Behaviors and values	Statistics
Depth of BPR	B1	0.074	0.046	0.539	0.009	0.041	0.451	
	B2	−0.167	0.474	0.704	0.089	0.246	0.297	
	B3	−0.136	0.247	0.665	−0.032	0.068	−0.030	Mean: 3.87
	B4	0.135	0.192	0.831	0.109	0.057	0.100	S.D.: 0.58
	B5	0.111	0.010	0.728	0.163	0.084	0.001	
	B6	0.108	0.104	0.844	−0.034	0.095	0.196	
Change Management	C1	0.280	0.629	0.169	0.184	0.040	0.008	
	C2	0.340	0.604	0.207	−0.075	0.179	−0.115	
	C3	0.292	0.620	0.119	0.196	0.158	0.075	Mean: 3.49
	C4	0.166	0.726	0.183	−0.016	0.230	−0.032	S.D.: 0.57
	C5	0.234	0.556	0.151	0.326	−0.010	0.351	
	C6	−0.066	0.554	0.127	0.219	0.496	0.178	
Adaptation to Business Change	A1	0.234	0.105	0.109	0.801	0.133	−0.013	
	A2	0.261	0.034	0.081	0.814	0.083	0.020	Mean: 3.82
	A3	0.489	0.166	0.062	0.595	−0.103	0.064	S.D.: 0.60
	A4	0.369	0.223	0.004	0.645	0.123	0.023	
Information Technology Practices	ITP1	0.432	0.090	0.046	0.136	0.830	−0.230	
	ITP2	0.157	0.287	0.210	0.139	0.802	−0.066	Mean: 3.70
	ITP3	0.431	0.242	−0.007	0.121	0.775	−0.062	S.D.: 0.65
	ITP4	0.218	0.338	−0.002	0.321	0.834	−0.193	
Information Management Practices	IMP1	0.673	0.296	0.181	0.200	−0.063	−0.050	
	IMP2	0.657	0.263	−0.045	0.333	−0.071	0.075	Mean: 3.76
	IMP3	0.784	0.155	0.026	0.247	0.137	0.144	S.D.: 0.67
	IMP4	0.671	0.015	0.039	0.244	0.350	0.070	
Information Behaviors and Values	IBV1	0.297	0.116	0.206	−0.023	0.140	0.675	
	IBV2	0.352	0.122	0.032	0.136	0.141	0.747	Mean: 3.58
	IBV3	0.136	0.230	0.033	0.210	0.356	0.875	S.D.: 0.66
	IBV4	0.221	0.124	0.060	0.118	0.268	0.771	

Table 5. Results of convergent validity.

Measures	AVE	CR	Cronbach α
Depth of BPR	0.507	0.856	0.797
Change Management	0.534	0.873	0.826
Adaptation to Business Change	0.673	0.892	0.839
Information Technology Practices	0.657	0.884	0.826
Information Management Practices	0.676	0.893	0.839
Information Behaviors and Values	0.592	0.852	0.768

A discriminant validity compares the correlation between the average variance extracted (AVE) and the variable to determine if the square root of AVE is higher than the correlation [50]. It is shown that this is the case in Table 6, and this implies discriminant validity among all constructs.

Table 6. Results of discriminant validity.

	Depth of BPR	Change Management	Adaptation to Business Change	Information Technology Practices	Information Management Practices	Information Behaviors and Values
Depth of BPR	0.712					
Change Management	0.487 *	0.731				
Adaptation to Business Change	0.207 *	0.450 *	0.820			
Information Technology Practices	0.218 *	0.623 *	0.587 *	0.811		
Information Management Practices	0.197 *	0.517 *	0.658 *	0.737 *	0.822	
Information Behaviors and values	0.314 *	0.616 *	0.499 *	0.752 *	0.702 *	0.769

The shaded numbers in the diagonal row are square roots of the AVE. * Significant at $\alpha = 0.01$.

Furthermore, multicollinearity was analyzed by using the variance inflation factor (VIF) and tolerance methods. Typically, there is no issue with multicollinearity when the VIF value is 10 or less and the tolerance value is 0.1 or higher. There is no problem of multicollinearity among the variables, as Table 7 indicates.

Table 7. VIF and tolerance.

|	Tolerance	VIF		Tolerance	VIF
Depth of BPR	0.763	1.311	Change Management	0.635	1.574
Adaptation to Business Change	0.797	1.255	Dependent Variable: Information Orientation		

We conducted structural equation analysis using AMOS 24. The fit statistics of this study was good except for the GFI as shown in Table 8 (X^2/DF = 2.420, GFI = 0.936, RMSR = 0.052, RMSEA = 0.044, AGFI = 0.8273, CFI = 0.918, TLI = 0.927, PGFI = 0.6202). As suggested by the index, it was judged to be acceptable to proceed with the analysis under the current conditions.

Table 8. Fit statistics for validating the measurement model.

	Recommended Value	Measurement Model
	X^2/DF ($\leq$3.000)	2.420
	RMSR ($\leq$0.050)	0.042
	RMSEA ($\leq$0.080)	0.044
Fit statistic	AGFI ($\geq$0.800)	0.827
	CFI ($\geq$0.900)	0.918
	TLI ($\geq$0.900)	0.936
	PGFI ($\geq$0.600)	0.620

4. Model Structure

The results of the analysis are presented in Figure 5 and summarized in Table 9.
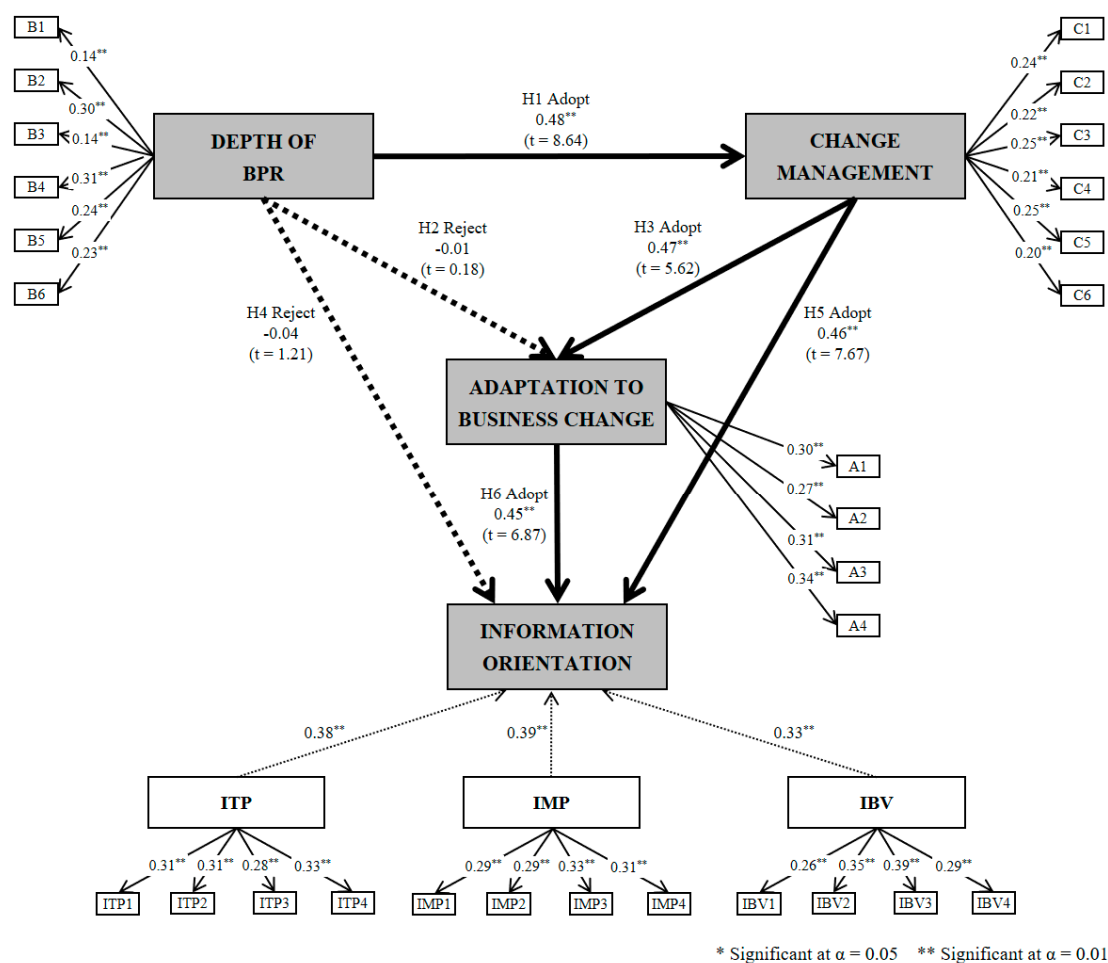
Figure 5. Results of hypothesis testing.

The statistically significant results related to H1 show that the depth of BPR affects change management ($\gamma = 0.48$, t = 8.64). This result is similar to previous findings [19], which indicate that, when the degree of change is higher, a greater range of change management facilitates cooperation between departments, somewhat resolving department-centricity and enabling easier conflict resolution [22].

The results related to H2, which indicate that the depth of BPR affects adaptation to business changes, have statistically insignificant values ($\gamma = -0.01$, t = 0.18). This contradicts previous findings [40], which indicate that task change due to BPR affects user adaptation to the system.

It seems that the result in this study is due to the consideration of change management factors in the analysis. As shown in Table 9, the depth of BPR has statistically significant indirect effects on adaptation to business change through change management (γ = 0.23, t = 4.73).

The statistically significant results for H3 show that change management affects adaptation to business change (β = 0.47, t = 5.62), which is similar to findings in previous studies [34] that indicate that organizational members can easily use a system with a changed task system when they are encouraged to make decisions effectively through change management tactics, such as education and training [4].

The results related to H4, indicating that the depth of BPR affects IO, have statistically insignificant values (γ = −0.04, t = 1.21). The first-order construct analysis also shows that the depth of BPR has insignificant effects on the ITP (γ = −0.12, t = −1.08), IMP (γ = −0.07, t = −1.04), IBV (γ = 0.03, t = 0.36). This differs from results in previous studies [19], which indicate that BPR changes an organization and can thus affect members' information capabilities. The results in the current study seem to be correct because the analysis considers change management factors. As shown in Table 9, the depth of BPR has statistically significant indirect effects on IO through change management (γ = 0.32, t = 5.80).

The statistically significant results for H5 show that change management affects IO (β = 0.46, t = 7.67). The first-order construct analysis shows that change management significantly affects the ITP (β = 0.58, t = 7.76), IMP (β = 0.37, t = 4.66), and IBV (β = 0.56, t = 6.89). This is similar to previous findings [44] which indicate that change management tactics, such as education and training, enable organizational members to use information and data, as well as make decisions, more effectively [32].

The statistically significant results related to H6 show that adaptation to business change affects IO (β = 0.45, t = 6.87). The first-order construct analysis demonstrates that adaptation to business change has significant effects on the ITP (β = 0.42, t = 6.61), IMP (β = 0.60, t = 9.03), IBV (β = 0.31, t = 4.50). This is similar to findings in earlier studies [5], which indicate that positive change in users' attitudes, rather than pressure to use the system, can positively affect performance.

Table 9. Coefficients of direct, indirect, and total impacts.

		Change Management	Adaptation to Business Change	Information Orientation
Depth of BPR	Direct Effect	0.48 *	−0.01	−0.04
	Indirect Effect		0.23 *	0.32 *
	Total Effect	0.48 *	0.22 *	0.28 *
Change Management	Direct Effect		0.47 *	0.46 *
	Indirect Effect			0.21 *
	Total Effect		0.47 *	0.67 *
Adaptation to Business Change	Direct Effect			0.45 *
	Indirect Effect			
	Total Effect			0.45 *

* Significant at α = 0.01.

5. Conclusions

This study analyzed the effects of the depth of BPR and change management on the performance of ERP. It also examined the information performance of ERPs, which has been ignored in previous studies (Marchand et al., 2000) [13]. Firms are willing to enhance their information capabilities by adopting IS, although there are few studies on these capabilities. This study measures IO as the effect of adoption of IS, in terms of ERP performance, by classifying IO into the ITP, IMP, and IBV categories. Moreover, this study empirically examined the reciprocal causal relation between BPR and change management, which affects ERP performance, and conducted comparative research based on existing studies.

First, the depth of BPR has significant effects on change management and insignificant effects on adaptation to business change and IO. The first-order construct analysis shows that the depth of BRP has insignificant effects on the ITP, IMP, and IBV. However, this study found that the depth of BPR has significant indirect effects on adaptation to business change and IO, which is likely due to the analysis including change management. Thus, analyzing the depth of BPR and change management separately shows that BPR significantly affects adaptation to business change and IO. This result implies that organizational efforts to manage users according to organizational change, rather than the degree of organizational change due to BPR, affects performance to a greater degree.

Second, change management has significant effects on adaptation to business change, as well as IO—in terms of ITP, IMP, and IBV—which is similar to previous studies [34,44]. Change management has significant indirect effects on IO, indicating that appropriate change management has a greater effect on system performance than task changes through BPR. Thus, change management tactics, such as education and training, has positive effects on system performance through adaptation to business change.

Third, adaptation to business change has significant effects on IO in terms of ITP, IMP, and IBV. This result is in line with the previous result [5] that users' adaptation to the system can have positive effects on system performance. These results verify that firms can maximize organizational performance by adopting an ERP system only when users successfully adapt to the accompanying task changes.

This study offers academic and practical contributions through its empirical examination of the complex relationship between the CSFs of ERP and the effects of attempts to implement ERP on IO. Moreover, because this study proposed CSFs for ERP, the results will provide practical management guidelines for firms that are planning to adopt ERP or firms that have done so but failed to effectively manage internal and external corporate resources.

First, this study is significant because it measures ERP performance in terms of IO. Previous studies do not address the increase in users' and firms' information capabilities through the adoption of an ERP system.

Second, this study identified the effects of the depth of BPR, which has previously been incorrectly examined as a CSF, on ERP performance. Researchers typically expect that organizational change due to BPR affects adaptation to business change. However, the results in this study also considered change management factors and verified that organizational change due to BPR does not have direct effects on adaptation to business change.

Third, this study examined the mutual and precedence relationships among the factors in a successful ERP implementation. While existing studies classify ERP CSFs into several categories, this study measured the complex mutual relationship among the ERP CSFs through an empirical analysis.

Fourth, this study measured and positively analyzed performances in terms of IO after the introduction of ERP. Furthermore, ERP performances were approached from the perspective of change management for a better understanding of the effect of adoption. ERP is a company's strategical asset, not a short-term project. Therefore, CEOs should aim for continuous change management. In this context, the findings revealed that IT competence can be strengthened by change management, not only a greater amount of IT assets, due to the introduction of ERP.

Despite this study's academic and practical contributions, it is subject to several limitations. First, this study was based on cross-sectional data from a survey, which was performed and analyzed at only one point in time, so it does not consider the dynamic processes related to IO. Thus, further longitudinal studies should be conducted by more strictly controlling exogenous variables that affect the research model and consider the effect of time delay in order to verify the change in information capabilities over time.

Second, future studies should determine whether firms that have a high level of IO achieve high financial performance based on the results of this study. Furthermore, changes in the success factors of ERP, relating to the period of use, need to be analyzed.

Third, this study examined firms that had an ERP system in place for at least one year to verify the proposed model. However, these results are based on the results of a survey that was performed only once due to the difficulty of obtaining sufficient data for analysis. Therefore, it may pose issues with respect to the representativeness of the responses due to individual prejudices or errors.

Conflicts of Interest: This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. I provided informed consent, and the study design was approved by the appropriate ethics review board. I have read and understood *Sustainability*'s policies, and we believe that neither the manuscript nor the study violates any of these policies. There are no conflicts of interest to declare.

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