Linking Knowledge Creating Capabilities, IT Business Value and Digital Business Value: An Exploratory Study in Japanese SMEs

Christian Riera[1] and Junichi Iijima[2]
[1]*Department of Industrial Engineering and Management, Tokyo Institute of Technology, Ookayama 2-12-1-W9-66, Meguro, Tokyo, Japan*
[2]*Department of Industrial Engineering and Economics, Tokyo Institute of Technology, Ookayama 2-12-1-W9-66, Meguro, Tokyo, Japan*

Keywords: Knowledge Creating Capabilities, Balanced SECI, Digital Business Value, IT Business Value.

Abstract: Aiming to address the increasing focus on digital technologies and the continuous concern of Knowledge Management (KM) performance, this study explores the relationship between 'Knowledge Creating Capabilities', 'IT business value' and 'Digital business value'. The latter two concepts are re-defined as the achievement of business objectives by the use of IT or digital technologies in a balanced scorecard approach. The concepts of 'Knowledge Creating Capabilities' and 'Balanced SECI' are leveraged. Balanced SECI (Riera, Senoo and Iijima, 2009) refers to the balance of the four knowledge creation processes from Nonaka and Takeuchi's SECI model (1995). This framework is applied to Japanese small and medium enterprises. A positive relationship between the achievement of business objectives by IT and the achievement using digital technologies was verified. On the other hand, although a relationship of 'Balanced SECI' with 'IT Business Value' or 'Digital Business Value' was not statistically significant; the observations showed that higher levels of 'Balanced SECI' were negatively related to the achievement of Financial, Customer and Business Processes types of business objectives and; positively related to Learning & Growth. Analysis from each SECI process confirmed such behaviour.

1 INTRODUCTION

The increasing focus on Digitalization and digital technologies, and in particular on how to gain a competitive advantage is currently being actively explored (Ross et al., 2016). These efforts aim to facilitate the companies' journeys onto Digital Transformation. As mentioned by Ross et al. (2016), digital technologies like the ones in SMACIT (social, mobile, analytics, cloud and Internet of Things) are currently available in the marketplace. Therefore replication of the use of such technologies may not sustain competitive advantage (Carr cited in Ross et al.; Piccoli et al. cited in Ross et al., 2016). Also the same study identified key elements that the established players use to leverage the digital technologies and integrate with the firm's capabilities and components such as digital strategy, operational backbone and digital services backbone become the key to successfully leverage the opportunities of digital technologies (Ross et al., 2016). This study also considers digital technologies as part of the Digital Transformation but the real transformation relies on the interaction with the capabilities that already exist in the firm.

As classified by Chen and Chen (2006), in the early years the evaluation of KM was approached from perspectives like: qualitative, quantitative, internal/external performance, and project/ organizational-oriented; while recently the research mainly used the quantitative approach.

The Knowledge-based view considers knowledge as a strategic asset of firms (Grant, 1996) and one of the motivations for a firm to manage knowledge is the business performance improvement (Choi and Lee, 2003). Almost all the different definitions of the KM processes acknowledge some form of Knowledge Creation (Benbya, Passiante and Belbaly, 2004; Chen and Chen, 2006; Davenport and Prusak, 2000).

The Knowledge creation process is also recognized as one of the most important strategic assets of the firm (Dierickx and Cool, 1989; Leonard-Barton, 1992; Conner and Prahalad, 1996;

Riera C. and Iijima J.
Linking Knowledge Creating Capabilities, IT Business Value and Digital Business Value: An Exploratory Study in Japanese SMEs.
DOI: 10.5220/0006487900290040
In *Proceedings of the 9th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (KMIS 2017)*, pages 29-40
ISBN: 978-989-758-273-8

Grant, 1996 cited in Lewin and Massini, 2004). This study follows the same research path and is aligned with other studies which are focused on the Knowledge Creation Process (Choi and Lee, 2002; Chou, 2005).

In terms of Knowledge Creation theory, Nonaka and Takeuchi (1995) acknowledged tacit and explicit knowledge types and their interaction and transformation as key components of their knowledge creation process under the name of 'SECI Model'.

This study leverages the concept of 'Balanced SECI' as a measurement of 'Knowledge Creating Capabilities' (Riera, Senoo and Iijima, 2009). The concept considers that a bottleneck in the knowledge creation process may appear if a firm is over-focused or has a lack-of focus on a particular SECI process. It also identified a positive relationship between Balanced SECI level and financial performance.

Finally, there is extensive research that addresses the concern of the IT effect on firm performance. This concern officially started when the term IT Productivity Paradox was coined in 1987 at the time the economist Robert Solow mentioned that the computer age could be seen everywhere except in the productivity statistics (Brynjolfsson and Hitt, 1998). Together with the development of IT, researchers have also changed their approach to this phenomenon. Initially the analysis considered the IT investment first independently in the form of IT assets, Weill and Aral defined IT assets into categories and found specific relationship between certain types of assets with specific benefits (Weill and Aral, 2007). Later on new theories emerged and examined the business processes associated with the IT utilization (Sandulli et al., 2007).

Subsequently, the research focused on organizational characteristics. Overall the results have not been conclusive. Only some found a positive relationship between IT and firm performance.

This study is aligned with other studies focusing on the critical capabilities of the firms in the search to unveil how IT enhances firm performance (Weill and Aral, 2007; Brynjolfsson and Hitt, 1998).

Since the business value from IT has been extensively analyzed, with the availability of digital technologies it can be foreseen that similar concerns will arise in the near future.

Acknowledging the individuality of each firm to define and pursue its own goals; this study uses a well known classification of business objectives defined by the Balanced Scorecard (Kaplan and Norton, 1996). It uses these to inquire the firms in which type of business objectives the IT and digital technologies were put into practice; while it inquires also about the contribution obtained from IT and digital technologies. This is not the first time that the Balanced Scorecard concept has been linked with KM (Cabrita, Machado and Grilo, 2010), however no studies have tested the Balanced SECI concept against the achievement of business goals.

In a nutshell, this study contributes to the literature of KM performance measurement by using Balanced SECI and considering that each firm pursues its own objectives, while at the same time inquiring on the level of achievement by the use of IT and digital technologies, -defined as IT and Digital Business Value.

The rest of the paper is organized as follows. Section 2 presents the theoretical background. Section 3 explains the framework and hypotheses. Section 4 describes the data and metrics. The analysis and findings are included on Section 5. A discussion is included on Section 6, while the conclusions are addressed in Section 7.

2 THEORETICAL BACKGROUND

2.1 Knowledge Creating Capabilities

Over the years academia and scholars have studied and developed several concepts with the aim to explain how competitive advantage can be achieved and sustained. It starts with the resource-based view that considers that the organization is a collection of resources (Amit and Shoemaker, 1993) and suggests that competitive advantage can be achieved when an organization is able to develop difficult-to-imitate resources (Barney, 1986).

Later on, recognizing the dynamic nature of the market and its changes over time, the concept of Dynamic Capabilities was developed. This concept states the need that the firm's resources need to change over a period of time to keep them relevant (Teece and Pisano, 1997). Researchers (Grant, 1996) explain that dynamic capabilities are the foundation that makes managers acquire and combine resources in order to generate value-creating strategies. To make the difference clear between Resources and Capabilities the academia (Amit and Schoemaker, 1993) defined that resources are converted into final products or services, while capabilities enable a firm to deploy resources, using organizational processes to achieve a desired end.

The knowledge-based view considers the knowledge as the most important resource for a firm. Within the phases of KM, the knowledge creation and integration phases were considered the most important assets of the firm from a strategical point of view (Lewin and Massini, 2004).

A very important work in the area of knowledge was done by Nonaka and Takeuchi (1995). They introduced the SECI Model as a model of knowledge creation process to understand the dynamic nature of knowledge creation, and to manage such a process effectively. They suggested that the most important aspect of understanding a firm's capabilities in terms of knowledge is the dynamic capability to continuously create new knowledge out of existing firm-specific capabilities, rather than the stock of knowledge that a firm possesses at one point in time (Nonaka, Toyama and Takeuchi, 2000).

The concept of Balanced SECI (Riera, Senoo and Iijima, 2009) was developed as a measure of Knowledge Creating Capabilities (KCC) and considers that there could be bottlenecks in the process of knowledge creation when a firm is either over-focused or has a lack-of focus in one of the four processes of the SECI Model. Previously Balanced SECI score has been linked with two specific financial measures (Riera, Senoo and Iijima, 2009). This study also aims to expand the literature on Balanced SECI by determining if there is a relationship with the overall firm objective achievement accomplished by the use of IT or digital technologies in the categories provided by the Balanced Scorecard.

2.2 Business Value from IT

Decades of studies have been dedicated to exploring the effects of IT on firm performance. This phenomenon is known as the "IT Productivity Paradox". Earlier studies found inconclusive results, however as the research developed and started to consider other firm characteristics as complements to IT the results were more optimistic. Table 1 is adapted from an existing study (Dedrick, Gurbaxani and Kraemer, 2003) and shows major researches on the topic. This research is consistent with studies considering that the IT impact on firm performance requires an analysis performed together with firm capabilities such as the ones on the bottom section of Table 1.

IT Business Value has become a term which usually refers to the same concept as the IT Productivity Paradox but with a more positive perception in particular on the industry side. In this study the definition of IT Business Value came from the application of a concept found in the literature relevant to IT maturity where IT Business Value is defined as the contribution that IT resources and capabilities make to help an organization achieve its objectives (Curley, 2004 cited in Innovation Value Institute, 2016).

Table 1: Key studies exploring IT, firm performance and other firm capabilities (adapted from Dedrick, Gurbaxani and Kraemer, 2003).

Study	Findings
Relationship among IT and firm performance	
Mahmood M.A. et al. (1993), Weill (1992), Wilson (1993), Loveman (1994)	None or Negative
Weill (1992), Wilson (1993), Loveman (1994), Brynjolfsson and Hitt (1995), Brynjolfsson and Hitt (1996), Hitt and Brynjolfsson (1996), Brynjolfsson et al.(1998), Greenan et al. (2001)	Positive
IT, firm performance and other firm capabilities	
Bresnahan et al. (2002), Brynjolfsson et al. (1998), Ramirez et al.(2001), Francalanci and Galal (1998), Devaraj and Kohli (2002),Tallon et al. (2000), Weill et al. (2004, 2005)	Positive

2.3 Business Value from Digital Technologies

The development and availability of digital technologies like social, mobile, analytics, cloud and Internet of Things bring opportunities as well as threats for established companies (Ross et al., 2016).

The definition of Digital Business Value is derived in a similar way than the definition of IT Business value and it is described as the contribution that digital technologies make to help an organization achieve its objectives.

3 FRAMEWORK AND HYPOTHESES

This study explores the relationship between Knowledge Creating Capabilities on one side, and the business value of IT and digital technologies measured as the level of achievement of 4 types of business objectives on the other side. The model is described in Figure 1.

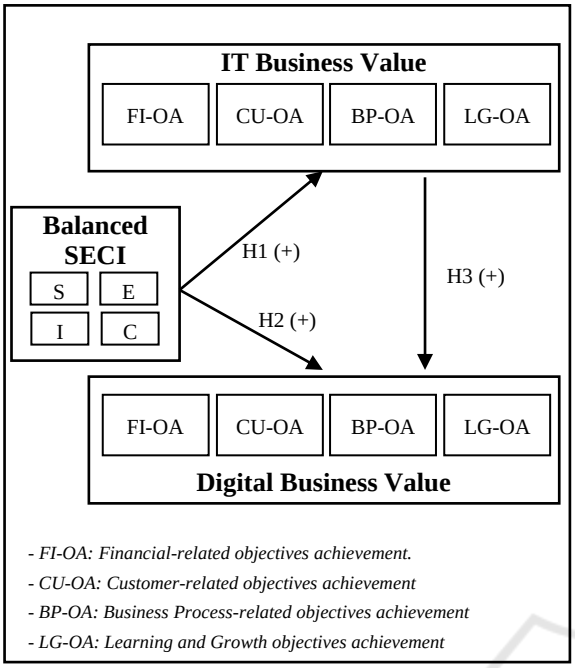

Figure 1: Main Framework and Hypotheses.

The main hypothesis in this study is defined as: "Knowledge Creating Capabilities, IT Business and Digital Business Value are positively related". The detailed hypotheses are:

- H1: Knowledge Creating Capabilities are present in firms that achieve business value from IT (IT Business Value).
- H2: Knowledge Creating Capabilities are present in firms that achieve business value from digital Technologies (Digital Business Value).
- H3: the firms' objectives achieved by using digital technologies (Digital Business Value) are supported by the level of achievement in IT (IT Business Value).

4 DATA AND MEASURES

An empirical analysis is used in order to validate these three hypotheses. This is aligned with studies that evaluated KM based on firm performance (Choi and Lee, 2002) as well as with the literature on IT and firm performance (Weill, 1992; Weill and Aral, 2007).

4.1 Target Population

This study focuses on Japanese SMEs that have been selected by the Japanese Ministry of Economy, Trade and Industry (METI, 2016a) in the list of "Competitive IT Strategy SME Selection 100" from 2015 and 2016. The companies corresponding to the year 2017 were not published at the time this study was closed. The companies in this list are selected due to their record of effective utilization of IT and demonstrated good business performance.

This particular group of companies were selected as the target population since this study aims to clarify the relationship between Knowledge Creating Capabilities, IT Business Value and Digital Business Value. The characteristic of business achievement by the use of IT is already verified by METI and therefore, it makes these companies worth analyzing in order to validate the hypotheses. Furthermore, earlier studies have leveraged similar groups as target population (Hirano, 2005; Riera, Senoo and Iijima, 2009).

Nevertheless, it is important to justify the focus on Small and Medium Enterprises (SME) that this study addressed and the particular characteristics and context of SMEs. The relevance of SMEs in the Japanese economy is reported by the Ministry of Economy, Trade and Industry. They account for 99.7% of all enterprises and approximately 55% of gross value-add across the Japanese economy (Small and Medium Enterprise Agency, 2016). Due to their importance there is a need for SMEs to understand how to use IT and digital technologies in order to remain competitive.

The industry composition of the 60 companies in the target population is as follows: 25.0% Manufacturing, 11.7% Retail, 10.0% Services, 8.3% Wholesale, 6.7% Information & Communication, 6.7% Construction, 5.0% Printing, 5.0% Other, 3.3% Transportation, and with 1.7%: Wholesale and retail trade, Other (nursing care), Accommodation, Retail / Nursing care, Gravel sampling, Other (dental), Agriculture, Food & Beverage, Real Estate, Information service and Manufacturing and Agriculture.

4.2 Measuring Knowledge Creating Capabilities (KCC)

Consistent with similar studies that explored Knowledge Creating Capabilities as Organizational Characteristics in an SME context (Riera, Senoo and Iijima, 2009), 'Balanced SECI', was used to measure Knowledge Creating Capabilities (KCC). This was captured with a questionnaire that listed six items or behaviours related to each of the four SECI Model processes. Firms were requested to select 12 out of 24 behaviours that most reflected their

employees' behaviours. The content came from literature review (Nonaka et al., 1994; Nonaka and Takeuchi, 1995; Nonaka, Toyama and Takeuchi, 2000). Balanced SECI as defined in Riera et al. (2009) uses the results from the questionnaire to calculate the scores in each of the SECI processes. Afterwards, the firm's Balanced SECI score is calculated as the minimum score achieved in any of the four processes. This concept tries to avoid bottlenecks in the knowledge creating process and represents the maximum level in which all the 4 SECI processes together can support the spiral of knowledge creation and convert individual knowledge into organizational knowledge which is shared and internalized by the employees. The Balanced SECI score is represented in Figure 2. A sample of the SECI survey is available in Riera et al. (2009). Using the questionnaire the highest Balanced SECI score of a firm could be from a firm that selected 4 items in each of the SECI process.

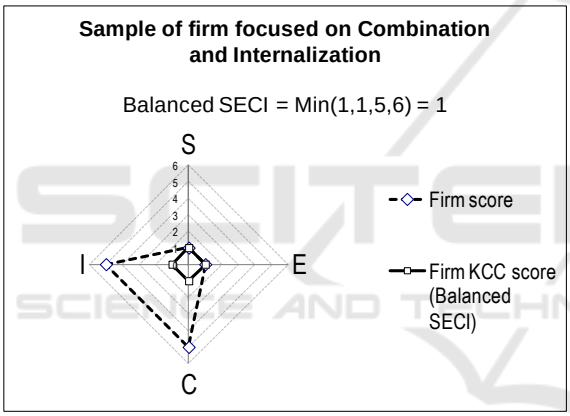

Figure 2: Balanced SECI score (sample).

4.3 Measuring IT Business Value and Digital Business Value

This study defines IT Business Value as the contribution that IT provides towards the achievement of the firms' objectives. This study requested the firms to consider the IT Investment over the last 3 years and classify it over four types of objectives: Financial (expanding revenue, improving productivity, improving the financial structure, etc.), Customer-related (improving customer satisfaction, improving customer loyalty, increasing sales to new customers, etc.), Business Process (quality improvement, productivity improvement, etc.), Learning and growth (securing human resources, human resources education, creativity, development capability, etc.) .

The 3-years consideration was done in order to minimize the impact of lagged results from IT investment as well as to consider that companies can pursue different objective types according to their strategy. For instance a more customer-driven company could invest in IT in order to increase customer experience, while another could invest focusing on fostering learning and growth to develop new services and products. Once the IT investment was classified into business objective types, then the measurement of achievement used a scale with 4 levels: Not achieved (0-15%), partially achieved (16-50%), highly achieved (51-85%) and fully achieved (86-100%).

Following a similar approach, Digital Business Value is defined as the contribution that digital technologies provide towards the achievement of a company's objectives. From the data collected during the IT inquiry, the participants were asked to specify in which type of business objectives the digital technologies were used and, the level of objective achievement they experienced for the four types of business objectives, using the same 4-level achievement scale.

A list of digital technologies with definitions was included in the questionnaire in order get responses aligned with respect to what a specific technology referred.

The responders were asked to consider these digital technologies: Mobile, Cloud technology, SNS (Social Networking Service), Big Data and Analytics, IoT (Internet of Things), Artificial Intelligence and 3D printing technology.

4.4 Data Collection

The questionnaire was distributed to the 60 companies registered mailbox address and they were requested to complete the questionnaire over a period of 2weeks. During the 2 weeks period follow up calls were done to increase the response rate.

Twenty out of the sixty companies filled-out the survey, representing a high response rate of 33%. Factors which most likely helped with this response rate could be the customized cover letter introducing the background of the study, the follow-up calls, as well as executing and closing the survey one month in advance of the busy period of fiscal year end. However the nature of the group was definitely a factor because the list was validated by METI but initiated by each company thru self-nomination. Finally a report with the summary of the initial findings was sent to the responders. The industry composition is presented on Table 2.

Table 2: Response Ratio by Industry.

Industry	Target	Received	Resp. Ratio %
Manufacturing	15	7	47
Service	6	3	50
Wholesale	5	2	40
Construction	4	2	50
Printing	3	2	67
Transportation	2	1	50
Gravel sampling	1	1	100
Other (dental technician)	1	1	100
Food & Beverage	1	1	100
**Industries with no responses not included*	*22*	*0*	*0*
Total	**60**	**20**	**33.3 %**

4.5 Reliability of the Data

As with any survey study, the data is as reliable as the reliability of the responders. This is the reason that the questionnaire was addressed to the main responsible in each company (e.g. CEO, Director). As a result the answers were filled by both business and IT, such as business managers, IT strategy representatives and CEOs. Considering that this study focuses on the business value or achievement of business objectives it is reasonable to accept this mix of responders minimizing any bias that the IT personnel may have either on purpose or per lack of knowledge.

4.6 Validity of the Data

The same instrument to measure Balanced SECI and its validity has been discussed previously (Riera, Senoo and Iijima, 2009).

In addition, studies are vulnerable to non-response and coverage errors when considering external validity. Non-response type of error happens when the subjects under study are different on a characteristic relevant to the study from the subjects which didn't participate. In order to verify this in the current study, firm size (number of FTE and number of Total employees), capital, active years were used in tests. Also as mentioned below statistically significant differences were not found between the groups of responders versus non-responders.

Coverage error occurs when the sample itself does not fully represent the characteristics of the population to which the results are to be generalized. In the case of this study the results are not to be generalized to all Japanese SMEs because of the particular characteristic of the target population which have shown effective utilization of IT enough to be nominated and selected as part of the list of "Competitive IT Strategy SME Selection 100" by the Ministry of Economy, Trade and Industry (METI) in Japan. Because of this reason the results cannot be generalized. However they can be used as a reference to understand how Knowledge creating capabilities in such companies can support the effective utilization of IT and digital technologies to achieve business objectives.

5 ANALYSIS AND FINDINGS

5.1 Relationship between KCC and IT Business Value (Firm's Objective Achievement by IT)

In order to assess this relationship, correlation analysis was done and included both parametric (Pearson) and non-parametric (Kendall's tau) tests.

The tests failed to identify a statistically significant relationship between KCC and IT business value.

Four measurements were used to explore KCC:

- SECI aggregated score result as the sum of results of each knowledge conversion process.
- Balanced SECI as the minimum score of the 4 processes in the SECI model.
- Balanced SECI based on the minimum score using proportional scale of the number of responses by each firm (i.e. some firms selected less items than the 12 requested in the questionnaire).
- Individual score of the 4 processes in the SECI model.

IT Business Value was measured as the level of objective achievement. Two criteria were explored:

- IT BV score (IT Business Value AVG)
- IT BV for each of the 4 objectives categories (financial, customer, business process, learning and growth).

5.1.1 Differences in the IT Contribution towards the Achievement of Business Objectives According to Balanced SECI Score

The firms were divided into 3 categories according to their Balanced SECI score: Low, Medium and High. Analysis of variance (ANOVA) was used in order to verify if there were differences.

Although no statistical difference was found, a small tendency could be observed where the level of business objectives' achievement decreased as the level of Balanced SECI increased for Finance, Customer, Business process objectives; but increased for Learning and Growth objectives group.

This is observed in the overall achievement score. Figure 3 shows the graph using the average score.

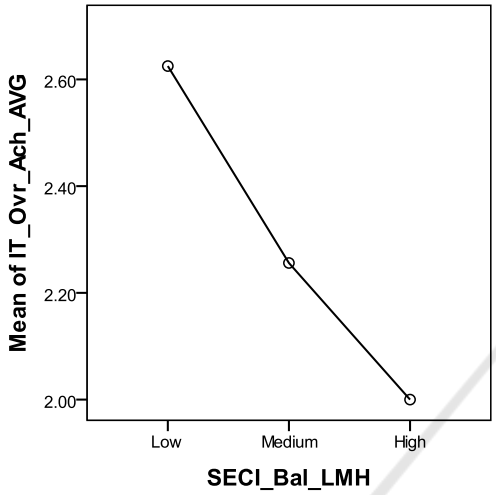

Figure 3: Differences of Achievement of Overall business objectives (average score) by IT according to Balanced SECI groups (Low, Medium and High).

Each type of business objectives is also explored, trends can be observed in Figures 4, 5, 6, 7 for each of the objective types.

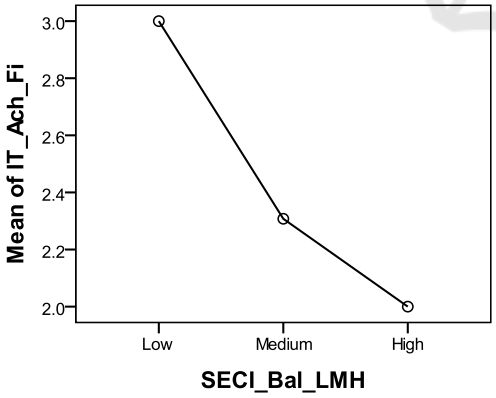

Figure 4: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Financial obj. by IT.

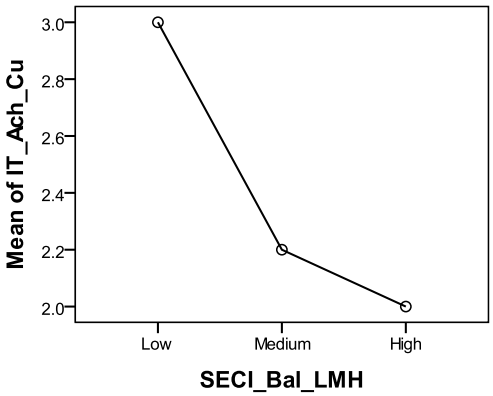

Figure 5: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Customer obj. by IT.

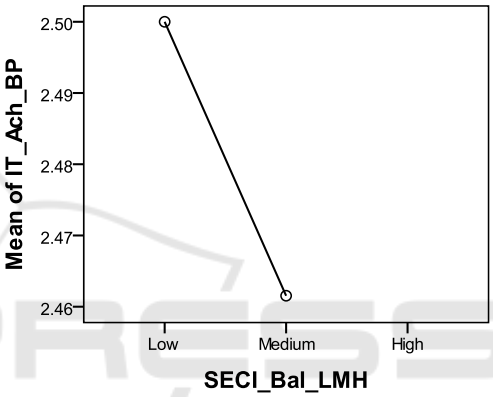

Figure 6: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Business Proc. obj. by IT.

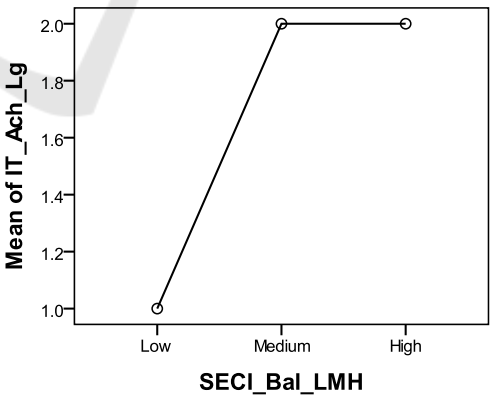

Figure 7: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Learning and Growth obj. by IT.

5.1.2 Differences in the KCC According to the Level of Achievement of Business Objective by IT

The firms were divided into 3 categories according to their Level of Achievement of business objectives: Low Achievers, Medium Achievers and High Achievers. Analysis of variance (ANOVA) was also tested in order to explore the differences.

There were no companies that fall into the category of High Achievers (i.e. full achievement of business objectives in all types) therefore these are inconclusive results. No statistically significant difference was identified between the Low and Medium achievers.

5.2 Relationship between KCC and Digital Business Value (Firm's Objective Achievement by Digital Technologies)

With similar results, this study did not find a statistically significant relationship between Knowledge Creating Capabilities and Digital Business Value.

The same four measurements were used to explore Knowledge Creating Capabilities. Digital Business Value was measured as the level of objective achievement by the use of digital technologies; similar criteria as in section 5.1 were explored.

5.2.1 Differences in the Digital Technologies' Contribution towards the Achievement of Business Objectives According to Balanced SECI Score

In the same way Knowledge Creating Capabilities and IT were analyzed in section 5.1, the categories of Low, Medium and High Balanced SECI score served to explore the group differences.

With similar non-statistically significant results, the level of business objectives achievement decreased as the level of Balanced SECI increased for Finance, Customer, Business process objectives. In contrast, it increased for Learning and Growth objective group. Figure 8 shows the results at an overall level.

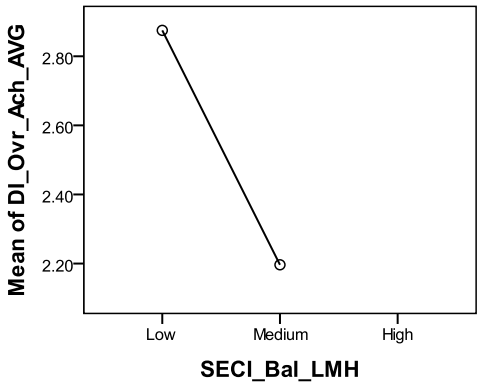

Figure 8: Differences of Achievement of Overall business objectives (average score) by digital technologies according to Balanced SECI groups (Low, Medium and High).

The view by each business objective category also shows a similar tendency and can be observed in Figures 9, 10, 11, 12.

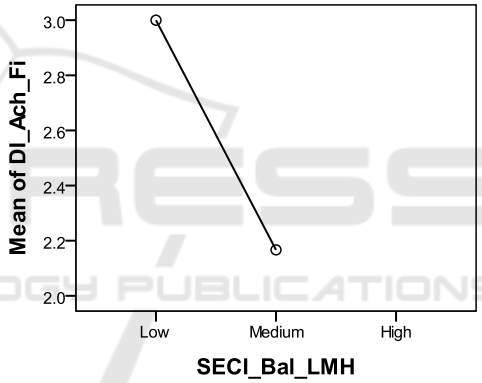

Figure 9: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Financial obj. by Digital Technologies.

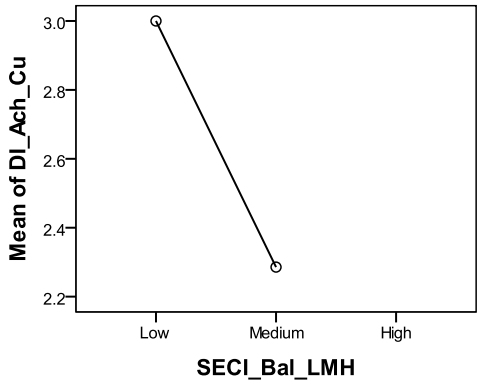

Figure 10: Differences on Balanced SECI groups (Low, Medium and High) - Achievement of Customer obj. by Digital Technologies.

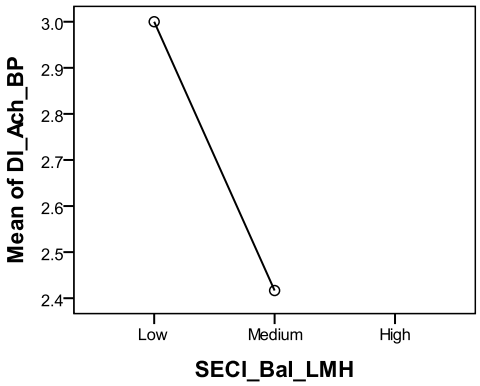

Figure 11: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Business Proc. obj. by Digital Technologies.

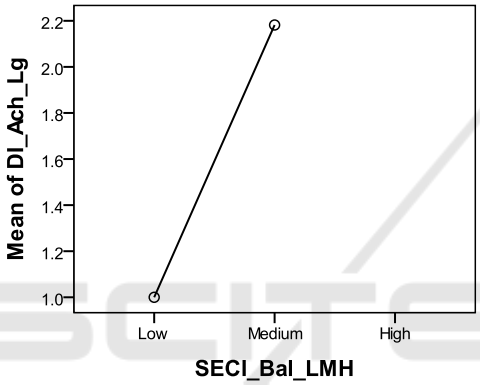

Figure 12: Differences among Balanced SECI groups (Low, Medium and High) - Achievement of Learning and Growth obj. by Digital Technologies.

5.2.2 Differences in the KCC According to the Level of Achievement of Business Objective by Digital Technologies

There were no companies that fall into the category of High Achievers therefore these are considered inconclusive results. No statistically significant difference was identified between the Low and Medium achievers.

5.3 Relationship between Firm Objective Achievement by IT and Digital Technologies

The relationship between IT Business Value and Digital Business Value (measured as achievement objective by the use or contribution of IT in the first case and digital technologies in the second case) was explored by correlation analysis (both parametric and non-parametric tests). This analysis produced the statistically significant positive relationships between the variables below:

The criteria used for IT Business Value:

- IT BV score (IT Business Value AVG)
- IT BV for each of the 4 objective categories (financial, customer, business process, learning and growth).

The criteria used for Digital Business Value:

- Digital BV score (Digital Business Value AVG)
- Digital BV for each of the 4 objective categories (financial, customer, business process, learning and growth).

Although this may seem obvious from a first look, it is important to remember that there is also an extensive research related to IT project success and IT project failure rate.

The results on this particular case seem to suggest that the companies in the sample that have experienced achievement of financial objectives by the use of IT also have experienced achievement by digital technologies. This effect may be because of the particularity of the sample: these are companies that have been recognized because of their efficient use of IT in their business.

Results from correlation analysis (parametric) are listed below (all results with $P<0.01$).

At overall level:

- IT_Ach and DI_Ach ($r=0.885$, $n=16$)

Between each IT and Digital objective counterpart:

- IT_Ach_Fi and DI_Ach_Fi ($r=0.850$, $n=13$)
- IT_Ach_Cu and DI_Ach_Cu ($r=0.837$, $n=16$)
- IT_Ach_Bp and DI_Ach_Bp ($r=0.701$, $n=14$)
- IT_Ach_Lg and DI_Ach_Lg ($r=0.911$, $n=12$)

These results confirmed the relationship at a consolidated level as well as for each objective type; where the achievement of each type of business objective supported by IT is related with the achievement of the same objective type by Digital Technologies.

Additional relationships unveiled by the analysis are presented here.

Between IT business value supported objective types (** for $P<0.01$, * for $P<0.05$):

- IT_Ach_Cu and IT_Ach_Bp ($r=0.532$*, $n=15$)

Between Digital Business Value supported objective types:

- DI_Ach_Fi and DI_Ach_Lg ($r=0.632$*, $n=11$)
- DI_Ach_Cu and DI_Ach_Bp ($r=0.802$**, $n=14$)
- DI_Ach_Lg and DI_Ach_Cu ($r=0.583$*, $n=12$)

- DI_Ach_Bp and DI_Ach_Lg (r=0.758**, n=12)

Also below IT and Digital cross relationships were found. However these are not pursued in detail in this study as explained below.

- IT_Ach_Bp and DI_Ach_Lg (r=0.812**, n=12)
- IT_Ach_Cu and DI_Ach_Bp (r=0.708**, n=14)

These results suggest that achievement of Business and Process objectives by using IT (IT business value in BP) is related to the achievements of Learning and Growth by using digital technologies (Digital Business Value in Lg) achievement.

A similar relationship is found between the IT Business value in Customer objectives and Digital Business Value in Business processes.

Although if we consider only the objective areas from these two relationships it could be generally accepted that Learning and Growth could relate to Business Process objectives; and that Business Process objectives may relate to Customer objectives; the variables are one related to IT technologies and other to digital technologies. This could be true only if all the IT technologies used for the achievement are digital technologies. Therefore these relationships could actually be the result of indirect effects (e.g. relation with a common variable) and are not pursued in more detail in this study.

5.4 Relationship within the Processes of SECI Model

This study also identified a negative relationship between SECI knowledge processes.

- Socialization and Combination (r=-0.751**, n=19)
- Externalization and Internalization (r=-0.593**, n=19)

These could be expressed also as:

- Socialization (Tacit to Tacit) and Combination (Explicit to Explicit) are negatively related.
- Externalization (Tacit to Explicit) and Internalization (Explicit to Tacit) are negatively related.

These results are not surprising but it is important to remember that this negative relationship exists when designing knowledge creation initiatives.

The research framework is updated and included in Figure 13.

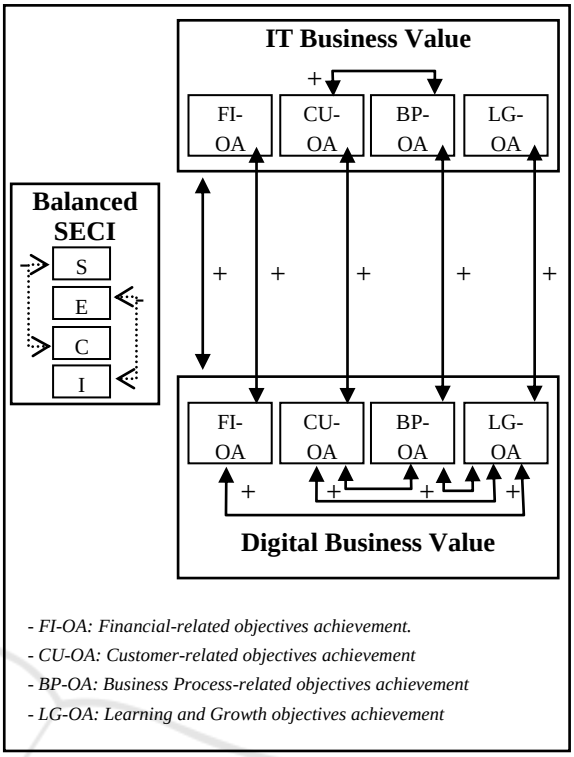

Figure 13: Updated Framework.

6 DISCUSSION

This study did not explicitly inquire the participating firms to define a specific type of performance measurement, but instead concentrated on the overall contribution of IT and digital technologies towards the achievement of business objectives in four categories.

In general, available studies used standard measures like profitability, revenue, ROI, Net Present Value, etc. to explore the impact or contribution that IT as well as KM have on organizations. While such approaches serve well the purpose of generalizing findings on a specific type of measure, they do not acknowledge the individuality of each firm, as each firm could pursue different objectives while engaging in KM or IT initiatives.

Therefore the way how this study approached the measurement of KM, IT business value and Digital business value can offer a fresh look about benefit measurement in such areas.

Digital transformation is a topic that both academia and industry are increasingly focusing on. Studies aim to unveil how to effectively apply digital technologies and identify which specific

characteristics a firm needs to develop in order to obtain benefits. It could be expected that in a similar way that the IT Paradox raised concerns on the value from IT investments it will be sooner than later when similar concerns will rise towards digital technologies. This study aimed to leverage from past attempts to clarify the IT Paradox in order to provide insights on how to address the performance assessment of digital technologies.

The results do not suggest a direct relationship between the level of balanced knowledge creation processes (Balanced SECI level) and the achievement of business objectives by either the use of IT or digital technologies as initially considered by Hypotheses 1 and 2.

This suggestion should be further explored with a larger set of data as the number of observations in this study although had a good representation of the target population can be considered low. Another reason for the inconclusive findings could be that additional firm capabilities not explored in this study that may exist in the firms could shape the relationship between Knowledge Creation Capabilities and achievement of objectives by the use of IT or digital technologies.

On the other hand, the findings confirmed that firms with high level of achievement of business objectives by IT also experience higher level of achievements from digital technologies (Hypothesis 3). This could be a sign that such firms possess specific characteristics different from balanced knowledge creation processes. Characteristics such as an effective decision process or alignment of IT strategy with business strategy may be some factors supporting the achievement of objectives using IT or digital technologies.

The results showed a relationship between the achievements of Customer and Business Process objectives with both IT and digital technologies. Furthermore, the relationship between the achievement of Learning and Growth objectives by digital technologies and the achievement of the other 3 types of objectives could indicate that in the Digital Age, Learning and Growth focus goes hand to hand with the achievement of other type of objectives.

When deriving conclusions from this study, it should be considered that a key characteristic of the target population was that participating organizations had achieved a level of success in the implementation and use of technology; either by creating new or improving existing services, increasing customer experience, adding and making decisions based on data captured thru mobile technologies, etc. and they do not represent the general population of Japanese SMEs.

Nevertheless it is worth considering that some findings -although not statistically validated- suggest that the levels of Balanced SECI are actually negatively related with objective achievement of Financial, Customer and Business Process objectives, while positively related with the achievement of Learning and Growth objectives.

This could mean that the more an organization is focused on having a balanced and highly intense Knowledge Creation Processes the more the firm will be able to achieve Learning and Growth type of objectives such as education, creativity, development people capability. Likewise the same intensity of higher balance in the Knowledge Creation Processes may not necessarily help the achievement of financial, customer and business processes objectives; these types of objectives include for example expanding revenue, improving productivity, improving customer satisfaction, improving customer loyalty, etc.

7 CONCLUSIONS

This study follows a business-oriented perspective when defining IT and Digital Business Value as the level of achievement of firm objectives by the use of IT and digital technologies.

Exploring the relationship between Knowledge Creating Capabilities and the achievement of business objectives on several categories provided insights about which objective area a firm focusing on knowledge creation process could expect to obtain results; as well as on which types may not yield any results.

A relationship between the level of objective achievement with IT and with digital technologies was observed. In other words low achievers in the utilization of IT also showed to be low achievers in the use of digital technologies. Likewise high achievers show similar performance in both business objectives achievement with IT and digital technologies. This is worth considering in particular for the firms that plan to engage in digital initiatives as a good prediction of possible digital initiatives' performance could be taking a look at the performance currently achieved with IT.

The future work includes increasing the target population to provide further statistical evidence, as well as enriching the research with a mixed-method approach by using qualitative study on a selective sample. In addition, exploring other organizational

characteristics that could help linking the knowledge created through Balanced SECI with first the right strategic decisions at an organizational level and then the definition of IT and Digital initiatives (e.g. Business and IT alignment) and later with its execution (e.g. Program and Project Management, Change Management).

REFERENCES

Amit, R., Schoemaker, P., 1993. Strategic assets and Organizational rent. *Strategic Management Journal* 13, pp. 33-46.

Barney, J., 1986. Strategic factor markets: Expectations, luck, and business strategy. *Management Science* 32(10), pp. 1231-1242.

Benbya, H., Passiante, G., Belbaly, N.A., 2004. Corporate portal: a tool for knowledge management synchronization. *International Journal of Information Management* (24:3), pp. 201-220.

Brynjolfsson, E., Hitt, M., 1998. Beyond the productivity paradox. *Communications of the ACM* (41:8), pp. 49-55.

Cabrita M. R., Machado, V.C., Grilo, A., 2010. Leveraging Knowledge Management with the Balanced Scorecard. *Proceedings of the 2010 IEEE IEEM*, pp 1066-1071.

Chen, M., Chen, A., 2006. Knowledge management performance evaluation: a decade review from 1995 to 2004. *Journal of Information Science* (32:1), pp. 17-38.

Choi, B., Lee, S., 2002. Knowledge Management strategy and its link to knowledge creation process. *Expert Systems with Applications* (23), 2002, pp. 173-187.

Choi, B., Lee, S., 2003. An empirical investigation of KM styles and their effect on corporate performance. *Information & Management* (40), pp. 403-417.

Chou, S., 2005. Knowledge creation: absorptive capacity, organizational mechanisms, and knowledge storage/retrieval capabilities. *Journal of Information Science* (31:6), pp. 453-465.

Davenport, T. H., Prusak, L., 2000. Working Knowledge: How Organizations Manage What They Know. *Harvard Business School Press*. Boston, MA.

Dedrick, J., Gurbaxani, V., Kraemer, K. L., 2003. Information Technology and Economic Performance: A Critical Review of the Empirical Evidence. *ACM Computing Surveys* (35:1), pp. 1-28.

Grant, R. M., 1996. Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science* (7:4), pp. 375–387.

Hirano, M., 2005. Informational Investments and Their Performance: A Mission of Management Informatics. *Collection of the 51st National Conference of Japan Society for the Study of Office Automation* (11), pp. 35-38.

Innovation Value Institute, 2016. *IT Capability Maturity Framework (IT-CMF) The Body of Knowledge Guide*. Van Haren Publishing, 2nd edition.

Kaplan, R., Norton, D., 1996. *The Balanced Scorecard - translating strategy into action*, Harvard Business Review Press. Boston.

Lewin, A., Massini, S., 2004. Knowledge Creation and Organizational Capabilities of Innovating and Imitating Firms. In: *Organizations as Knowledge Systems*, Palgrave Macmillan. UK, pp. 209-237.

Ministry of Economy, Trade and Industry of Japan, 2016. *Competitive IT Strategy SME Selection 100 in years 2015, 2016*. Available at: http://www.meti.go.jp/english/press/2015/1027_02.html [Accessed 20 May 2017].

Nonaka, I., Byosiere, P., Borucki, C., Konno, N., 1994. Organizational Knowledge creation Theory: A First Comprehensive Test. *International Business Review* (3:4), pp. 337-351.

Nonaka, I., Takeuchi, H., 1995. *The Knowledge-Creating Company*. Oxford University Press, New York, NY.

Nonaka, I., Toyama, R., Konno, N., 2000. SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. *Long Range Planning* (33), pp. 5-34.

Riera, C., Senoo, D., Iijima, J., 2009. A Study of the Effect of Knowledge Creating Capabilities on Corporate Performance. *International Journal of Knowledge Management Studies*. 3(1/2), pp. 116-133.

Ross, J., Sebastian, I., Beath, C., Mocker, M., Moloney, K., Fonstad, N., 2016. Designing and Executing Digital Strategies. In ICIS 2016 *Thirty Seventh International Conference on Information Systems*. Dublin.

Sandulli, F. D., Lopez-Sanchez, J.I., Rodriguez-Duarte, A., Fernandez-Mendez, J., 2007. Analysing the IT Paradox in the Supply Chain. [online] Available at: https://ssrn.com/abstract=1105687 [Accessed 20 May 2017].

Small and Medium Enterprise Agency, 2016. White Paper on Small and Medium Enterprises in Japan 2016. Available at: http://www.chusho.meti.go.jp/pamflet/hakusyo/H28/download/2016hakushopanflet_eng.pdf [Accessed 20 May 2017].

Teece, D. J., Pisano, G., Shuen, A., 1997. Dynamic capabilities and Strategic Management. *Strategic Management Journal* 18(7), pp. 509-534.

Weill, P., 1992. The Relationship between Investment in Information Technology and Firm Performance: A Study of the Value Manufacturing Sector. *Information Systems Research* (3:4), pp. 307-333.

Weill, P., Aral, S., 2007. IT Assets, Organizational Capabilities and Firm Performance: How Resource Allocations and Organizational Differences Explain Performance Variation. *Organizational Science* 18(5), pp. 763-780.