An Empirical Study on the Relationship among IT Capabilities, Business Process and Firm's Performance

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ABSTRACT

This study investigates the influencing mechanism between IT capabilities and firm's performance. We believe that business process is the principal factor and suggest that IT capabilities improve business process and subsequently enhance firm's performance. The study of the underlying factors among IT capabilities, business performance, and firm's performance is considered rare and although some researchers have introduced conceptual models and empirical tests, they are not able to support the cumulative model. It is found out that IT capabilities have a significant and positive relationship to firm's performance. Besides, business process reengineering and process efficiency contribute more to this relationship by mediating effect. This study will benefit business researchers, strategic researchers and managers in various industries because this will contribute to a better understanding of IT capabilities, business process, and firm's performance to a greater extent and provide fundamentals for strategic decisions in IT investments of a firm.

Keywords: Information Technology, IT capabilities, Managerial IT capability, Technical IT capability, Business process, Firm's performance

Introduction

The potential of Information Technology (IT) to deliver firms competitive advantage has been a very interesting area to researchers, and reflected in considerable literature investigating the impact of IT on organizational performance (Dana, 2013; Ramadani et al, 2017; Chae et al, 2014). Following this, investments in IT has increased dramatically along with the role of IT in strategic thinking in many organizations (Sukumar et al, 2020). Despite the significant work in this area, there are still knowledge gaps on how IT capability influences business processes and firm's performance. While the current literature has examined the relationship between IT capabilities and firm performance in various contexts (Chae et al, 2014), work looking into firm's performance through business processes undermined by IT capability is still growing (Aydiner et al, 2019) and further evidence on the role of the underlying mechanisms of business processes and IT capability in contributing to firm's performance is needed. Although, many studies for the past years have provided strong evidence that IT contributes to firm's performance (Kim et al, 2011; Peng et al, 2016), the cumulative results of the study linking firm performance and IT capability has been varied (Peng et al, 2016), with some results suggesting a positive link between IT capability and firm performance (Wang, 2010; Kim, 2017), while others pointing out that there is no considerable influence of IT capability on firm performance (Carr, 2003).

In this paper, our aim is to examine business process as the underlying mechanism, influenced by IT to enhance firm's performance. In the previous studies, role of information technology on firm's performance has been addressed directly (Mithas et al, 2011), as is the role of business performance (Pradabwong et al, 2016), however, research connecting the three has been sparse (for example, Kim et al, 2011). Work done in this area previously has examined the process oriented capabilities in general but has not looked into what these capabilities specifically constitute and how they influence firm performance through the lens of IT capability. In this study IT capability is examined through managerial IT capability and Technical IT expertise in the firm, while business process is measured through the firm's agility, efficiency and ability to re-engineer the process. A cumulative model investigating the relationship between the three main themes is sparse. This paper looks at addressing this deficiency, its aims to investigate the mediating effect of business process in the determining the IT capability's influence in a firm's performance. The rest of the paper is structured as follows, the next section explores the literature on IT capabilities, business process and measures of firm performance and develops hypotheses assess the mediating effects of business process. The third section highlights the methodology used in the work, while the fifth and sixth section discusses the results from the study and conclusion stating the contribution from the paper.

2. Literature and Hypothesis

Bharadwaj (2000) defined IT capabilities as "the ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities (Bharadwaj 2000, p171)". Scholars divided IT capabilities into dimensions, depending on their study focus. For instance, Wade and Hulland (2004) adopted a typology suggested by Day (1994) to sort IT capabilities into three types of processes: inside-out, outside-in, and spanning. Instead of using this typology, Bharadwaj et al. (1999) adopted Grant's (1991) three keys IT resources and their relationships to a firm's capability to increase firm's performance. The three keys IT resources are IT infrastructure, human IT resources, and intangible IT-enabled. Later Bharadwaj (2000) suggested that the tangible resource consisted of physical IT infrastructure components, human IT resources involving managerial and technical IT skills, and the IT-enabled intangibles such as synergy, customer orientation, and knowledge assets. Wu et al. (2008) suggested another category: IT capabilities into IT capabilities for exploitation and IT capabilities for exploration. Exploring the nature of IT capabilities and link to firm performance,

2.1 IT capabilities, Business Process and Firm Performance

The association between IT capabilities and firm performance has been studied by a number of scholars. For example, Bharadwaj (2000) did an empirical investigation of the correlation between IT capabilities and firm performance and concluded that a firm performance will be higher if it can successfully create a unique IT capability. Similar assertions were also made by Mata et al (1995), who note that in order to leverage on IT investments, unique capabilities must be created. . Clemons and Row (1991) argued that IT is generally available to all industries and can only present a sustainable competitive advantage if applied to leverage differences in resources. Wu *et al.* (2008) investigated whether IT capabilities can enhance firm performance by influencing organisational decision-making while, Xie *et al.* (2010) studied the connection between IT capabilities, organisation structure and enterprise performance. More recently, Chae et al (2018), noted the role played by a particular industry in linking IT capability and firm performance.

IT capability as a concept has been well established (see for example, Tarhan et al, 2016) and its link to business process has also been studied extensively (ref). Since firms deploys a number of business processes to accomplish their business objectives, there are opportunities to use IT improve business process (Porter and Millar, 1985). Basu and Blanning (2003) in their work noted that IT would not only help improving a firm's individual process, but it would also allow integration across organisational boundaries. Tallon (2007) in his study of IS executives in 241 firms, highlighted that the development of IT capabilities drives agility and ability of a firm to respond to changes in its markets or products. The study notes that faster or cheaper technology are not the pathways to improve agility rather, the human factors that determine whether a firm is agile to changes in the external environment. Akhavan *et al.* (2006) and Attaran (2004) also confirmed that IT facilitates firms to gather and analyse information, develop strategic visions, assist process redesign, and improve teamwork and co-operation. Work by Kang *et al.* (2008) investigated the impact of ERP on firm performance. They note that standardisation and centralised integration are key factors for successful ERP implementations. Contrasting to common theme that IT capability influences business process, a recent study by Nadarajah et al (2019), notes that IT capability was not related to business process improvement or sustainable competitive advantage.

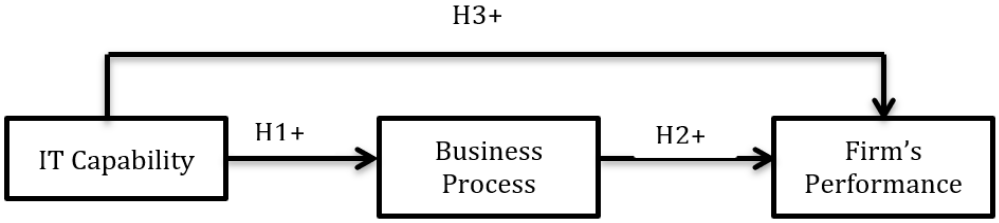
Examining the previous work in linking business process and firm performance, there are two strands of metrics that are used to measure performance. The first, examines the operational efficiency within business activities. For example, improve inventory management process to reduce the cycle time, and process redesign to increase quality (Melville *et al.*, 2004). Metrics that can be used to identify the effectiveness and efficiency of the firm's business processes such as inventory turnover (Barua, Kriebel and Mukhopadhyay, 1995), and customer satisfaction (Devaraj and Kohli, 2000). The second, organisational performance, denotes aggregate IT-enabled performance linked across all firm activities, for example, revenue enhancement, cost reduction, and competitive advantage (Melville *et al.*, 2004). Majority of IT-business value researchers use metrics such as productivity enhancement and cost reduction as operations measures, and stock market valuation and Tobin's Q as market-based measures (Dehning and Richardson, 2002). Nevertheless, Tallon *et al.* (2000) argued that the range of potential measures is not limited to financial metrics, and may include perceptual measures, usage metrics, and others. But unarguably, financial key performance indicators are the most important and most commonly used KPIs for firm performance, and they also provide some valuable insights into business process performance (Dehning and Richardson, 2002; Matolcsy *et al.*, 2005). Firms invest in IT system such as Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) with the belief that it will deliver benefits including improved business efficiency with streamlined business processes and consequently enhancing firm performance (Soh and Markus, 1995; Basu and Blanning, 2003). Further findings note that both human and technical ERP resources play a critical role in affecting financial and non-financial performance of a firm through improved business

processes. More recent work has examined IS capabilities and firm performance through organisational decision making (Aydiner et al, 2019) and enabling firm performance through business intelligence and analytics (Jakkola et al, 2016)

2.2. Hypotheses Development

Exploring, the relationship between IT capabilities, business process and firm's performance, we have developed a model linking the three themes. Using Tallon (2007)'s work, we divide IT capability into managerial IT capability and technical IT capability, and business process into business process reengineering, business process agility, and business process efficiency. Table 1 illustrates the conceptual model regarding the influencing factors of IT capabilities on firm's performance.

Figure 1: Conceptual model.



- Managerial IT capability
- Technical IT capability
- Business process agility
- Business process reengineering
- Business process efficiency
- Firm's performance

2.2.1 IT Capability and Business Process

Examining the individual influences of the identified factors, we first investigate the role played by managerial IT capability on business process. Managerial IT capability has been explored as an antecedent in exploitation of IT benefits and in IS alignment (Tai et al, 2019). Managerial IT capability is linked with dynamic capabilities of a firm and is closely linked to achieving firm performance (Tai et al, 2019). Business process agility is closed linked with dynamic capabilities of a firm and thus is can be hypothesized that,

H1a. Managerial IT capability has a positive impact on business process agility.

Several IS/IT studies have confirmed that there is a link between technical IT capability and agility (Kim et al, 2011). Using Resource Based theory, studies have notes the importance of Technical IT capability in responding to changing business needs (Sabherwal et al, 2019). It capability can allow firms to more competitive and respond to changes in internal and external environment (Sabherwal et al, 2019). IT can allows firms to be proactive rather than reactive (Zaheer & Venkataraman, 1994). When it comes to agility, the stronger the IT capability, easier the response to changes in strategic and operational environments. Thus, we can hypothesize that,

H1b. Technical IT capability has a positive impact on business process agility.

Business process reengineering is a strategic action and needs a strong understanding of customers, industry, market, and competitive status. Moreover, it requires consistency between the company's business strategy and vision. Managerial Information Technology capability can help firms guide uncertainty, match customer expectations and drive efficiency. Managerial IT capability will not be realized if it does not sync with Technical IT capability and the business processes designed on capabilities (Kim et al, 2011; Sabherwal et al, 2019). IT capability influences the design of business processes and vice versa. There are a number of factors that influence business process design. IT capabilities, whether it is managerial IT capability or the technical IT capability, is one of the important factors influencing business process and fit of the process to drive corporate objectives (Seth et al, 2019). To examine the relationship between IT capabilities and business process reengineering, the following hypotheses are proposed,

H1c. Managerial IT capability has a positive impact on business process design.
H1d. Technical IT capability has a positive impact on business process design.

Closely linked to business processes is process efficiency. Process efficiency is a key factor that can affect the accomplishment of the business objectives (Seth et al, 2019). One of the main reasons for IT adoption is to increase efficiencies, efficiencies and associated benefits can be seen in customer satisfaction, increase in profitability, cost savings and better competitive advantage (Seth et al, 2019). Both managerial and IT capability influence the business process efficiency and hence we propose that

H1e. Managerial IT capability has a positive impact on business process efficiency.
H1f. Technical IT capability has a positive impact on business process efficiency.

2.2.2. Business process and firm's performance

Literature has noted the influence of business process on firm performance (Kim et al, 2011). However, some researchers believe that business agility can benefit firm's performance when it meets a particular condition, such as significant change of environments or instant need of changing the process chain (Chakravarthy et al, 2013). The impact on the performance of the agility may not be reflected during the current period. But it will convert into financial performance in the following year. Business process reengineering can simplify business process by removing non-value added steps, and this can improve efficiency of production and services for customers (Bhaskar, 2018). Moreover, simplification can improve monitoring capabilities in quality management aspects. Firstly, it can improve responsiveness. Secondly, it can reduce costs and complete elimination waste, reduce rejection rates and improve customer satisfaction (Bhaskar, 2018). Business process agility, re-engineering and efficiency leads to overall benefits to the firm and contributes towards achievement of key performance indicators and overall firm performance (Bhaskar, 2018). In the context of IT capability, business processes and firm performance, we state the following hypotheses,

H2a. Business process agility has a positive impact on firm's performance.
H2b. Business process reengineering has a positive impact on firm's performance.
H2c. Business process efficiency has a positive impact on firm's performance.

2.2.3. IT capabilities and firm's performance

To compare the effects on business process between IT capabilities and firm's performance, the direct link between IT capabilities and firm's performance is necessary (See H3+ in Figure 1). Both managerial and technical IT capability can improve firm performance (Chae et al, 2016). Managerial IT capability can lead to better utilization of IT and non-IT resources and improve efficiencies and

overall firm performance. Technical IT capability can help in reducing costs and contribute towards agility and better customer satisfaction. IT capability can also timely information flows that can allow better decision making and proactively shape the market (Chae et al, 2018). Timely information allows executives to have more options on decision making for exploring an enterprise's direction of the future development. Both high revenue and low cost are the significant symbol reflecting good performance. So, it is likely that IT capability can influence firm's performance. Hence,

H3a. Managerial IT capability has a positive impact on firm's performance.
H3b. Technical IT capability has a positive impact on firm's performance.

3. Research Method

The target population of this study includes managers from medium to large organizations[1]. The firms were chosen because it is assumed that IT contributes significantly to improve the effectiveness of their business and are likely to be most informed about issues pertaining to IT usage in firms. The firms were randomly selected from FAME database and an online questionnaire was used to collect from managers of the firms. The invitation to the questionnaire was sent via an email link to managers in 1,523 medium-large size firms randomly selected from FAME. A total of 117 responses were received noting a response rate of 7.6 %. For the responded companies, secondary data in the form of financial statements were also collected from the database. Data was collected from 2011-2016 and financial ratios including ROCE was calculated using the financial statements and the data was cleaned to address any missing variables.

The questionnaire had 63 items. The items are adopted from Ross, Beath, and Goodhue (1995), Ravichandran and Lertwongsatien (2005), but primarily based on a study by Tallon (2007). Questions related to business reengineering are mainly from Attaran (2003), while business agility are from Tallon (2007). For the scales of efficiency, this research refers to Saeed, Malhotra, and Grover (2005). A Seven-point A seven point Likert scale was adopted to measure the dimensions, 16 items to measure technical IT capability, 18 items to measure managerial IT capability, while 15 items were used to measure business process reengineering, 11 items to measure business process agility, and 3 items used to measure business efficiency.

3.1 Control variables

Age, industry, and size are used as the main control variables to limit the efforts of IT capabilities. Specifically, size control variable is aimed at removing the scale differences. For example, large companies have the resources to implement IT infrastructure and train qualified IT staff. However, small to medium firms can only implement and develop parts of IT capabilities as a starting point. They are aimed at earning more money first, and then developing the IT capabilities next. For the industry control variable, its function is mainly focused on removing the industrial degree differences in implementing IT capabilities. For the manufacturing and wholesale industries, a high level of IT capabilities, especially technical IT capability can dramatically improve the efficiency of working process and save labor cost. However, in the service-provided companies, the main value-added part is processed by the experienced staff and professional knowledge, what may not be easily improved by IT capabilities. The supporters of defining, age as a key control variable insist that business experience has an invisible impact on each transformation of business type. Experienced companies can afford more risks and get more opportunities than the other newly established companies.

[1] UK definition of large and medium sized firms is used in this paper. Firms with more than 250 employees and a turnover of more than £25m. Medium sized firms are 50-250 employees.

4. Results and Discussion

Table 1 describes the sample characteristics from the survey. We can see that the group with capital assets of 500 million pounds – 1 billion pounds accounts for the majority of the responded sample. The figure reaches the surprising 46.2 percent, followed by the companies with capital assets over 250 million but less than 500 million pounds, accounting for 18.8 percent. Companies with their capital assets at 100 – 250 million and 1 – 2 billion take up similar percentages of 11.9 and 11.1 percent respectively. The minorities of respondents have their capital assets less than 100 million and more than 2 billion, accounting for 4.2 and 6.8 percent respectively.

Table 1: Sample Characteristics (N=117).

Capital Assets (2011)	**Frequency**	**Percent**
Less than £100 million (M)	5	4.2
£100 M - £250 M	14	11.9
£250 M - £500 M	22	18.8
£500 M - £1 billion (B)	54	46.2
£1 B - £2 B	13	11.1
More than £2 B	8	6.8
Industry Categories		
Wholesale and Retail	23	19.7
Financial Services	20	17.1
Software Services	17	14.5
Electronics and Computer Machinery	19	16.2
Pharmaceuticals and Health Care	16	13.7
Other	22	18.8
Age		
Less than 5 years	13	11.1
5 years – 10 years	28	23.9
10 years – 20 years	59	50.4
More than 20 years	18	15.6

Analyzing the responses from an industry perspective, most responses are from firms in wholesale and retail industry, accounting for 19.7 %. It is followed by financial services, and electronics and computer machinery industries at 17.2 % and 16.1 % respectively. Numbers of replies from health care and software sectors are quite similar with the previous two groups, with the 16 and 17 responses each. Other industries constituted at 18.8 %, while age distribution of the respondent firms noted that the highest proportion of firms were in the age range of 10-20 years.

4.2. Construct Validation

This research uses PLS (Partial Least Squares) method to validate constructs adopted in the questionnaires. Confirmatory analysis was done to validate the constructs, table 2 states the constructs and their code used in factor analysis. It includes the construction of managerial IT capability (12 items), technical IT capability (18 items), business process reengineering (15 items), business process agility (8 items), and business process efficiency (3 items).

Table 2: Research construct and indicators.

Indicators/Constructs	Description
MITC	**Managerial IT capability**
ITBC	IT-business cooperation
REV	Post-implementation reviews
SPIT	Strategic plans for IT use
TITC	**Technical IT capability**
ITS	IT skills adaptability
NC	Network connection
HD	Hardware compatibility
SW	Software compatibility
BPR	**Business process reengineering**
PIT	Process improvement trust
CF	Customer focus
BPA	**Business process agility**
BPA	Business process agility
BPE	**Business process efficiency**
BE	Business efficiency
FP	**Firm's performance**
ROCE	Return of capital employed

After establishing the factor structure in AMOS software, indicator loadings were given the right place under the constructs structure. Consequently, we estimated figures indicating the representativeness of the factor, along with the standard error, critical ratio and significance value (Table 3). In order to identify the model, some coefficients have been fixed as 1.00 in the model (e.g., the path from managerial IT capability to IT-business cooperation 1). Table 3 also shows the coefficient of the standard error of the path, along with the critical ratios. "CR" is considered as the estimated value of the regression coefficient divided by its standard error (0.857 / 0.105 = 8.202), and the critical ratio is relevant with the original hypotheses. In this study, the regression coefficient of the original hypothesis is 0. If we deal with the approximate standard normal random variable at the significance level of 0.05, the absolute value of the critical ratio more than 1.96 indicates significant relevance. So, the critical ratios of all the indicators listed in table are over 1.96, meaning that these regression coefficients, when standing at the 0.05 level, are significantly not equal to 0. The P value is aimed at identifying significant level to test the null hypothesis. In Table 3, all the items, excluding the factors for model identification, are given the P value less than 0.001, which means the indicators can well represent and describe those independent and dependent variables.

Table 3: Confirmatory Factor Analysis.

Indicators	**<---**	**Constructs**	**Estimate**	**S.E.**	**C.R.**	**P**
ITBC1	<---	MITC	1.000			
ITBC2	<---	MITC	.857	.105	8.202	***
ITBC3	<---	MITC	.742	.100	7.455	***
ITBC4	<---	MITC	.660	.090	7.351	***
ITBC5	<---	MITC	.826	.102	8.121	***
REV1	<---	MITC	.903	.099	9.110	***
REV2	<---	MITC	.711	.102	6.952	***

REV3	<---	MITC	.938	.105	8.938	***
SPIT1	<---	MITC	1.068	.107	9.985	***
SPIT2	<---	MITC	.737	.102	7.221	***
SPIT3	<---	MITC	.709	.106	6.682	***
SPIT4	<---	MITC	.726	.106	7.008	***
ITS1	<---	TITC	1.000			
ITS2	<---	TITC	.983	.130	7.592	***
ITS3	<---	TITC	.757	.111	6.822	***
ITS4	<---	TITC	.791	.131	6.037	***
NC1	<---	TITC	1.023	.128	8.008	***
NC2	<---	TITC	.844	.113	7.482	***
NC3	<---	TITC	.801	.111	7.242	***
NC4	<---	TITC	.898	.124	7.269	***
SW1	<---	TITC	.935	.123	7.620	***
SW2	<---	TITC	1.031	.123	8.402	***
SW3	<---	TITC	.867	.115	7.547	***
SW4	<---	TITC	.994	.125	7.940	***
HD1	<---	TITC	.911	.112	8.149	***
HD2	<---	TITC	.745	.107	6.956	***
HD3	<---	TITC	.729	.110	6.606	***
HD4	<---	TITC	.875	.115	7.618	***
PIT1	<---	BPR	1.000			
PIT2	<---	BPR	1.107	.123	9.008	***
PIT3	<---	BPR	1.076	.119	9.053	***
PIT4	<---	BPR	.632	.120	5.273	***
PIT5	<---	BPR	.782	.127	6.179	***
PIT6	<---	BPR	.668	.132	5.069	***
PIT7	<---	BPR	1.127	.117	9.642	***
PIT8	<---	BPR	1.143	.121	9.447	***
CF1	<---	BPR	1.133	.135	8.380	***
CF2	<---	BPR	.986	.115	8.568	***
CF3	<---	BPR	1.212	.134	9.027	***
CF4	<---	BPR	1.204	.134	8.950	***
CF5	<---	BPR	1.029	.123	8.378	***
CF6	<---	BPR	1.238	.129	9.637	***
CF7	<---	BPR	1.105	.118	9.375	***
BPA1	<---	BPA	1.000			
BPA2	<---	BPA	.961	.175	5.504	***
BPA3	<---	BPA	1.295	.178	7.283	***
BPA4	<---	BPA	.794	.139	5.701	***
BPA5	<---	BPA	1.217	.199	6.116	***
BPA6	<---	BPA	1.136	.166	6.836	***
BPA7	<---	BPA	1.063	.162	6.545	***
BPA8	<---	BPA	1.118	.170	6.565	***
BE1	<---	BE	1.000			

BE2	<---	BE	.945	.118	8.011	***
BE3	<---	BE	.848	.114	7.450	***

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

4.3. Model Estimation

The main hypotheses in this paper can be divided into three,

H1+: IT capabilities have a positive impact on the business process
H2+: business process has a positive impact on firm's performance
H3+: IT capabilities have a positive impact on firm's performance (examining the mediating effect of business process)

In the relationship between IT capabilities and business process the relationship contains multiple independent variables and multiple dependent variables. Based on this, we created a second order factor for IT capability comprising two first order constructs: managerial IT capability and technical IT capability, and business process, three first order factors of which were: business process reengineering, business process agility, and business process efficiency. In order to establish a second order factor, we created a weighted average for all first order factors in each firm as the PLS graph model weights and standardized factor measures, by considering all other items to create a single score for each factor. The result after the PLS second order factor loadings is shown in Table 4. All the second order factors are significantly representing their first order factor at the P value level, equal to 0.001. Standard errors are shown in parentheses and the control variables for industry sector – firm age and size – were insignificant.

Table 4: Second Order Factor Loadings.

IT Capabilities	N=117
Managerial IT Capabilities	0.853***
Technical IT Capabilities	0.773***
Business Process	
Business process reengineering	0.877***
Business process agility	0.877***
Business process efficiency	0.916***
Variance Explained : R^2	
IT Capabilities	41.2
Business Process	55.8

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

According to the model and hypotheses stated in H1a, H1c, H1e, managerial IT capability is considered the independent variable, and business process reengineering, business process agility and business process efficiency are regarded as dependent variables. Next, we put the independent variables and dependent variables into the regression analysis grouped by hypothesis in the model net link. Table 5 notes the results of the regression analysis. Managerial IT capability is strongly significant level of 0.000 on process reengineering. This is followed by 0.006 significant level of process agility and 0.037 general significant level of process efficiency. The result supports the prior hypotheses: H1a, H1c, and H1e.

Table 5: The effect of managerial IT capability on business process reengineering, agility and efficiency.

Dependent variables	Standardised coefficients beta	Sig. (p-value)	R-squared
Process reengineering	0.342	0.000	0.375
Process agility	0.298	0.006	0.153
Process efficiency	0.173	0.037	0.097

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

Next, the relationship between technical IT capability and business process is examined through the regression analysis. The result is displayed in Table 6.

Table 6: The effect of technical IT capability on business process reengineering, agility and efficiency.

Dependent variables	Standardized coefficients beta	Sig. (p-value)	R-squared
Process reengineering	0.229	0.055	0.083
Process agility	0.178	0.032	0.102
Process efficiency	0.376	0.004	0.204

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

In this model, technical IT capability is considered an independent variable. Meanwhile, the process reengineering, process agility and process efficiency are regarded as dependent variables. Examining the significance values, we can notice that process agility and process efficiency are significant, noting that only H1d and H1f are supported. Next, the relationships between managerial IT capability, technical IT capability and firm's performance is examined through the regression analysis. The results are displayed in Table 7.

Table 7: The effects of managerial and technical IT capabilities on firm's performance.

Independent variables	Standardised coefficients beta	Sig. (p-value)
Managerial IT capability	0.167	0.053
Technical IT capability	0.245	0.038
Notes: R-squared = 0.234		

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

This model is mainly focused on the examination of the relationship between IT capabilities and firm's performance. IT and managerial capability are independent variables, while firm performance is dependent variable. The model notes that the managerial IT capability is insignificant in comparison with IT technical capability, thus supporting hypotheses H3b. H3a is not supported in the analysis with model net link.

Table 8 highlights the relationship between business process and firm performance. Firm performance is the dependent variables, while re-engineering, agility and efficiency are independent variables.

Table 8: The effects of business process reengineering, agility and efficiency on firm's performance.

Independent variables	Standardized coefficients beta	Sig. (p-value)
Business process reengineering	0.156	0.004
Business process agility	0.122	0.063
Business process efficiency	0.343	0.000
Notes: R-squared = 0.646		

Significance: ns: not significant * p<0.05 ** p<0.01 *** p<0.001

In terms of significance, both process re-engineering and process agility are significant at less than 0.05 p value. However, the p-value of process agility is over 0.05, which means that positive effect on firm's performance is insignificant. Given this, only H2a and H2c are supported.

In the final analysis, the mediating effects of business process on the relationship between IT capabilities and firm's performance is studied. Here, the relationship between IT capabilities and firm's performance is examined in a direct link without influencing business process. The regression result is shown in Table 9:

Table 9: Effects of managerial and technical IT capabilities on firm's performance without the mediate business process.

Independent variables	Standardized coefficients beta	Sig. (p-value)
Managerial IT capability	0.227	0.034
Technical IT capability	0.308	0.032
Notes: R-squared = 0.371		

From table 9, we can note that both managerial and technical IT capabilities have significant effect on firm's performance, this is different from previous analysis with the mediating effect. By checking the regression result of the analyses above, the available mediating paths for mediation is listed below:

(i) Managerial IT capability ---> Process reengineering ---> Firm's performance
(ii) Managerial IT capability ---> Process efficiency ---> Firm's performance
(iii) Technical IT capability ---> Process efficiency ---> Firm's performance

From Table 7, the p-value of managerial IT capability is not significant, noting that the mediating variables like process re-engineering and process efficiency have contributed to firm's performance than managerial IT capability. In path (i) and (ii), the mediating effect is significant, however, when it comes to path (iii), there is a partial mediation effect. Technical IT capability has impact on firm's performance (table 7). In path (iii), the standard coefficient a between technical IT capability and process efficiency is 0.376, (table 6), and the coefficient between process efficiency and firm's performance is 0.343, (table 8). Also, the direct coefficient between technical IT capability and firm's performance is 0.308 (table 9). The mediating effect accounts for 0.376 * 0.343/0.308 = 41.8% of the total effect.

Summarizing, this study investigates the influence of IT capabilities on firm's performance. IT capabilities can be divided into two types: managerial IT capability and technical IT capability. These

two dimensions are the core components of IT capabilities in the academic studies. The higher these dimensions are, the more positive firm's performance is, as stated in the hypothesis H3+. However, in practice, things can be different. Indirect relationship can play a role and it is noted that some mediating factor exists between IT capabilities and firm's performance. This study introduces business process as the mediate variable. The study explores, three business process dimensions have an influence on firm's performance as stated in the hypothesis H2+ of this study. Furthermore, the effect of IT capabilities on each dimension of business process was analyzed in this research. Firstly, it is found that business process reengineering, business process agility and business efficiency are affected by managerial IT capability significantly and positively. Secondly, technical IT capability analysis was conducted subsequently. The result shows that the coefficients of business process agility and efficiency are positive and significant. However, the result rejects the hypothesis H1b, as there is no significant relationship between technical IT capability and BPR. Also, as stated in the model, the definition of business process reengineering is focused on the process improvement and optimization. Infrastructure and human resource cannot easily guide the development of the process. Thirdly, the relationship between business process and firm's performance is examined and it is revealed to be positive. Hence, it can be inferred that process as the value-added core part of business will reasonably induce positively effect on firm's performance.

Mediating analysis is the final analysis part of this article. We conducted mediating analysis to test the relationship between IT capabilities and firm's performance with the mediators, i.e., business process's dimensions, namely business process reengineering (BPR), business process agility and business process efficiency. The impact of technical IT capability on BPR is insignificant. While result notes that BPR and business process efficiency have significant mediation effects between managerial IT capability and firm's performance. Additionally, the result of mediation analysis also indicates that effect of business process efficiency between technical IT capability and firm's performance is partially significant. Unlike managerial IT capability, technical IT capability can directly contribute to the performance, in line with the previous analysis done in this area (e.g., Mata et al. (1995,). IT technical capability has positive impact of IT infrastructure on firm's profit.

5. Conclusion

This research explores the relationship among managerial, technical IT capability, business process reengineering, business process agility, business process efficiency, and firm's performance. The conceptual framework references Tallon (2000), and relies on methodology given by Bhatt (2000). Both primary and secondary data was collected with confirmatory factor analysis and model estimation used to analyze data. The findings of this research can be concluded as follows,

- IT capabilities affect firm's performance significantly and positively. However, there is a mediate effect in this relationship.
- IT capabilities can effect most of business process dimensions significantly and positively, excluding the relationship between technical IT capability and business process reengineering.
- Only two dimensions of business processes which are BPR and process efficiency influence firm's performance.
- The mediate effects of BPR and BPE are completely significant in the relationship between managerial IT capability and firm's performance; mediate effects of BPE are partially significant in the relationship between technical IT capability and firm's performance.

Following the results of the analysis, business executives in organizations and decision makers in IT related industries could improve their performance through business process dimensions. Business process reengineering and business process efficiency have significant mediating effect on the relationship between managerial IT capability and firm's performance. If executives develop their managerial IT capability, they can emphasize on improving business process reengineering and

efficiency. These efforts will help them to increase performance. However, if executives develop their technical IT capability, they can still increase their performance by emphasizing on business process efficiency.

The study is not without its deficiencies, i.e., there are several limitations within this research. Firstly, this study examined only firms headquartered in United Kingdom. The results cannot be generalized to a wider population of firms. Next, the sample in this research got only 117 responses from 1,523 attempts. The response rate is relatively low. In terms of the complexity of the model in this study, the number of responses is very small. Also, financial performance is not suitable for the analysis of agility efforts as we did in our model. Either loosing this dimension or adding more appropriate dimensions, the results could be different. Recommendations for further research are based on the limitation of this study. Future research should include other countries or diversified environment. Then, the difference of cultures could emerge through the perception of companies from various countries. Studies in the future should gather a larger sample for more responses, especially when the model is complex. Additionally, the variable for non-financial performance could be used to develop other models in the future. Finally, multiple year data collection is recommended for further research since data collected in the current year may not represent the true situation of the companies-respondents.

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