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TOWARDS A UNIFIED VIEW OF INFORMATION SYSTEM (IS) CAPABILITY[i]

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Abstract

Since the introduction of the concept of IS capability to IS research, it has been extensively used to explain various IS related studies - for instance: competitive advantage, firm performance, and agility among several others. This extensive use of the concept has resulted in several interpretations and diverse classifications. These discrepancies in combination with the extensive use of the concept put its fundamental logic at the danger of losing its meaning. Using a systematic literature review, this paper highlights the similarities, differences and fragmented knowledge groups and consequently provides a possibility to move towards a unified view of IS capability. To consolidate the fragmented classifications, the paper advances a four ellipse model from prior classification to vividly conceptualize the IS capability construct and hence provide an integrated platform for future research.

Keywords: IS Capabilities, Ellipse Model, Literature Review, Innovation and Information Systems/Technology IT/IS Capability Classification.

INTRODUCTION

The concept of IS capability was first introduced to IS research in the mid 1990's (Ross, Beath and Goodhue, 1996; Andreu and Ciborra, 1996). Since then, it has been used by many authors in research about Competitive Advantage (Bhatt and Grover, 2005; Doherty and Terry, 2009), Organisational Change (Clark, Cavanaugh, Brown and Sambamurthy, 1997), Agility (Fink and Neumann, 2007; Lu and Ramamurthy, 2011), Firm Performance (Bharadwaj, 2000; Li, Cheng and Huang, 2006) and Innovation (Pavlou and El Sawy, 2006; Tarafdar and Gordon, 2007) to mention a few. These wide utility of the concept has led to varying and diverse interpretations of the concept.

As a background, the capability concept has largely been drawn from organization science and strategic management research. Therefore IS capability largely borrows its foundational principles from these research fields. IS capability generally refers to the ability for an organizations to - redesign processes - facilitate information management and - fulfill knowledge sharing needs among many other benefits (Ramirez, Melville and Lawler, 2010; Mithas, Ramasubbu and Sambamurthy 2011). Apart from the resources of an organization, the capabilities of today's organizations additionally come from the attributes of their IT resources (Hoopes & Madsen 2008), and this can be particularly useful for firms operating in rapidly changing environments (Wade & Hulland 2004). Therefore, even if the IT resources/capabilities do not lead the organization to a position of superior competitive advantage, they are nonetheless very important to attaining a sustained competitiveness in stable/unstable environments. This is particularly the case if the IT resource/capability can help the organization to develop, add, integrate, and release other key resources over time (Wade et al. 2004).

This paper uses a systematic literature review to collect research that has built upon the concept of IS capability. This review is aimed at throwing light on what has been done previously on IT/IS capability specifically in the IS domain. The paper is geared towards providing the different perspectives and lenses with which research on this concept has been approached over the years. This is done with the objective of *identifying similarities, disparity, research focus, research calls, maturity areas, and areas open to further research* (Okoli and Schabram, 2010).

The review of the use of IS capability led to identification of some similarities but there were also differences. Some typical examples of the disparate interpretations accorded to this concept includes: differences in terminologies, fragmentation in classifications and unconsolidated definitions. These discrepancies plus the extensive use of the concept puts its foundational essence at the peril of losing its significance. Hence, this paper is a step towards a unified view of IS capability. Perhaps most importantly, this paper advances the ellipse model to consolidate current knowledge on this topic.

The paper is structured in three related divisions. Firstly, we take an historical look at the origins and the use of the concept in IS research as part of the introduction. Secondly, the study design and ensuing results are presented as section 2 and 3. Lastly, we discuss the results and analysis which leads to the theoretical and practical contribution of the research in sections 4 and 5.

1.1 Origins of the concept of IS Capability

The capability concept generally stems from the management research discipline. It is a concept that is built on and closely related to the resource based view. From the IS perspective, there are generally three related school of thoughts to the capability concept. These are – Resource based view, Dynamic Capability and Core Competence views. Even in the management field, disparity and area of dissensus can be identified (Leiblein, 2001). To have a good understanding of how this concept developed and diffused into the IS domain, we will give a brief discussion of these three concepts.

The *resource-based view* (RBV) has evolved over the years into arguably one of the most referenced theories in the field of management (Kraaijenbrink, 2010) The theory looks at the source of a firms sustained competitive advantage as emanating and dependent on the internal resources of a firm. This view is a different dimension to Porter (1985) view of a firm's competitiveness being dependent on its operating environment. The core essence of the theory is that a firms competitive stand is as a result of

its acquisition and management of valuable, rare, inimitable, and non-substitutable resources. (Barney, 1991). *Dynamic capability theory* stems from the RBV with an added proposition that an organization needs to be able to integrate and reconfigure its resources in other to attain a sustainable competitive advantage in a rapidly changing environment – hence the "dynamic" component (Helfat and Peteraf, 2003; Teece, Pisano, and Shuen, 1997). In addition, *core competence* has also been advocated to refer to distinctive abilities of an organization relative to other organisations which is also related to the asset endowment of the organization. (Prahalad and Hamel, 1990; Teece et al. 1997)

While IS research field may have borrowed these important concepts from management, we have also carried along the disparity associated with the terminologies. This is because even in the management domain, there is yet to be a standing consensus on the difference between this constructs. In IS research, it remains necessary, in fact essential to borrow from other disciplines, however as Wade et al (2004) points out, it may be beneficial to pause and evaluate the use and application of a borrowed theory in an IS context before adapting it to an IS-based research. Having highlighted the root of the IS Capability – IS Resource – IS Competence construct, we would suggest that as this research stream approaches maturity and for the sake of consistency, it is important that a clear taxonomy and clarification of the definitions of these related constructs be advanced for the IS domain.

1.2 Use of IS Capability concept in prior IS research

As was typical of the IS literatures of the mid 1990's, which corresponds to the strategic Information systems (SIS) era, managements were more interested in how to extract competitive advantage from their IT/IS investment (Peppard and Ward, 2004). Consequently, during the early days of IS capability which corresponds to that era, research was mostly focused on this same theme and providing answers to the competitive value contribution of IT to the enterprise (Feeny and Willcocks, 1998; Ross et.al., 1996).

Subsequently, IS capability research evolved to include other research focus. This ranged from research about the contribution of IT to firm performance, agility, and outsourcing among many others (Feeny, Willcocks and Olson, 2006). However, this view tend to present the static potentials of the IS capability construct. In an environment that is characterized by not just constant change but rapid change and turbulence, this opens up possibilities to consider the dynamic component of IS capability IS and IT Researchers and practitioners are thus left with some questions: what is the role of IT, or perhaps more importantly, what value does IS capability provide to an organization in a disruptive scenario?

2 STUDY DESIGN

In conducting the systematic review of literature on IS capability, the approach suggested by Webster and Watson (2002) has been mostly adopted. The selection process of the papers to be analyzed began with the identification of the required keywords to be used in the search process. Foremost in the keywords list were the terms: IS capability, IT capability including their plural forms and full expressions (i.e IS - Information System and IT - Information Technology). For, the initial phase of the search process, Science Direct (SciVerse, Scopus) journal database was employed with "IS Capability" as the keyword. However, very few relevant results were identified from this search. From the relevant results, articles that were published in top journals excluding conference papers were further identified.

An additional drilling down of the remaining subset of returned articles was carried out to identify the earliest of the articles from the selected articles. In this case the paper was the well cited paper by Peppard and Ward (2004). After this, the remaining articles were sorted in that order – from earliest to latest. Following the guideline for a structured approach to sourcing material for a literature review proposed by Webster et. al (2002), the next steps involved *going backward* and subsequently *going forward*. Going backward, involved a review of the references provided in each of these top articles. Going forward, required using the citation list provided by the SciVerse database for each of these

articles to identify which articles citing each of these papers, qualifies to be considered in these literature review.

The process of checking references and citations highlighted above quickly showed how sparingly the keyword IS and IT capability (and their full forms) have been used in the titles of IS articles. This then required a pause in the search process to read through the abstract of most of the articles found by this stage. However, it is worth mentioning that additional articles included in this review only became obvious as relevant, after they were referenced while fully reading other IS capability articles. In reading through the articles, it became apparent that there has been different terminologies used in describing the IS capability concept in prior literature. This is a clear indication of the fragmentation in the naming convention used by IS researchers in referring to this concept.

In effect, no single search terminology would yield all the relevant articles on the topic of IS capability. This therefore informed the need to go back and broaden the keywords used in the search. The possible keywords list expanded continuously, such that after reading a few articles another possible '*synonym*' for IS capability would surface. This process continued until likely new keywords stopped emerging. The new list of keywords includes: IS/IT Resource, IS/IT Competence, IS/IT Assets.

With the plethora of keyword possibilities, the determination of the relevance of an article required first checking the title for keywords, and then reading through the abstract of selected returned papers with any inclination towards the concept of IS capability. It was also discovered that by reading the earlier sourced articles, other articles referenced in between the text and based on the actual context, provided more clue to the papers that are likely to have discussions relevant to IS capability. In this regard, Webster et al. (2002) approach of going forward and going backward proved very useful for this review. In locating a potentially relevant paper that was identified based on how it has been cited in another article, Science Direct was not always returning these specific articles. Therefore Google scholar which searches through multiple databases, was employed to locate such papers. After selecting a potential paper to be considered, the content of the abstract in most cases was sufficient to decide on the relevance of the article. In addition, some articles were found that have conducted certain degree of literature review on these concept. Utilizing both approaches provided further list of relevant articles that were considered for this work. In total a count of 45 IS capability related articles[1] were included in this review.

Summarily, the disparity in terminology used made the sourcing of relevant articles by the sole use of selected keywords ineffective. However, the combined approach eventually adopted made it possible to identify a wider range of articles than would have been normally identified using the traditional keyword approach.

3 RESULTS AND ANALYSIS

3.1 Publication Distribution (By Journal and Research Period)

A scan of the collected literatures indicated a tilt towards some particular journals. This prompted further analysis to understand what journals have been showing attention to this research stream. This analysis also lends itself readily to describing the time span through which IS capability has been researched and presented since its introduction into IS literature (see Table 1).

From the journal analysis of the reviewed articles, it becomes apparent that almost 40% of the IS capability articles are published in two journals – MIS Quarterly and Journal of Strategic Information Systems. While MIS Quarterly takes a significant representative portion of the published articles, twenty two (22) other journals actually published IS capability articles. However, most of the journals categorized as 'others' published just one article included in this review.

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[1] Due to space limitations, a comprehensive detail of reviewed articles are available on request

Journal	Quantity (Articles)	Distribution (%)	Cumulative
MIS Quarterly	11	24,44	24,44
Journal of Strategic Information Systems	6	13,33	37,78
Information Systems Journal	3	6,67	44,44
Information Systems Research	3	6,67	51,11
Information & Management	3	6,67	57,78
Journal of Management Information Systems	2	4,44	62,22
Sloan Management Review	2	4,44	66,67
Others	15	33,33	100,00
TOTAL	45	100,00	

Table 1.   Journal distribution of IS Capability articles

If we consider the spread of the articles in a time period from the date of publishing of the earliest paper 1996 to the most recent article found 2012 (Ross, Beath & Goodhue 1996 and Liu, Ke, Wei, & Huang 2012), we would observe a significant increase in the number of publications addressing this issue. The numbers of publications in the last 8 years (2005-2012 with 29 publications) have almost doubled the publications found for the first 9 years (1996-2004 with 16 publications) of research on this concept. The core emphasis and principal foundations for the IS capability research began in the early 2000s hence the research stream can still be considered relatively new. This suggests that there exist possibilities for more research in this area.

3.2   What can be learnt from the 'What' and 'How' of Prior Research?

While this review aligns with earlier reviews on this topic, it is necessary to note that the objective of this review is not to make a tautological replay of past reviews but to highlight the similarities and differences in prior research towards advancing a unified view of the concept of IS capability. We investigate prior literature to see the areas of *consensus vs dissensus* and areas that are *matured vs emerging*. Thus, the selected literatures will, among other analysis, be reviewed specifically for relationships to three main parameters: Organizational Change / Turbulence, Competitive advantage / Firm performance and Innovation. The three axis from which this review will be focused can be modelled on the classification of IS capabilities described by Bhatt (2005). These are Value Capability, Dynamic Capability and Competitive Capability. Bhatt's classification lends itself readily to these highlighted attributes of disruptive innovation. A mapping of the review parameters and the classifications can be directly represented as*: Innovation* – Value Capability; *Change/Turbulence* – Dynamic Capability and *Competitive Advantage* – Competitive Capability.

Reviewing existing literature shows where IS research on IS/IT capabilities has been focused in the past and how this has progressed in recent years. The chart in Figure 1a shows the distribution of prior IS capability research on these three dimensions. For this analysis, the reviewed papers were grouped into two periods: 1996-2004 and 2005-2012. Although 1996-2004 covers 9 years, it can be seen as a grouping of 8 years each since no article was found from 2001 to be included in this review. From Figure 1a, among other deductions, two things become immediately obvious. Firstly, there has always been interest in studying the issue of IS contribution to firm performance and a firms competitive advantage. Secondly there is relatively little research focused on the relationship between innovation and IS capability *[Emerging]*. The interest in studying a firms competitiveness has significantly grown over the years and IS capability researchers have considerable researched these dimension of IS capability (McLaren, Head, Yuan and Chan, 2011). It is worth mentioning that IS capability evolved at a time when there was increasing question about the value or significant contribution of IS/IT to an organization. In overview, IS capability has contributed significantly in understanding how information technology remains a valuable component of any modern day firm (Santhanam and Hartono 2003).

While there has been predominant focus on using IS capability to advocate the value of IT to a firms competitiveness [*Consensus*], the second obvious fact from the figure is that there has been relatively

few research on the role of IS capability in the innovativeness of an organization. As evidenced in the chart, the move from the 1990s to the 2000s shows no significant increase in the number of studies relating IS capability to innovation. With notable exceptions like (Li et al. 2006; Bharadwaj et al., 1999; Pavlou et al. 2006; Lu and Ramamurthy 2011) that have advanced knowledge in this area. This indicates that there is room for more studies in this dimension. It has been posited that *sustainable* competitive advantage of an organization is directly related to its innovativeness (Tarafdar et al. 2007; Li et al 2006; Sambamurthy, Bharadwaj and Grover, 2003). Hence further research positioning the significance of IT in this area would be a valuable contribution to the body of knowledge.
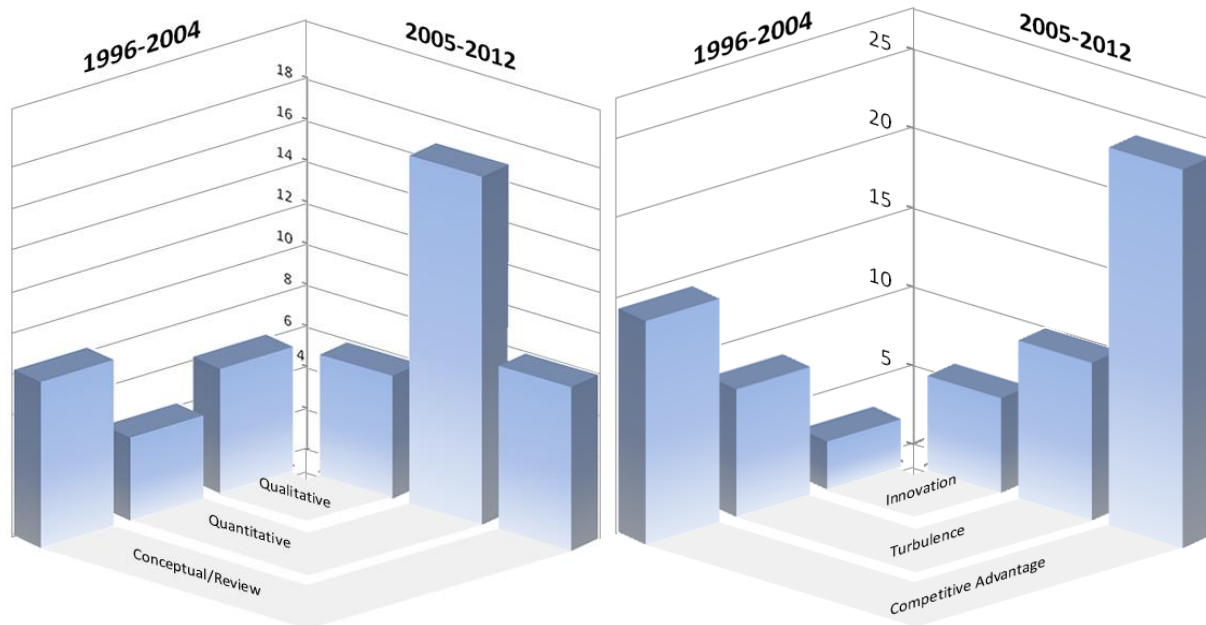

Figure 1. *(a) Trend of article distribution by adopted methodology (b) Emerging trend of IS capability research on Innovation, Turbulence and Competitive Advantage.*

The third component in Figure 1a – Organization Change/Turbulence appears to have had considerable medium research focus relative to Competitive advantage and Innovation. On the other hand, a close look at the increase in turbulence studies between the two periods shows a little change. A comparative analysis shows that not significantly much more study have been carried out relating IS capability to organization change, agility or turbulent environments.

The chart in Figure 1b presents the different research methods adopted over the two time period being studied. As is expected of a new and evolving research area, there were more conceptual papers in the early period of the IS capability research. However moving forward to the recent period of 2005-2012, the jump in the number of research adopting the quantitative approach is significantly high. While quantitative research accounted for the lesser of the three adopted methodologies between 1996-2004, it dwarfed both the qualitative research and conceptual papers in the 2005-2012 period. This confirms the disposition of IS researchers to utilize the quantitative research approach. Another striking observation is the flat nature of the change in the number of publications using the qualitative approach over the two periods.

4   DISCUSSION

4.1   Terminology fragmentation from the lens of prior research

There is presently an avalanche of constructs and definitions which although are all generally describing the same or similar IS capability phenomena, have been presented under different terminologies. Firstly, previous literature reviews conducted on topics related to the IS capability have

identified this variations. To make these variations vivid, the distributions of constructs used in the reviewed articles are presented in Figure 2. The import of this figure is to show that contrary to expectations, terms like IS/IT resource are not predominantly used as the core construct in IS research. The figure demonstrates that the term IT capability is attaining dominance as it appears to be mostly used as the central construct in reviewed articles, followed closely by IS capability. Although these terms have been used interchangeably in most of the articles, there is usually a central term used in each paper. It is this main construct used in the literature that has been outlined to highlight the disparity in this area. (The axis labeled as 'Others' are the constructs that have been used as the central construct only once in the articles reviewed.
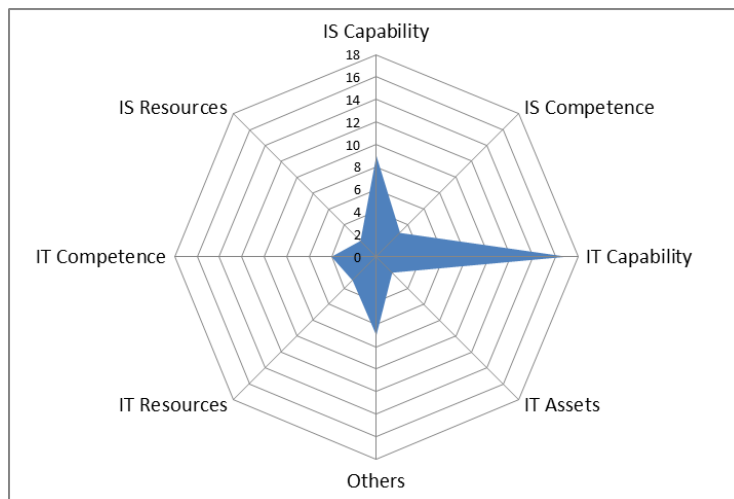

Figure 2.   IS related constructs used in prior literature

These plethora of constructs thus suggests that - as this research stream approaches maturity and for the sake of consistency, it is important that a clear taxonomy and clarification of the definitions of these related constructs be advanced for the IS domain. It is therefore wise to take a step back to understand the foundation of the term IS capability as used by IS researchers.

4.2   Reviewing IS Capability Definitions

Based on the articles reviewed we attempt to highlight the different school of thoughts that exists in the IS field concerning the definition of these terms. Several of the papers reviewed highlighted the disparity in the definitions of the terms – IS/IT Capability, IS/IT resources, IS/IT Competence among other related constructs (Cragg, Caldeira and Ward, 2011; Caldeira and Dhillon, 2010; Wade and Hulland 2004). These three terms have particularly been used interchangeably in IS literature. There have been attempts to distinguish between these constructs (Sambamurthy et al., 2003). To highlight the existing construct definitions we have grouped them into three categories: The *Subset View, The Combination View* and *the The Equality View*.

The Susbset View: Concerning which of the three constructs is a subset of the other, draws a close analogy to the classic dilemma of the *chick or the egg, which comes first?* Some authors present IS capability as a subset of IS resources while others argue for the reverse. Similar positions are also being held by different researchers concerning IS competencies and IS capabilities. These are views that describe the core of the constructs as the raw material or building block from which the higher order construct is made. Hence, according to Peppard et al. (2004) perspective, resources are the fundamental unit of this relationship. They presented *resources* as the information, systems and technology possessed by a firm and extensible to include the knowledge and skills of personnels. While *Competence* is presented in terms of resources as the ability to deploy organization *resources* in order to achieve a specific objective. *Capability* is then in turn presented in terms of competencies as the strategic application of *competences* in order to achieve given organizational goals. Similar reasoning as demonstrated from Peppard et al. view is also applied in the definitions ascribed to this

construct by some authors (Bharadwaj, 2000; Ravichandran and Lertwongsatienl, 2005 and Samabamurthy et al., 2003)

The Combination View: Authors maintaining this view present very close logic with the subset view. However these constructs are expressly used to describe the combination of two or more constructs rather than aiming at expressing one construct as a direct function of the other as presented by the subset view. In the combination perspective these constructs are considered as compositions of two or more constructs. For example, In describing *resources*, Wade and Hulland (2004) referred to it as the combination of the *assets* and *capabilities* that are available and relevant in the response and detection of market opportunities and threats. Some other examples include Caldeira et al.(2010), Stoel & Muhanna (2009) and Tippins & Sohi (2003) among others.

The Equality View: In this perspective, the constructs are directly referred to interchangeably and explicitly defined as same. With this view, a resource can be equal and same with capability. In other words some constructs are considered as synonyms of each other. It is interesting to note that while many authors have not explicitly defined constructs as equal, it has mostly been subtly implied in the literatures. This would explain the frequent interchange in the use of this constructs. It is based on the premise of the equality view that most IS capability research need to get context from. This is because for a thorough understanding of what has been done, it is necessary to apply the equality view otherwise relevant research describing same or related phenomena would be missed. With this view, researchers of IS capability, IS resources and IS competence would have an underlying assumption that these terms have been interchanged. While this might be necessary when studying what has been done in the past, it does not have to be so going forward. Andreu and Ciborra (1996) in defining *Capabilities*, completely assigned all the attributes associated with *resources* in prior literature to describe the capability construct. They described capability to be of strategic potential when it is valuable, rare, imperfectly imitable and with no strategically equivalent substitutes. When compared with the definition of resources by many other researchers (Barney, 1991; Conner, 1991; Leiblein, 2011) these two constructs could be perfectly interchanged according to this view. Similar perspective is shared by a school of thought that considers competence and capability to be one and same (Prahalad and Hamel, 1990)

Having evaluated the different perspectives with which these constructs have been defined [*Dissensus*], it is important however to understand that one definition is not necessarily wrong relative to the others. According to Caldeira and Dhillon (2010), these differences could be be explained as a result of the differences in the objectives and contexts under which the research was carried out. For instance, Caldeira and Ward (2003) as focused on SMEs while Peppard et al (2004) was based on analysis of large companies. Caldeira et al. also posits that this could be also due to the differences in the level of abstraction and level of details used in the definition of the terms. He showed this by using the contrast in the case study approach used by Dhillon (2008) which was at a higher level of abstraction compared to the multiple case studies they employed in their research.

4.3 Status Map of current IS Capability Studies and a Call for Research

IS capability has evolved to be a research stream that underscores the valuable contribution of information systems both for practical application in business organizations and for knowledge advancement in IS research. As a research area, IS capability in relation to competitive advantage has gained *maturity* to a substantial degree relative to other emerging IS research fields. However, there still exists some areas in need of improvement in the IS capability research. Using an adaptation of Deetz (1996) framework as depicted in Figure 3, we present a status map to give an overview of the current state of the IS capability research stream.

The figure makes it obvious at a glance to see conclusions of this review. Areas where there needs to be more attention (*Dissensus* and *Emerging* axis) and the areas that have received significant attention (*Matured* and *Consensus*). The *Dissensus* and *Matured* quadrant is indicative of an area where there is identified difficult to reconcile discrepancies. This was not identified in this review at this present stage of the IS capability discuss, hence it is left open. It however becomes immediately clear from the

status map that IS capability literatures have significantly indicated the value of IS capability in detailing its benefits to firm performance and competitive advantage over the years.
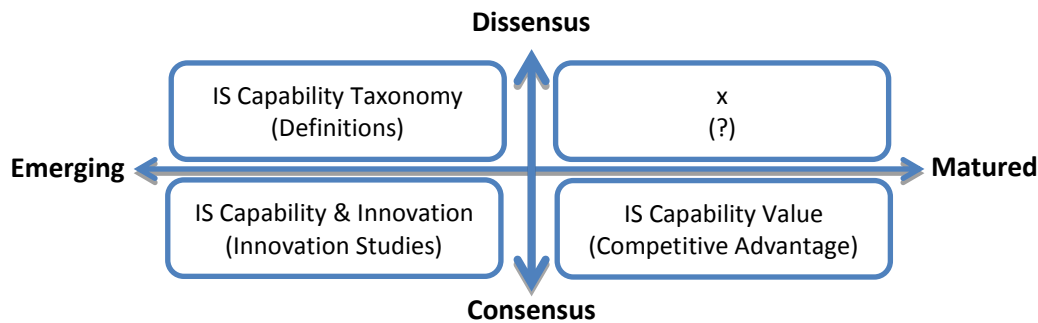

Figure 3.   A status map summarizing the present status of IS capability research

On the other hand it also reveals the apparent lack of consensus in the definition of IS capability and its related constructs. Also as mentioned earlier, the research stream on Innovation studies (and organizational change or environmental turbulence) is still emerging and this is an open call for more studies in this area.

5   CONTRIBUTIONS

5.1   Contributions for research: The 4 Ellipse Model

IS Capability and its related constructs have been classified into different categories in prior research. A careful identification of these classifications reveals similarities which can all be regrouped to formulate a broader taxanomy. These are grouped into four major IS components – IS Infrastructure, Business and IS development, Networking and IS Management Capability (see Table 2). This categorization provides a concise and yet encompassing view of the constituent elements defining an organizations' IS capability. With this background, we advance the four ellipse model to capture the essence of this categorization for future evaluation of IS capability in practice and in research.

Existing classifications of IS capability related constructs have been developed from different perspectives. Starting from Ross et al. (1996) who made a grouping of IT resources into human assets, technology assets and relationship assets plus IT processes. Bharadwaj (2000) made a modification to this classification to IT infrastructure, human IT resources and IT enabled-intangibles. However, Li et al. (2006) observed the missing process dimension in this classification. On a similar pedestal, Feeny and Willcocks (1998) using the IS capability terminology proposed a classification of nine IS capabilities. Using a construct where Feeny et al's capability construct equates to competence in similitude, Peppard et al. (2004) made a   classification of six macro capabilities that are composed of 26 competences. Peppard's classification was later modified by Cragg et al. (2011) from an SME perspective. In total, fourteen (14) articles were identified with different classifications and these are composed of a total of 60 individual elements.

In developing a conceptual synthesis, it is essential to build on existing research and theories in relevant domains. Following the steps of Nevo and Wade (2010) who identified the parallel between systems theory and the resource base view, we posit that a systemic view of IS capability provides a broader base to describing an organizational IS Capability. In systems theory, organizations are viewed as the assembly of interrelating subsystems which can be delineated by the activities they carry out and the objectives towards which they are aimed (Courtney 2001; Daft 1992). In a similar way, RBV also views an organization as a collection of resources which culminates into the defining capabilities of the organization (Nevo et al., 2010; Tippins et al., 2003; Amit and Schoemaker, 1993; Ravichandran et al., 2005). From an organizations perspective, several subsystems are put in place to

Article		IS Infrastructure Capability	Business & IS Development Capability	Networking Capability	Management capability
Bharadwaj (2000)		IS/IT infrastructure, Human IS/IT skills	IS/IT enabled intangibles		
Tippins and Sohi (2003)		IT operations, IT knowledge, IT objects			
Bhatt and Grover (2005)		IT infrastructure	IT business experience; Relationship experience		
Fink and Neumann (2007)		IT Infrastructure Capabilities; IT Personnel Capabilities	IT-Dependent Organizational Agility		
Lu and Ramamurthy (2011)		IT infrastructure capability	IT proactive stance; IT business spanning capability		
Ross, Beath and Goodhue (1996)		Technology assets; IT processes, Human assets	Relationship assets		
Ravichandran and Lertwongsatien (2005)		IS operations capability; IS support maturity	Systems development capability		IS planning sophistication
Bharadwaj, Sambamurthy and Zmud (1999)		IT infrastructure	Internal IT partnerships, business process integration	External IT partnerships	IT management, Strategic vision of IT
Sambamurthy, Bharadwaj and Grover (2003)		Knowledge reach, Process reach	Knowledge richness, Process richness, Agility		Entrepreneurial alertness
Li, Chen and Huang (2006)		Knowledge reach, Process reach, Positional assets	Knowledge richness, Process richness, Agility		Entrepreneurial alertness
Peppard and Ward (2004)		Delivery solutions	Defining the IS contribution; Exploitation	Supply	Strategy, Defining the IT capability
Cragg, Caldeira and Ward (2011)		Delivery solutions	Defining the IS contribution; Exploitation	Supply	Strategy; Business & IS strategic thinking
Wade and Hulland (2004)		IS infrastructure, IS technical skills, cost-effective IS operations	IS development, external relationships, market responsiveness, IS business partnership		IS planning and change management
Feeny and Willocks (1998)		Design of IT architectures; Making technology work	Business system thinking; Business-IT relationship	Contract facilitation & monitoring; Informed buying; Vendor development	IS/IT Goverannce

Table 2.   Grouping of IS Capability classifications

achieve different goals. With regards to IS, organizations would have systems setup for handling specific IS objectives. These could include subsystems for mapping organizational IS strategy, one for coordinating IS processes and another for managing IS/IT infrastructures plus one for the IS organization among others. These IS subsystems are also defining macro components of the constituent IS capabilities identified in prior research.

If we represent each element by an ellipse as depicted in Figure 4, each component represent a composition of subsystems of constituent IS-Capabilities as expounded in Table 2. The measure of the IS Capability is a function of the interaction of these components with each other. Hence the IS capability of an organization is not simply the addition of these components but a synergetic combination of each component.
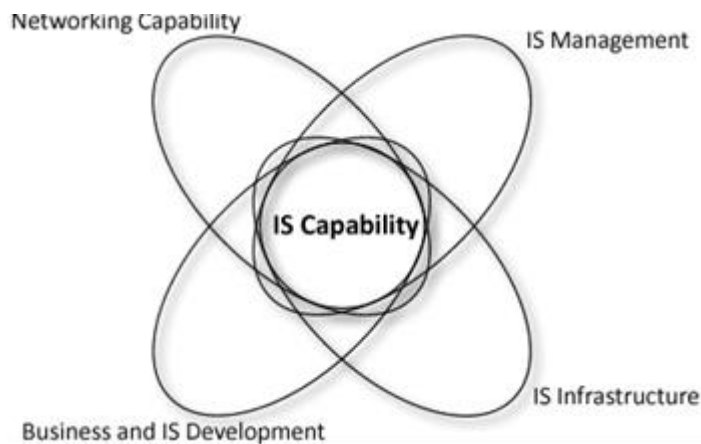

Figure 4.   The four Ellipse Model of Organizational IS Capability

The synergetic formation of IS capability from these four components stems from the complementary nature of capabilities. Synergy is about joint action or co-action. It means the ensuing IS capability of an organization from this interaction is such that the achieved capability is one which each component is individually incapable of achieving, hence the overlap in the ellipses (Li et al., 2006). The degree of overlap of these IS subsystems in an organization determines potency of the IS capability of the organization. When synergy and competitive advantage are aligned, the result is less likely to be imitated easily because such effect are usually achieved via a distinctive circumstance peculiar to the resources of the firm (Bharadwaj, Varadarakam and Fahy, 1993).

From the foregoing analysis and from the review of previous literature, the four ellipse model provides an overview for the conceptualization of IS capability. This is built on the various classifications that have been used to describe IS capability in different categorization. We posit that all this classifications can be largely grouped under the four axis of the ellipse model: IS Infrastructure, Business and IS development, Networking and IS Management Capability. Such a Meta representation provides a unification to the IS capability discussion.

IS Infrastructure Capability: This relates to the technological foundation which determines the extent to which an organization can exploit the benefits of most of its IS investments. Based on the definition of Broadbent, Weill and O'Brien (1996) The IS infrastructure capability of an organization includes not only its physical and tangible assets but also extends to its human resources and their inherent knowledge. The ability of an organization to exchange knowledge/information, align processes and remain competitive is associated with this component.

Business and IS Development Capability: This component describes the operational IS capabilities for strategic positioning. It has a lot to do with the ability of the organization to orchestrate and govern other IS related systems in relation to the business needs. This is the element of how well the IS

activities of the organization fits or aligns with the business objectives. Significant tacit and intangible elements of Information System are embedded under this component.

IS Management Capability: While the Business and IS development capability of an organization addresses the operational capacity of the business, the IS management Capability is indicative of the planning and foresight capacity of the organization. This component determines the capability of the firm to effectively manage and deploy the IS knowledge, IS skills, IS competences, IS personnel and relationships plus partnership within its domain as dictated by the dynamic nature of a business landscape. Summarily, it encompasses the capacity for an organization to assess its IS status and to spot business opportunity from IS to enhance its competitive and performance advantage.

Networking Capability: Today, most organizations operations are intertwined and directly dependent on the relationships with its external environment. The defining capability here is the ability of an organization to acquire value from its business environment. This relates to the degree of agile response an organization can attain via the information and resources that it can harness from outside the fore-walls of its business. It also defines its ability to understand the appropriate outsourcing model that suits its core business operation. The capability of an organization to know how to respond to emerging threats or changes that tests the agility of the organization is captured by the effectiveness with which it can effectively align its internal IS resources with the wealth of resources in its network.

A close consideration of the different classifications of IS capability and related constructs from the reviewed articles, shows that each of the classifications could fit in one or multiple sectors of the ellipse model. For ease of presentation each classification will be grouped into the most closely fitting grouping. This is demonstrated in Table 2. The list is a grouping from the compilation of classifications in the reviewed papers. The model and the list are open to be extended, reviewed, expanded and built upon with emerging knowledge. The constituent of each ellipse as grouped in Table 2 is made up of a combination of resources, competences and capabilities. These are fundamentally different, however based on the 3-tier distinction adopted from Peppard (2004), it can be logically deduced that their utility effectively adds up to forming the macro capability of the organization. From this perspective, an organizations IS capability can be seen as a reinforcing relationship between the IT competencies and IT resources of an organization. For instance, if we take an individual view, the IT personnel are the resources but the skills that they possess is their competency which is beneficial and transferrable to the organization.

As an extension, we can consider two organizations that have each employed a specific IT personnel to fill the same kind of position. What would advertently determine the edge in this investment is not the personnel (resource) itself but the quality and relevant extent of the skill (competency) that such a personnel brings along. However, this is still latent, it becomes part of the organizational capability when it is exploited and utilized in complementary with other organizational resources or competences. When the value of a resource or competence is enhanced due to the presence of another resource or competence, complementarity is said to exist. (Powell and Dent-Micallef, 1997 in Tippins et al, 2003).

5.2   Contributions for Practice

Due to the tangible and intangible nature of information system, it is of value for practitioners, particularly IS managers to be able to evaluate the IS capabilities that they possess in the organisation. Furthermore, IS managers and CIOs need to continuously argue for the significance of IT with respect to the organisational strategy. A unified view of IS capability reduces the ambiguity involved in defining and classifying the IS capability possessed by an organisation.

In addition, the paper provides IS managers with a consolidated view that encompasses all the identified possible classifications of IS capability in IS research. This ultimately provides a comprehensive checklist for better judgement and positioning of there is capability. This is such that

the decision makers can have a realization of the limitations/weakness and the strengths and opportunities that are inherent in their overall IS structure.

5.3   Limitations and further research

This is a literature review paper that has been conceptual developed to unify the different lose ends observable in the topic of IS capability, which implies that the limitations associated with this type of research would also apply in this case. Firstly, there is always the possibility of some articles missed out in the review. However to minimize this, the paper has been developed by adopting a systematic review process following the guidelines of Webster & Watson (2002). Secondly, being a conceptual paper indicates there are openings that only empirically driven research can validate. We therefore advance this as a call for IS researcher to empirically validate, build on, criticize and develop the research agenda that has been opened with the unified perspective of the study of IS capability.

6   SUMMARY

One contribution of IS research is that it introduces new and useful concepts. IS capability is one such concept that cuts across virtually all the facets of the IS setup of an organisation. Via a systematic literature review, this paper presents current knowledge on the concept and its utility. A lack of clarity in taxonomy, definition and classification hampers a consolidated advancement of this concept. Hence this paper presents a possible unified view of IS capability classification to lessen the increased divergence of the concepts. Furthermore, key Areas approaching maturity and some areas just emerging are highlighted to open an agenda for further scientific enquiries.

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