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Conflict of Interest

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A Study on BI System: A Moderating Role of Organizational Learning

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Abstract

Organizational performance significantly depends on business intelligence. Business intelligence (BI) converts raw data into meaningful and useful information that managers use to make quick and improved assessments. Before implementing business intelligence in their firms, the manager must thoroughly evaluate it. Absorptive capacity (ACAP) and BI systems are closely related. We assessed the impact of the sub-dimensions of ACAP “acquisition, assimilation, transformation, and exploitation” on BI, Impact of BI on firm performance, and the moderating role of organizational learning. We adopted the quantitative method that comprises gathering secondary data from middle managers in Karachi’s banking industry and analyzing the data using partial least squares-structural equation modeling (PLS-SEM). The study found the dimensions of ACAP “acquisition, assimilation, transformation, and exploitation” positively affect the BI system. The BI system promotes firm performance. We also found organizational learning insignificantly moderates BI and firm performance. Managers can use the model to determine which areas of their company need more development before making the major financial commitment toward the BI system and to determine whether their company is ready to adopt it.

Keywords: *Business intelligence system, absorptive capacity, acquisition, assimilation, transformation, exploitation, and firm performance.*

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Introduction

A business intelligence system is a tool for acquiring, storing, analyzing, and refining data that support decision-making (Buhasho, Wausi, & Njihia, 2020). Technology has improved considerably in the last few years, allowing organizations to handle large quantum of data available in various forms, like images, web pages, and graphs (Zhang & Chen, 2020). Businesses generate and use a large volume of data which earlier technology could not handle (Cheng, Zhong, & Cao, 2020). Consequently, researchers' and practitioners' interest in business intelligence has increased profoundly (Lee, Cheang, & Moslehpour, 2022). Al-Eisawi, Serrano, and Koulouri (2020) investigated the influence of absorptive capacity on the efficiency of business intelligence systems and organizations. Based on a sample of 150 respondents, the study found a significant association between "acquisition, assimilation, transformation, and exploitation" and the efficiency of the BI system. Another research examined the association between business intelligence, business analytics usage, ambidexterity, and firm performance. Based on 500 web respondents, the study found that utilization of business analytics positively correlates with explorative and exploitative balancing efforts, consequently improving a firm's performance. The study also found that absorptive capacity mediates the association between business intelligence and ambidexterity (Božić & Dimovski 2019).

Additionally, Abusweilem and Abualoush (2019) investigated the relationships between knowledge management process organizations' business intelligence and firm performance. The study collected a sample of 126 respondents from Jordan's Housing Bank branches in Irbid. The study documented that knowledge management processes and organizational performance are significantly correlated. Another study in joint venture banks in Alexandria examined the impact of business intelligence on organizational agility and the mediating role of absorptive capacity. Based on a sample of 228 respondents, the study found organizational business intelligence promotes organizational agility, but technological business intelligence insignificantly affects organizational agility. In addition, the study found that absorptive capacity mediates business intelligence and organizational agility (Aly, Youssef, Matar & Hayder, 2021). Hooi (2021) investigated the organizational learning capability of Malaysian Retailers-Chain members and found benefits, rewards, empowerment, and teamwork significantly affect organizational performance. The study also found organizational commitment, experimentation, and openness positively affect organizational learning. Another study examined the impact of entrepreneurial orientation on firm performance using entrepreneurial orientation as a mediator. The study collected a sample of 250 Pakistani software engineers. The study found that entrepreneurial orientation positively affects job performance and mediates organizational learning and job performance (Hina,

Hassan, Parveen, & Arooj, 2021).

The above discussion shows that a few studies have examined the absorptive capacity sub-dimensions' effect on business intelligence. Many past studies have used ACAP as a mediator, but insignificant studies have used organizational learning as a moderator between business intelligence systems and firm performance. Given these gaps, this study examines (i) the effect of absorptive capacity determinants on the business intelligence system, (ii) the impact of BI on firm performance, (iii) The mediating role of the business intelligence system, (iv) the moderating role of organizational learning.

Theories Underpinning and Conceptual Framework

We have extended Peppard and Ward's (2004) Information Systems Capability (ISC) Theory and Fiol and Lyles' (1985) Organizational Learning Theory (OLT) to develop the conceptual framework of the study. Information System Theory emphasizes a company can gain a competitive advantage by "integrating, assimilating, appraising, and rearranging assets." Consequently, it improves the business intelligence system. Popescu, Valaskova, and Horak (2022) assert that firms can align business intelligence with current organizational architecture to generate additional opportunities (complimentary). Rana et al. (2022) assert that dynamic complementary partnerships are multi-facets. Therefore it is difficult for other companies to replicate them. According to the OLT, evaluating activities and procedures helps attain the defined goals. Thus, organization leaders should perpetually change the organizational BI System to align it with real-world outcomes (Elkjaer, 2022). Based on the above discussions, we have developed a conceptual framework, depicted in Figure 1.

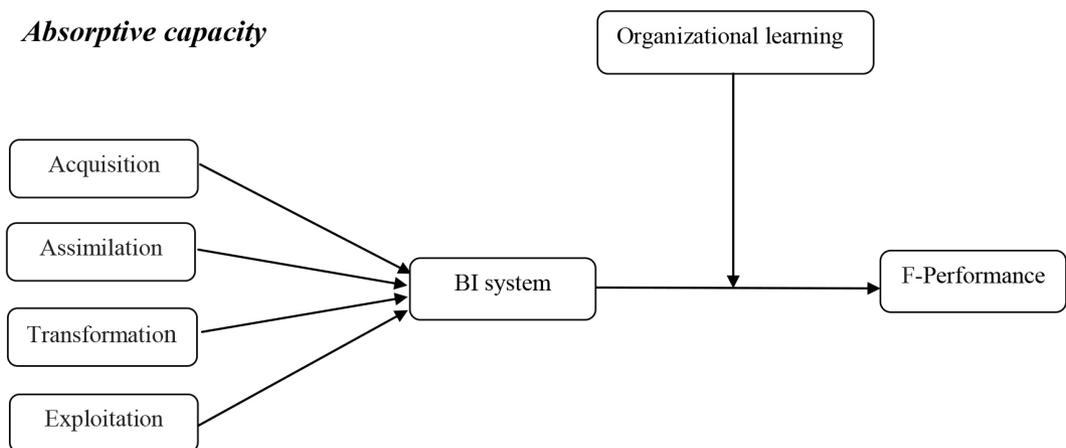


Figure 1: Conceptual Framework

Hypothesis Development

In the following section, we have presented theoretical support for the articulated hypotheses.

Acquisition

The acquisition dimension of ACAP allows organizations to recognize and acquire external knowledge for growth and sustainability (Elbashir et al., 2022). Extant literature suggests that firms must invest in R & D to acquire knowledge and make business intelligence systems effective (Chatterjee, Chaudhuri, & Vrontis, 2022). Knowledge acquisition in a firm depends on “intensity, speed, and direction.” Thus, intensity and speed are important to recognize and acquire the necessary knowledge for the ACAP and business intelligence system (Mehralian & Khazaei, 2022).

H1. The acquisition positively affects the BI system.

Assimilation

The assimilation dimension of ACAP refers to the analysis, processing, and interpretation of routine external information acquired from external sources. This dimension is crucial for the effectiveness of business intelligence systems (Cho et al., 2023). Many researchers believe it is difficult for firms to assimilate and implement external knowledge into business intelligence systems. Therefore, the firms must develop the capacity to “assimilate, integrate and implement external knowledge” into business intelligence systems (Du & Wang, 2022). Crupi et al. (2022) assert that external knowledge, apart from being difficult to comprehend, may not align with the firm’s business structure and process. The misalignment between external knowledge and firms’ business structure may delay the assimilation of external knowledge into business intelligence systems. However, external knowledge, apart from delay in understanding and implementation, may bring new insight to improve the working environment and business intelligence system (Knoppen, Saris, & Moncagatta, 2022).

H2. The assimilation positively affects the BI system.

Transformation

Transformation is another dimension of ACAP. It refers to the capability of organizations to refine their current routine by combining newly acquired knowledge (Ahmed et al., 2020). Dzhengiz and Niesten (2020) assert that the transformation process is refining existing knowledge by deleting irrelevant aspects of knowledge and adding new knowledge to enhance the business intelligence system. In the transformation process, firms face problems when a new idea generates two dependable but incompatible settings of resources. Therefore, firms must develop the capacity to use two or more inconsistent

pieces of information (Xue, Boadu, & Xie, 2019). Kale, Aknar, and Başar (2019) assert that transformation links with strategic change in an organization. Strategic change or transformation refers to changing common organizational knowledge constructively and positively. Khan, Majid, and Yasir (2021) assert that organizational transformation promotes “growth and sustainability.”

H3: The transformation positively affects the BI system.

Exploitation

Exploitation is also an important dimension of ACAP. A successful firm can exploit knowledge by integrating it into its business process with little or no technical problems. It allows the organization to “refine and enhance existing capabilities” (Chichkanov, 2021). Khan, Lew, and Marinova (2019) assert that exploitation is the “formation of new services, products, systems, and knowledge.” While developing a new project, firms with good exploitation capabilities acquire knowledge from different resources, including competitors, customers, and the market (Qin et al., 2020). Additionally, such organizations integrate existing and new knowledge to reposition their target market with improved creative value propositions (Knoppen, Saris, & Moncagatta, 2022).

H4: The exploitation positively affects the BI system.

BI and Organizational Performance

The purpose of business intelligence is to support a company by converting data into usable knowledge and information (Paulino, 2022). It enables companies to access, evaluate, and share information and knowledge to enhance organizational performance (Popovič, Puklavec, & Oliveira, 2019). Managers can make better decisions and successfully run the business using new knowledge (Maroufkhani et al., 2019). BI provides the necessary information to firms to increase their performance.

BI goes beyond policy and database sharing. It includes the active participation of all employees by sharing their experiences and knowledge with others (Caseiro & Coelho, 2019). The BI system has various regulatory benefits (Talaoui & Kohtamäki, 2021). Paulino (2022) asserts that organizations develop effective market strategies by optimizing and exploiting their existing resources (Wamba-Taguimdje et al., 2020). BI is a critical competitive tool, and it helps firms to identify new market segments and cater to their needs with new innovative products. The BI system can store, analyze, and retrieve large amounts of data, which firms can use to develop new products, streamline procedures, or learn from competitors’ research. As a result, BI improves an organization’s performance (Yiu, Yeung, & Cheng, 2021).

Firms' ability to develop new knowledge by exploiting existing knowledge is important for growth and sustainability (Bordeleau et al., 2020). BI is extremely useful for learning about the competitive environment, including market dynamics, governmental restrictions, emerging technology, and competitors (Nithya & Kiruthika, 2021). It is also useful to anticipate the changes in the environment in which the company functions (Bag et al., 2021).

H5. Business intelligence systems positively affect organizational performance.

Organizational Learning and Organizational Performance

Strong organizational learning boosts business performance by nurturing and utilizing knowledge to achieve organizational objectives (Khan, Zhang, & Salik, 2020). It increases innovation and creativity by developing new tools and capacities to cater to the demand of anticipated change (Oh, 2019). Organizational learning makes firms more successful, competitive, and inventive (Waruwu et al., 2020). Extant literature documents organizational learning improves firm performance (Putra et al., 2020). A learning organization provides learning material to the employees and encourages them to change their attitudes and behaviors according to the new requirements (Hosseini et al., 2020). Past studies document that employees must unlearn old procedures to adopt new changes (Lin & Huang, 2021). Also, empowering employees is necessary to implement new changes.

Organizational learning enables firms to cope with external challenges by adopting novel ideas and taking calculated risks. All these aspects improve organizational performance (Antunes & Pinheiro, 2020). Abbas et al. (2020) and Oh (2019) assert that external knowledge gathered through organizational learning helps businesses explore innovative opportunities, recognize client choices, foster innovation, and enhance performance. Rafiki et al. (2023) assert that organizational learning is a precursor of organizational performance.

H6. Organizational learning moderates the relationship between BI and organizational performance.

Methodology

Population and Sampling

The current study is quantitative. The study distributed 250 questionnaires to the middle managers working in the banking sector in Karachi, Pakistan, and received 210. We found that 61% of respondents were females and 39% were males. Regarding age,

we found that 28% of the employees were in the age bracket of 20-30, 66% in the age bracket of 31-40, 3.2% in 41-50 age bracket, and the remaining were above 51 years old. We found that 18% have Bachelor's degrees, 46% have Master's Degrees, and 31% have MS/M. Phil's level of education and the rest have diplomas or certifications. In terms of experience, we found that 53% of employees have up to five years of experience, 12% have experience 6 to 10 years, 14% have experience between 11 to 15 years, and the rest have an experience of at least 16 years or more.

Scales and Measures

The study has seven constructs and 44 items adopted from earlier studies. Table 1 shows the names of constructs, sources, reliability in earlier studies, and the number of indicators in the latent variables.

Table 1: Scale and Measures

Constructs	Sources	Reliability	Items
Acquisition	Al-Eisawi et al (2020)	0.821	7
Assimilation	Al-Eisawi et al (2020)	0.800	5
Transformation	Al-Eisawi et al (2020)	0.778	3
Exploitation	Al-Eisawi et al (2020)	0.819	4
Business intelligence	Al-Eisawi et al (2020)	0.808	10
Firm performance	Hina et al. (2021)	0.864	4
Organizational learning	Hina et al. (2021)	0.890	11

Statistical Analysis

This study used partial least squares-structural equation modeling (PLS-SEM). It includes "generating measurement models, reliability and validity statistics, and a structural model for hypotheses results."

Results and Findings

Descriptive Analysis

In Table 2, we have presented the results related to descriptive analysis.

Table 2: Descriptive Statistic

	Cronbach's Alpha	Mean	SD	Skewness	Kurtosis
Acquisition	.985	3.879	1.912	-.011	-1.737
Assimilation	.887	3.851	1.052	.179	-1.747
Transformation	.896	3.710	1.918	-.075	-1.667
Exploitation	.868	4.206	0.987	.042	-1.823

Business Intelligence	.879	3.510	0.968	-.171	-1.670
Firm Performance	.815	3.993	1.260	-.005	-1.570
Organizational Learning	.865	3.959	1.840	-.136	-1.731

The findings reveal that “Cronbach’s Alpha values” fall between 0.815 to 0.985. Firm performance has the lowest value ($\alpha=0.815$, Mean=3.993, SD=1.260), and acquisition has the highest value ($\alpha=0.985$, Mean=3.879, SD=1.912). The values of Skewness and Kurtosis are between ± 2.5 . Therefore, we can conclude that the study’s constructs adhere to the univariate normality and internal consistency requirements (Hair et al., 2017).

Convergent Validity

Assessment of convergent discriminant validities is essential for a study. Table 3 summarizes these results.

Table 3: Validity Analysis

	CR	AVE	Acq	Ass	BI	Exp	FP	O.L.	Trans
Acquisition	0.918	0.616	0.785						
Assimilation	0.918	0.691	0.469	0.832					
Business Intelligence	0.909	0.625	0.617	0.544	0.791				
Exploitation	0.891	0.671	0.669	0.617	0.731	0.819			
Firm Performance	0.880	0.647	0.518	0.307	0.661	0.458	0.804		
Organizational Learning	0.904	0.652	0.689	0.449	0.786	0.572	0.497	0.808	
Transformation	0.911	0.773	0.674	0.474	0.733	0.736	0.624	0.640	0.879

The “factor loadings of all retained items are more than 0.65” All-composite values are higher than 0.70, as recommended by (Kock, 2017), and AVE values are higher than 0.60, as recommended by Hair Jr et al. (2017), suggesting the results meet the criteria for convergent validity. Considering that “AVE squared values are greater than Pearson correlation values,” we have deduced that each construct is “unique and distinct” (Fornell & Larcker, 1981).

Measurement Model’s R Square and Q Square Values

We used R² and Q² values presented in Table 4 to assess the model’s predictive power. According to Hair et al. (2010), the model has an appropriate “predictive capacity” because the “R² values are larger than 0.10 and the Q² values are greater than zero” (Hair et. al., 2017).

Table 4: Measurement Model (Predictive Power-R² and Q²)

	R ²	Adjusted-R ²	Q ² (=1-SSE/SSO)
Business Intelligence	0.686	0.680	0.417
Firm Performance	0.438	0.430	0.274

Measurement Model's Fit Indices

The “fit indices” values in Table 5 show that the model fits well, with “SRMR values less than 0.08 and NFI values greater than 0.70” (Hair et al., 2022).

Table 5: Measurement Model's Fit Indices

	Saturated Model	Estimated Model
SRMR	0.065	0.074
d_ ULS	2.535	3.273
d_ G	1.304	1.390
Chi-Square	1418.795	1490.737
NFI	0.835	0.822

Hypotheses Results

The study tested five direct and one moderator hypotheses. Table 6 displays the summary. And we have presented the “Measurement and Structural Models” in Figures 2 and 3, respectively.

Table 6: Hypotheses Results

	Beta	T-Stats	P Value	Results
Acquisition → Business intelligence (H1)	0.345	4.321	0.000	Accepted
Assimilation → Business intelligence (H2)	0.109	1.797	0.073	Accepted
Transformation → Business intelligence (H3)	0.284	3.306	0.001	Accepted
Exploitation → Business intelligence (H4)	0.224	2.216	0.027	Accepted
Business Intelligence → Firm Performance (H5)	0.708	9.101	0.000	Accepted
Moderating Effect Org. Learning → Firm Performance (H6)	0.012	0.165	0.509	Rejected

The study supports five direct hypotheses and does not support the moderating hypothesis. We found the highest impact between “business intelligence and organizational performance” ($\beta=0.708$). While the smallest was between “assimilation and business intelligence system” ($\beta=0.109$).

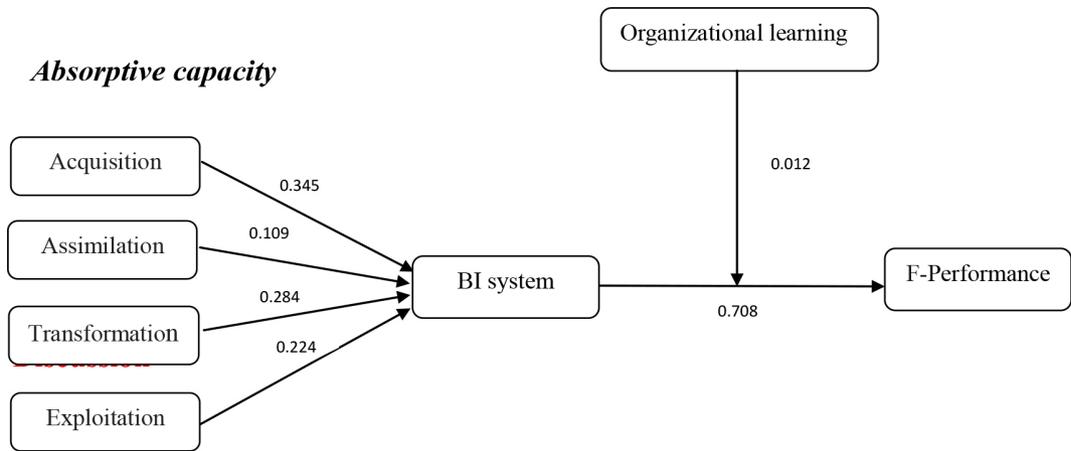


Figure 2: Measurement Model

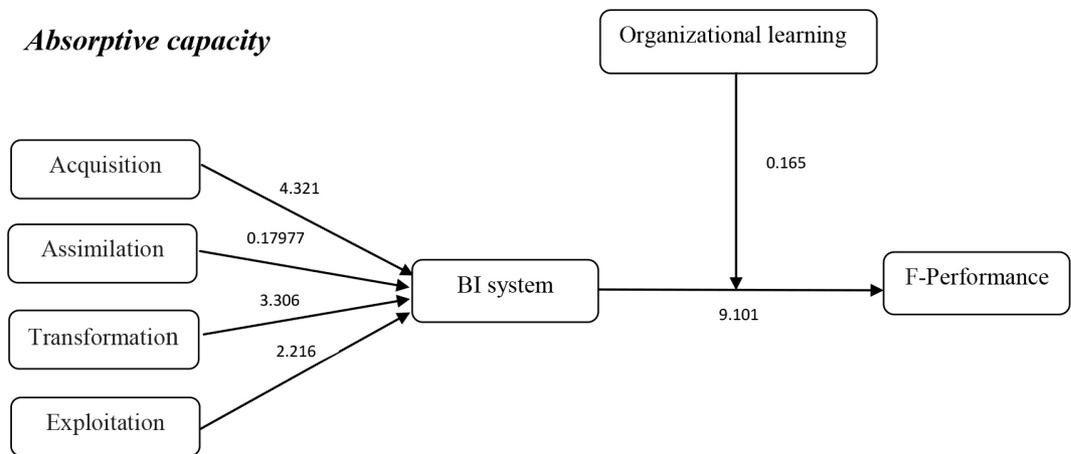


Figure 3: Structural Model

The study's findings validate that ACAP dimensions enhance the value of BI systems (Al-Eisawi et al., 2020; Chatterjee, Chaudhuri, & Vrontis, 2022). To increase the efficiency of the BI system, firms must focus on the four components of absorptive capacity, i.e., "acquisition, assimilation, transformation, and exploitation."

The study supported the effect of "acquisition on BI system." All of the examined measures of the acquisition dimensions offer a plausible potential benefit for enhancing data acquisition within businesses (Knoppen, Saris, & Moncagatta, 2022). Elbashir et al. (2022) assert acquisition of knowledge generates positive knowledge-sharing

interaction that positively affects the BI system.

The study found "Assimilation dimension positively affects the BI system." Many researchers believe it is difficult for firms to assimilate and implement external knowledge. Therefore, the firms must develop the capacity to assimilate, integrate and implement external knowledge into the BI systems. (Al-Eisawi et al., 2020).

We found "the transformation dimension positively affects BI systems." The ability of the organization to apply a series of modifications to its current practices and acquired knowledge can increase the effectiveness of the business intelligence system (Ahmed et al., 2020).

Al-Eisawi et al. (2020) assert that exploitation is an institutional capability built on methods and practices. It allows organizations to develop, disseminate, and enhance existing capabilities or generate new distinct ones by incorporating acquired and transformed knowledge into their operations. The study found that "exploitation positively affects the BI system."

The study found "BI system promotes organizational performance." The findings validate the works of many past studies that came up with the same conclusion (Khan et al., 2020; Buhasho, Wausi, & Njihia, 2020). Business intelligence technologies can help businesses perform better. However, the business must generate a thorough plan before implementing business intelligence. Businesses must deal with change management because they are dynamic (Khan et al., 2020).

We found that "organizational learning insignificantly moderates business intelligence and organizational performance," which aligns with the findings of Abbas et al. (2020).

Conclusion

Business intelligence problems affect the service sector, particularly the banking sector. Thus, we collected a sample of 210 respondents from the local banking sector using pen and pencil questionnaires. The study found that all four dimensions of absorptive capacity, i.e., "Acquisition, assimilation, transformation, and exploitation," positively affect the business intelligence system. Business intelligence also promotes organizational performance. Organizational learning insignificantly moderates business intelligence and firm performance.

Practical Implications

Our research has important real-world implications for managers interested in BI

adoption. Cheng, Zhong, and Cao (2020) assert that most organizations struggle to make sense of the data and insights that BI brings. The companies that successfully use BI are more of an exception than a norm. If researchers want to translate the usage of BI to increase business performance, they should concentrate on increasing BI-supported innovation skills. Organizations should use absorptive capacity dimensions more frequently to increase BI systems' efficiency.

Limitations and Future Research

The sample size for this study was small, and it focused on the banking sector. Other researchers may focus on other sectors and collect a larger sample size. We have focused on middle-level management; others may collect the data from lower management levels. Organizations at different stages of implementing business intelligence may have different attitudes, which future researchers may consider. We have used organizational learning as a moderator, and future studies may use other variables, such as spirituality and ethics as moderators.

Annexure -1

Constructs and Items used in the Questionnaire

Business Intelligence

- BI1. BI systems improve data collection from different systems resources using BI technical tools.
- BI2. Using the BI system and BI technical tools increase employee productivity in my organization.
- BI3. The BI system improve data collection from different systems resources.
- BI4. BI systems enhance coordination between partners, suppliers, and our organization internally.
- BI5. BI systems lowere the cost of transactions with business partners/suppliers and data providers.
- BI6. BI System improve data processing and storage using data warehouse and OLAP online analytical processing tools.
- BI7. BI systems improve the efficiency of internal processes.
- BI8. BI systems in my organization has lower operational costs.
- BI9. BI systems reduce the time and cost-to-market of products/services.
- BI10. BI systems reduce the cost of effective decision-making.

Firm Performance

- FP1. My firm is usually satisfied with the return on investment.
- FP2. My firm is usually satisfied with the return on equity.
- FP3. My firm is usually satisfied with the return on assets.
- FP4. My firm is usually satisfied with market share growth.

Organizational Learning

- OL1. Individuals generate many new insights in my firm.
- OL2. Individuals in my firm take experimental actions.
- OL3. Individuals in my firm are motivated to carry out assigned tasks.
- PL6. Individuals in my firm are aware of critical issues that affect their work.
- OL7. Our organization value group gives output.
- OL8. We have effective conflict resolution when working in groups.
- OL9. Different points of view are encouraged in group work in my firm.
- OL10. Lessons learned from one group are shared by other groups in my firm.
- OL11. Our organizational structure results from what we learn.
- OL10. Our cultural values are a result of our different ideas in my firm.
- O11. Group resolutions are used to improve the firm production/service delivery process.

Absorptive Capacity

Acquisition

- AC1. Management support for data exchange exists in my organization.
- AC2. Departmental data management exists in my organization.
- AC3. There is support for well-established relations with data providers.
- AC4. Research development activates, and investments exist in my organization.
- AC5. Periodical meetings and workshops with experts occur in my organization.
- AC6. Human resource competencies are highly encouraged.

AC7. My organization allocates financial budgets and supports different initiatives for data exchange purposes.

Assimilation

AS1. Timely data flow is organized and noticeable in my organization.

AS2. Well-established development exchange meetings occur in my organization.

AS3. Departmental employee communication occurs in my organization.

AS4. In my organization, employees have a degree of literacy regarding acquired data from other resources.

AS5. Technological readiness is apparent in employees in terms of data processing competencies.

Transformation

TR1. In my organization, there is adequate availability of technological infrastructure.

TR2. In my organization, employees' technical abilities and tendencies are highly present.

TR3. Robust and effective data security measures are implemented in my organization.

Exploitation

EX1. In my organization, there is an acceptable degree of quality decisions and decision-making.

EX2. In my organization, apparent innovative products and services are available.

EX3. We have prototype production support.

EX4. My organization always seeks the adoption of new technologies.

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