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<p>Abstract</p> <p>Digital transformation pursued by firms is characterized by business disruptions and dynamic changes. Thus, the normal resource base and routine capabilities are not adequate to manage these changes. 'Dynamic capabilities', born out of strategic management studies are necessary to manage rapidly the disruptions to pursue the strategic objectives of digital transformation. In this study, 6 dynamic capabilities have been developed through strategic actions as creating and modifying the company's resource base or integrating and reconfiguring its competences. They are identified either as 'first order' or 'second order dynamic capabilities'. The results of this research further shows that firms that would have a strong resource base will have lesser firm specific 'second order dynamic capabilities' while having more 'first order dynamic capabilities' that would be more homogenous in the manufacturing industry at a higher level. The 'second order dynamic capabilities' are extension of the 'first order' and can be developed through the firm specific strategic actions performed to maintain the disruptions during digital transformation.</p>			
Key words	Dynamic capabilities, digital transformation, digital transformation business strategy, digital innovation, resources.		
Further information			





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ROLE OF DYNAMIC CAPABILITIES FOR DIGITAL TRANSFORMATION

Developing Dynamic Capabilities Essential for Digital Transformation

Master's Thesis
in IMMIT

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Preface

This thesis is the culmination to the completion of my IMMIT study. The study is a memorable phase of my life visiting and doing one of the best programs in IS Management in 3 different European countries. It has been so tough with many obstacles in the way that I have come so far. Coming from a home wanderer without parents' support since childhood to completing a triple Masters is a personal achievement that I would be proud of, and worth re-telling for others that "*Nothing is impossible with God*" (Luke 1:37). All Glory and Praise to God that I believe in!

Every single day, I have been fighting to find my place on this earth without any physical support since childhood. Life has not been easy, and I took a leap of faith to even embark on this journey to pursue this study with only €2000 in my pocket and an initial 5 months scholarship in France. The study took an extra year than anticipated, but as they say "the rest is history". Here, this part of my journey is done!

The space would not allow me to thank everyone who may have helped, so if one has assisted me even just by talking or responding to an email request, he/she is very much appreciated. Just a mention for few notable individuals; my gratitudes to my 2 Supervisors, the IMMIT board members, Professors and associates who have helped along the way. I thank Professor Hannu Salmela specifically for the 5 months research assistant work in Finland, together with Dr Abayomi Baiyere. It was a great help. Thanks.

In a similar note, special thanks to Ambassador Pascal Maubert, Prof Jan Czuba & team at DHERST PNG for their support. Also to my Adventist church families in the 3 countries, France, Finland and the Netherlands. Special mention to Mama Elvi & Kirsti, Isä Jussi & Vuoko, Evy & Reijo, Odile Ledésert, plus others who have assisted me in one way or the other. Through this study, I have met them all and made good friends that I will keep forever. I am very much thankful towards them all. Not the least, my 2 mothers back home also deserve the appreciation; and finally my IMMIT colleagues in both cohorts 10 and 11. They have been a superb group of students. Getting to know them all and studying together have been a very good experience. Great memories made and I wish them all the best in their future endeavours.

All in all, this study was not just a paper that I was after but a life-story in the making. I know this experience will be a milestone that I would step on to tell others to persevere and work hard to gain what they want in life. I have always told myself that I will do my masters, but coming from a developing country and having a background as mine, it was a hard fight; yet completing this study is a testament. It is a testament to that desire and perseverance to find my place in this fast paced world where everyone is for themselves. And to this end, I am not yet done with this chapter in my personal life and I am looking forward to what lays ahead again (Psalms 23).

The originality of this thesis has been checked in accordance with the University of Turku quality assurance system using the Turnitin OriginalityCheck service.

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1 INTRODUCTION

Technical innovations and emergence has changed the business environment. Digital transformation encompassing recently conceptualized “SMACIT (social, mobile, analytics, cloud, and internet of things)” (Ross et al., 2016) have played very important roles in the performance, development and innovation scales of firms. Those companies who were born with the development of the SMACIT technologies such as Facebook, Amazon and Google are progressively researching and developing them still further gaining added advantage, while the traditional firms have been adopting these technologies to boost their operations and maximize value creations resulting in the studies such as that of the leadership capability and strategies of digital transformation (Sebastian et al., 2017).

In the recent years, many firms have been involved in the digital transformation, and its engulfing both the private and public sectors. Thus, “no sector or organization is immune to the effects of digital transformation” (Hess et al., 2016) when they want to be competitive. Wide varieties of initiatives have been taken for digital transformation but “generally companies were seeking to transform in two dimensions: to know more about their end customers, and to operate in an increasingly digital ecosystem” (Weill & Woerner, 2015). From these two and branching further to the high level to value propositions and being competitive with the digital transformation strategic objectives.

Before jumping on this engulfing bandwagon of digital transformation hype, the resource and capability assessment is a necessity for firms embarking on the implementation of such strategic plans. It is often one of the first tasks taken by a company to pursue their strategic objectives for creating value and being competitive (Clulow et al., 2007), either in their own market or niche markets.

Since digital transformation is associated with disruptions (Schwertner, 2017) resulting in changes that are dynamic and driven by the technology, a special assement of the resource and capability to manage these disruptions and changes is inevitably a study that has recently been adopted by the IS community (Sambamurthy, et al., 2003; Wheeler, 2002). It’s the study of ”dynamic capabaility” (Eisenhardt & Martin, 2000; Helfat et al., 2007; Teece, 2007; Teece et al., 1997) that has been prevalent in the strategic management strand (Eisenhardt & Martin, 2000; Helfat et al., 2007; Teece, 2007).

The study of dynamic capabilities associated information systems and technology has driven the IS researchers and practitioners to conduct specific studies about dynamic capabilities that would assist the firm to pursue its strategic choices in a volatile environment (Pavlou & El Sawy, 2006; Sambamurthy et al., 2003; Wheeler, 2002) created by the adoption of many technological innovations in their operating realms.

Resource based capability assessment has been done by firms in the different sectors driven by the DT hype, but the need for the assessment of the dynamic capabilities

development resulting from specific actions to meet the unique business requirement is very vital. Therefore, this thesis aims to present the dynamic capabilities necessary for digital transformation and the development activities performed by incumbent manufacturing firms to maintain changes.

2 RESEARCH APPROACH

In this section we present the research approach taken. This includes the brief background of the concerned manufacturing firm, ManuftX, which is discussed and the motivation behind embarking on digital transformation. We also outline the research design taken and the data being collected and analyzed for its reliability and credibility to avoid any possible biases.

2.1 ManuftX and D4A Project

We called the name of the case company where data has been collected as ManuftX. It has been operating for about 30 years but dates back to late 1900s. It is a manufacturing firm and has been providing flexible manufacturing software and machines to other clients in this industry. The company provides automation and integration to their clients in their production environment. Headquartered in Europe, it has offices in China, US and Japan where robotic automation and manufacturing is centered. It has sold its manufacturing systems and tools to over 40 countries. Its a mid-sized firm employing 350-700 staffs across its entire office chain, yet very progressive of its staff maintenance with high competence and skills across the firm.

Since 2016 it has embarked on a digital transformation due to competition from other firms who only provide *software* than together with machine (hardware) as done by ManuftX. With this challenge, came the need for digital transformation to be competitive and alleviate business performance with continued value creation for its firm and stakeholders.

“I’m not sure if that digitalization is the correct word there, but in some cases, we are already competing against the software companies, companies that do only software. So, some cases it’s possible that the customer purchase the hardware from somewhere, and then there is a software company who builds software that controls the whole production system.” (LCS Director).

This research is part of a collaborative research initiated by the firm together with Turku University to create value for it clients and itself, and aiming at supporting digital transformation within the company. We refer to this project as Digitalization for Agility (D4A) in this thesis. Researchers from Turku University have been working with the firm in this project in which we have also been involved with the primary research in analysing the collected interview data. The D4A research project is directly associated with the firm’s R&D department

where they have a strong stance to implement the researched findings going forward.

ManuftX has a strong resource and capability base. However, the identification and development of the dynamic capabilities necessary for digital transformation to be agile and deliver value in a dynamic environment is of vital importance.

2.2 Research Design

In this research we used a qualitative content analysis methodology to analyse the secondary data supported by a systematic literature search and review for the knowledge base. This approach taken is backed by research questions that pertain to finding the dynamic capabilities and how they have been identified and developed to support digital transformation necessary for manufacturing firms.

2.2.1 Research Questions

The selection of our main research question is motivated by a very recent article by Vial (2019) that recommends to “*study how dynamic capabilities contribute to digital transformation*” in the first part of their two research agenda propositions. We then extended it to our research to identify the dynamic capabilities that are fundamental for digital transformation in manufacturing firms with strong resource base. The capabilities and resources enable the firms to achieve their objectives of the digital transformation business strategy, and in this case to study on how the manufacturing firms can actually develop the dynamic capabilities that influence the transformation process.

By aligning the research question from a recent article (Alvesson & Sandberg, 2011), we don't necessarily claim to fully present every detailed document in the wider spectrum of sources available, but exhaustively search the IS' Basket of Eight Journals (Bo8), to meticulously examine literatures that would fill our research agenda and present the thesis that will add to the extent literature on digital transformation and dynamic capabilities. This is aided with further documents from Google scholar and few other well known journals as IEEE Xplore as supporting articles.

This research will particularly help the current D4A research project in the dynamic capabilities assessment when outlining the actual capabilities aligned with prior available literature and contribute to the body of dynamic capabilities studied for digital transformation. It will also contribute to the digital transformation embarked on by other manufacturing firms to know the common dynamic capabilities and means to developing them. Thus, the problem statement, “***How dynamic capabilities are being identified and***

developed through resource base to achieve digital transformation?”, and answering the sub-questions:

- **RQ1. What are the current resources and capabilities for digital transformation?**
- **RQ2. What are the dynamic capabilities necessary for manufacturing firms for digital transformation?**
- **RQ3. How are dynamic capabilities being developed?**

Below is the outline of how the research questions are being answered in this thesis.

RQ1. What are the current resources and capabilities for digital transformation?

The first question will be answered based on the data analysed to identify the resource base of manufacturing firms. These are said to be homogenous amongst manufacturing firms from where routine activities are adequately performed. From these resource base, a firm may then proceed to develop dynamic capabilities necessary to manage disruptions and changes brought about by the digital transformation. Every firm has resource base and competence to pursue digital transformation and we expected to have the resources identified on a high level from the data and be presented in our findings.

RQ2. What are the dynamic capabilities necessary for manufacturing firms for digital transformation?

This will be done in two fold. The first will be associated with the extant literature review on dynamic capabilities associated with IS studies to reveal the dynamic capabilities that have been identified. Then the second part of the identification will be done with the data analysis performed to present the dynamic capabilities necessary for digital transformation. Analysis based on the actions taken to develop the dynamic capabilities will be made on those dynamic capabilities identified via the analysed data so we categorise them as to whether they are arising from a resource base or another level of dynamic capabilities. This resulting in the presentation of the dynamic capabilities in orders.

RQ3. How are dynamic capabilities being developed?

The answer to this research question is the culmination to answering the main research question. The specific actions associated with developing the dynamic capabilities identified in this research will be revealed mostly through the findings from our data being analysed and supported by the extant literatures.

2.2.2 Qualitative Content Analysis

This research is a qualitative research based on inductive content analysis of the secondary data supplied by a senior researcher for the same D4A project where this

research is a party to. The motivation for this research and the selection of the qualitative research approach is associated with:

1. Having the data based on digital transformation for the firm being readily available.
2. Writer has been previously involved in the analysis of the same data for the primary research using a different methodology in grounded theory.
3. Qualitative research approach has been widely utilized in the IS researches (Conboy et al., 2012).

The qualitative content analysis was ideal given that the same data has been analyzed manually in the previous research using "grounded theory" (Charmaz & Belgrave, 2007; Corbin & Strauss, 1990) methodology. All the contents of the archival documents and the interview data were analyzed. *Inductive* was employed in here to gather and categorize the themes (Thomas, 2006) after analyzing the whole contents of the documents. We gathered the main ideas around the set of the data to identify the main dynamic capabilities essential for digital transformation.

In this qualitative content analysis, we used computer software to do the analysis while referring also to the manually coded MS Excel file (Neuendorf, 2016), not to arise at a theme that is not widely elaborated as within the interview data and also the archival data.

The content was exhaustively analyzed of the interview data supported with the archival documents, and the findings were the major themes generated from the coded contents. This was done in parallel analysis and comparison with the analyzed data using grounded theory methodology for the previous research to avoid manipulation of the data in this research while also trying to avoid the replication of the previous study. Additionally, the major themes were also generated in close comparison with the extant literatures reviewed for the dynamic capabilities necessary for information systems driven transformation in organizations (Lucas et al., 2013). The schematic research designed for the content analysis performed is as shown in Figure 1.

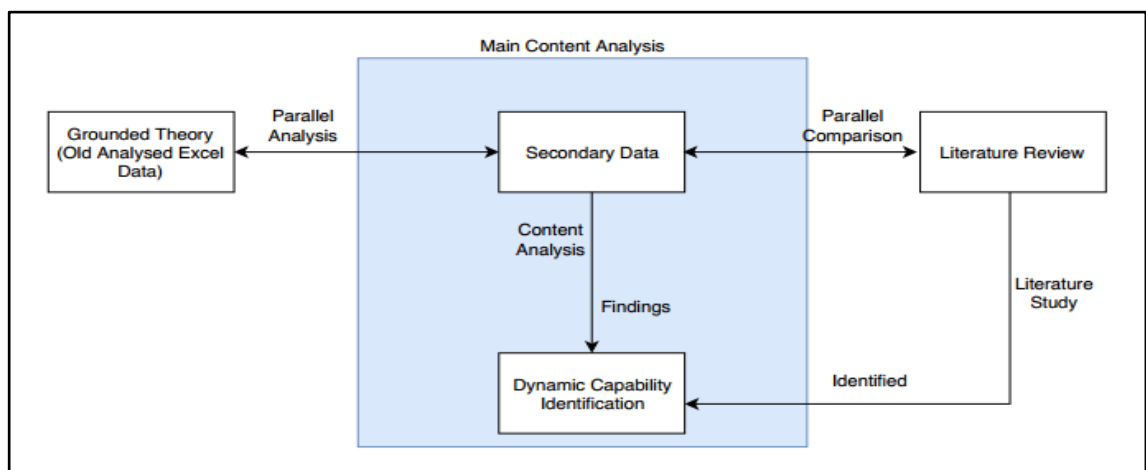


Figure 1 – Qualitative Content Analysis using Inductive Coding

Parallel analysis with the old MS Excel coded file was to identify the capabilities which was one of those major themes revealed using the grounded theory methodology. The literature review served as a guide to enabling if we have found dynamic capabilities that are uniform with those identified by extant literatures or we gathered something unique for this study. All in all, the independence of the content analysis was highly maintained, being done using a computer software and manually reading through each auto-generated themes.

2.2.3 *Literature Search and Selection*

In this thesis we were selective of the literatures for review to base our background knowledge, especially those related with dynamic capabilities so we can gather the specific dynamic capabilities related to information technology driven transformations. We used a *systematic search* for the literatures in employing the keywords that defined digital transformation. *Systematic* is used loosely as an “adjective to refer to the review or literature review, as well as describing the search strategy and selection criteria” (Schultze, 2015). However, the selection of the articles and interpretations were mostly done with an interpretive literature review methodology (Schultze, 2015). We employed the best possible literature search and review methodology for the articles necessary for our research specifically from the Basket of Eight (Bo8) Journals, supported by Google Scholar, IEEE Xplore and those relevant articles forwarded to us by our supervisor.

The keywords used are, *digital*, *transformation*, and *dynamic capabilities* to search for the literatures in the Bo8 journals. In each of the libraries that the particular Bo8 journal was made available, we searched with the keywords each time. We had digital innovation and digital strategy as keywords but we didn’t do the search using these keywords separately as they returned lesser number of articles compared to that of *digital*. We gathered that the articles related to these keywords were included in the search with digital.

We had the default settings for the dates, and the language to English in the e-library of the journals. All the results returned were exported to two bibliographic softwares, Zotero and Mendeley (Butros & Taylor, 2011). Our selection of the Zotero (paid version) and Mendeley (free) software was for aggregate storing for further searching using distinct criteria.

The total number of articles in the original search, prior to the migration to the software gathered were over 1000 (9095 to be exact), and some of them were clearly duplicates from the different journals that were saved into these softwares. Due to the difficulty in deleting duplicate documents in Zotero software, all the articles were moved to Mendeley software for specific search. We didn’t apply a particular year range for the articles to be

searched as we wanted to draw down to every specific articles as much as possible, especially with dynamic capabilities related articles. Both empirical and conceptual articles were selected. The keywords used were, *digital innovation and digital strategy*, *digital and transformation*, *digital*, and *dynamic capabilities* in the Mendeley software. From the final set of literatures, 13 Bo8 articles were selected specifically for dynamic capabilities associated with IS studies. Added 13 documents on dynamic capabilities from the management strands that were taken from Google scholar and other sources than Bo8 were also reviewed. We also reviewed 26 articles associated with digital business strategy, digital transformation and digital innovation.

The selected articles were based on thorough reading of their titles, abstracts, introductions and conclusions and closely associated with our research agenda. Other documents such as those discussing specifically innovation alone than together with digital transformation or digital innovation were not reviewed. We also checked the references of these articles and cross-cited where applicable (refer to Figure 12, Table 8-1, Table 8-2, in Appendix I for the literature search and selection).

2.3 Data Collection

The data was primarily collected for the D4A collaborative research project in digital transformation between ManuftX and Turku Univesity. The data sets are highly rich in that semi-structured interviews were conducted by a senior researcher from the university while the firm was strategizing and carrying out digital transformation. Also the firm archival data were adequately supplied and utilized. Credibility of the data is adequality discussed in *Section 2.4*.

There are two sets of “secondary data” (Vartanian, 2010) that have been used for this research, 60 sets of “semi-structured interview” (Myers & Newman, 2007) data from the senior researcher for a longitudinal study in digital transformation from 2016 to 2018 for the same firm, and company archival data from 1986 to 2018. The phrase *secondary data* is used to state that we were not directly involved with the collection of the data from the firm initially. It does not mean the data is not significant because it’s vey rich with unique sets of interview data done with more senior and strategic leaders of the firm for the D4A project, and also every detailed firm documents were at our disposal for this thesis.

The semi-structured interview data were done at 2 phases by the senior researcher for the primary research. 40 were related to the assimilation of the motivation for digital transformation and to achieve the planned objective of DT. The interviews were conducted with lower and middle management level, strategy team and leadership of the organization. The 20 were also unstructured interviews and were done a year later to uncover the relationship of IT and business process for the continuing DT.

The interview data were initially audio recorded by the primary researcher. The verbatim transcriptions were made available for our use for this research. The archival data used were all company data - presentations, historical background information of the firm, meeting minutes, intranet blog posts and comments, and all other documents that were necessary for our research as supplied by the senior researcher. We also searched for public information available about the firm, especially through their website for further information. This is necessary for the qualitative content analysis method to confirm that the collection and achieved results are valid (Weber, 1990). The documents were in different formats from jpg (Joint Photographic Experts Group (JPEG)) to pdf (Portable Document Format) file formats.

Though the data is rich, we have not been directly involved in the collection of the data. As such, to be certain of the data being utilized as reliable and useful for the content analysis and our research, we made a parallel acumen answering the questions mentioned by Engel and Schutt (2016, pp.327).

1. *What were the agency's or researcher's goal in collecting the data?*

The goal of the primary researcher was to know the process of digital transformation in the collaborative D4A research project. This thesis is about digital transformation and its still part of this main research project.

2. *What data were collected, and what were they intended to measure?*

The interview data and archival company data were related to understanding of the processes and the overall firm practices conducive for digital transformation.

3. *When was the information collected?*

The primary data were collected via participant observations and interviews over a period of 16 months within the firm by the primary research interviewer; specifically between 2016 and 2018. The archival data dated from 1986 to 2018. But the specific relied-upon-documents were that of 2014 to 2018, a period when digital transformation was initiated and implemented.

4. *What methods were used for data collection? Who was responsible for data collection, and what were their qualifications? Are they available to answer questions about the data?*

“Semi-structured interviews” (Myers & Newman, 2007) were conducted by the senior researcher in the collaborative D4A research project. It was done with middle managers and strategic leaders. The researcher shared only in a web-based shared drive of all the available verbatim transcriptions of the interview and archival data used in the primary research for this study. He was also kind enough to answer any questions sent to him regarding the data or even for the research itself.

5. *How is the information organized (by date, event, etc.)? Are there identifiers used to identify different types of data available?*

The data were organized in 2 sets: interview data conducted by the senior researcher and archival data provided with high authority by the firm employees to the senior researcher. The interviews were conducted in 2 phases too with the same interviewees.

6. *What is known about the success of the data collection effort? How are missing data indicated and treated? What kind of documentation is available*

All data came from within the firm and responsible officers who work in the firm. Basically they were qualitative data to our knowledge that were made available for our study by the senior researcher. The archival data were reliable as they were part of the firm's useful data, most of which came from internal intranet publications or under the authority of the custodians. The semi-structured interviews (Myers and Newman, 2007) were done in a proper manner to triangulate the emerging themes and conclusions drawn from the data.

The interviews span a total of almost 67 man-hours, 8 minutes and 34 seconds for the 60 interviews covering around 443, 344 words. All the archival data in English, totally 160 documents were kept while the foreign language documents were removed. Table 2-1 presents the list of interviews conducted while Table 2-1 contains the overview of the archived data (*hyphen (-) means no case*).

Table 2-1 – List of Interviews

<i>Interviewee Positions</i>	<i>Description</i>	<i>Number of Interactions</i>
<i>First set of interviews: Related to Business Process</i>		
Sales and Marketing Director	Overseas sales and marketing	2
CDO	Chief Digital Officer who heads the newly created Digital Business Unit	3
CIO	Chief Information Officer responsible for IT department	2
DBU Business Manager	Digital Business Unit's Business Manager	2
HR Director	Firm Human Resource Director	2
Innovation Director	Responsible head officers for innovations	1
LCS Director	Life Cycle Service Director (LCS deals directly with customer support services)	3

LCS Employee (Intern)	An intern in the LCS business unit.	3
LCS Employee	LCS Officer - common employee dealing directly with the clients on support services including sales too.	2
LCS Vice President	Life Cycle Service Vice President.	2
Marketing Director	Responsible for the marketing.	2
Marketing Employee	A representative of the marketing employees.	1
MMS Software Director	Oversees the development and distribution of the main client software	1
Product Manager	Product Manager.	1
Product Manager T Service	T-Service Product Manager.	4
Project Manager	Manager responsible for Projects.	1
Proposal Manager	Manager responsible for Proposals.	2
Software Director	Software Director.	2
Vice President	Firm's Vice President.	2
Vice President (Former CFO)	The current Vice president who used to be the Chief Finance Officer.	2
<i>Second sets of interviews: Related to Agility in Information Systems</i>		
CIO	Chief Information Officer.	4
Not Mentioned	The Interviewee not mentioned but from IT.	2
Named IT Officer	Senior IT Officer responsible for Innovation and IT Agility. Name was mentioned but anonymity kept.	1
IoT Officer	Staff responsible for working with the IoT Platform. Named preferred to be anonymous.	1
IT Agility Process Manager	This is for a particular office location. Name of office mentioned but anonymity applied.	1
IT Business Process Agility - Rep	A representative of the IT Business Process Agility.	1
IT HR	IT officer responsible for/at HR.	1
IT Office Rep	An IT officer representative of a business unit.	1
IT Support Manager	An IT officer representative of a business unit.	1
IT Solutions Manager	An IT officer representative of a business unit.	1

IT Office Rep	An IT officer representative of a business unit.	1
IT Rep of CFO	An IT officer representative of Chief Financial Office.	1
IT Director of Supply Chain	An IT officer representative of a business unit.	1
IT ICS Director	Internal IT ICS Director.	1
IT Key User	A main System Key User.	1
Senior IT Officer	A very senior IT Officer.	1
Total Interviews		60

Table 2-2 – Overview of Data

<i>Type</i>	<i>Amount</i>	<i>Duration (hh:mm:ss)</i>	<i>Documented</i>
Semi-Structured Interviews	60	67:08:43	443,344 words
First set	40	45:58:50	296,110 words
Second Set	20	21:09:44	147, 234 words
Archival Document	177	-	DOC - 49 Pages (10,184 words)
English	160	-	PDF - 295 Pages
Foreign Language	10	-	PPT - 520 Slides
			XLS - 5 Sheets
			HTML - 2 Files
			JPG - 8 Files
			PNG - 4 Files

2.4 Validity and Reliability

In qualitative research, the authentication and the credibility checks of the data are paramount to ascertain the reliability of the data collection and analysis in the content being analyzed (Walliman, 2017). Often vital for qualitative research is also its validity.

The validity and reliability of the qualitative studies have been pursued by the advocates of the qualitative studies and they remain “appropriate concepts for attaining rigor in qualitative research” (Bashir & Azeem, 2008). “Validity in qualitative research means the extent to which the data is plausible, credible and trustworthy; and thus can be defended when challenged” (Bashir & Azeem, 2008). Validity includes the credibility of the data collection, analysis, and techniques and instruments used by the researcher involved in the qualitative research (Bashir & Azeem, 2008).

Reliability is dependent on the validity of the qualitative research being conducted. “There can be no validity without reliability, a demonstration of the validity is sufficient

to establish the reliability" Patton (2001). Thus reliability is the consequence of the validity of the research. It involves the process by which the qualitative research has been carried out.

“Reliability and validity are conceptualized as trustworthiness, rigor and quality in qualitative paradigm” (Bashir & Azeem, 2008). They set the credibility of the qualitative research being conducted.

For this research, a thorough qualitative content analysis has been done on the data, and proper qualitative research methodology has been applied to ascertain its “credibility (reliability and validity)” (Bashir & Azeem, 2008).

The “semi-structured interview” (Myers & Newman, 2007) data were part of the digital transformation research within the firm conducted by a senior researcher for the firm’s collaborative D4A research project with Turku University. All archived data were also made accessible particularly for this thesis. They were provided with higher concern and authority, and none of the documents were required to be saved on the local machine other than the shared cloud drive. Every document was considered confidential outlining the high security and reliability concerns of the data.

We could not directly reach out to the firm except through the senior researcher who was using the same data to conduct the primary study about the role of agility in digital transformation. The interview data collected from credible officers within the firm form the credibility of the data, and they were all transcribed in a uniform format and made available for our use. We have also worked with these data for the primary research as a second coder using “grounded theory” (Charmaz & Belgrave, 2007; Corbin & Strauss, 1990) method in a constant comparative analysis and ordered coding, and believe also that these data sources are credible.

The content analysis methodology employed to triangulate the data for the second time with a different research question in the digital transformation project for the same firm makes this thesis reliable to really dig deeper into a specific theme of capability of the firm.

Biases were avoided as all documents were passed onto us without being selective of a particular group of documents and the rich interview data. Data analysis of the interview data was done using the NVivo 12 software utilizing the *auto coding* feature within the software than previously done with manual coding as a second coder using MS Excel 2013 for the primary D4A research in 2018.

2.5 Data Analysis

Qualitative data analysis was done using the NVivo 12 software (Bazeley & Jackson, 2013; Welsh, 2002; Hilal & Alabri, 2013). The NVivo 12 software was used specifically

to avoid biases and “being more rigorous and transparent than would be the case using manual methods” (Welsh, 2002), and to interpret the data more positively. Also to do a quick coding process and identify the themes that would be generated apart from the content of the same data that we have analyzed using grounded theory method as a second coder to the primary study.

However, the software was not taken as the central analysis tool to our content analysis (Welsh, 2002). We basically used the Nvivo 12 software to do an auto-coding to find the nodes it would generate and organize the data (Smith & Hesse-Biber, 1996). This was for a more thorough data organization and for us to analyze the content and assign the themes. We basically applied the steps mentioned by Bazeley (2007) as shown in Figure 2 to analyze the data and categorize each auto-generated nodes into the main themes. These were done with thorough analysis of the nodes’ contents too. These themes are the dynamic capabilities identified with parallel analysis and confirmation with the previously coded MS Excel file and the literature reviewed respectively, together with the whole contents analysis of the gathered documents.

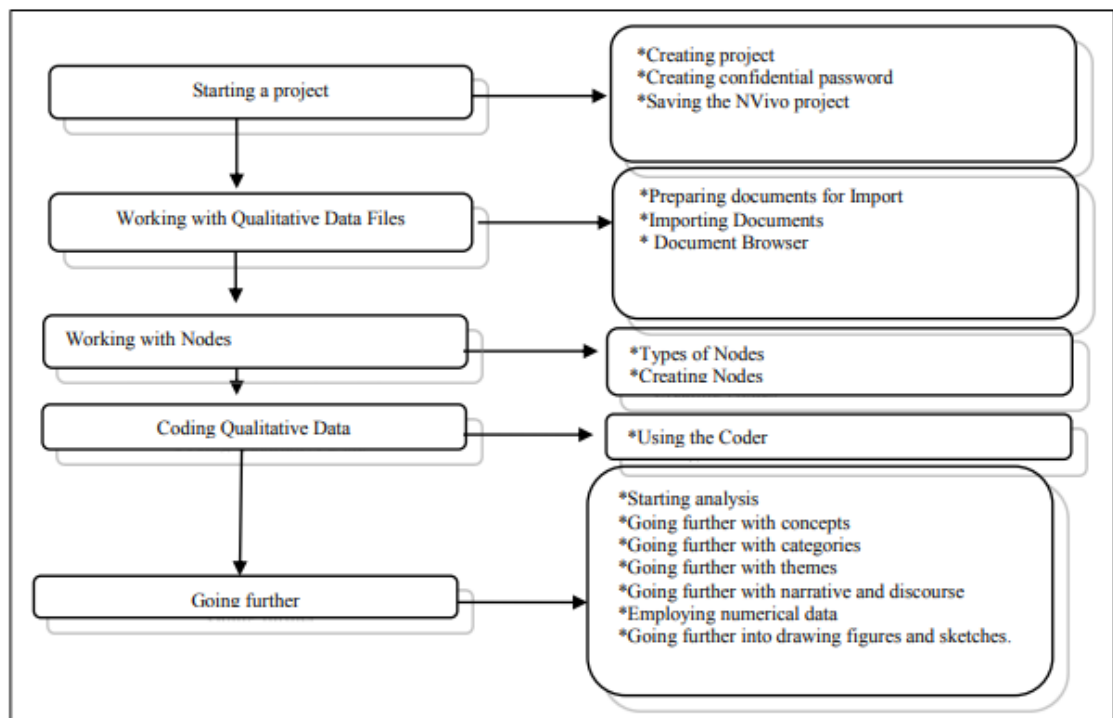


Figure 2 – Procedure Followed in Applying Nvivo software (Bazeley, 2007)

The NVivo 12 software was accessed via Turku University licensed library for students and staffs, and was installed on one local laptop. All the interview files that were downloaded and saved onto the local drive for this purpose only were imported into the software. Auto-coded themes were generated within the system. The auto coding was done to *identify themes* generated by the system. There were a total of 43 themes all

generated according to their occurrence in the interview documents (see the coding steps in Nvivo 12 in Appendix II).

Since we had a solid knowledge on the data from the previous work, we were able to identify and remove the irrelevant nodes as *thing*, *guys* and *bit* that doesn't add any vigor to the categorization of the themes. Then we did a manual parallel comparison with the previously coded MS Excel file done using grounded theory methodology for the primary study of the D4A research project and identified the main categories for this study to avoid generating foreign thoughts not being mentioned in the data. This was highly considered and done, because the interview data being analyzed by the NVivo 12 software were not specifically related to *dynamic capabilities* nor the research question in this research. However, it was still a relevant study based on the rich data collection for capability assessment for digital transformation. The analysis was also conducted in collaboration with the extant literature on dynamic capabilities necessary for information systems-driven transformations as digital transformation.

Overall the coding and analysis was performed specifically to arrange each nodes into themes generated with the content analysis and literature study that already presented dynamic capabilities necessary for digital transformation, yet not identified in manufacturing firms.

3 LITERATURE REVIEW

In this section, the theoretical background of the digital transformation, innovation and strategy will be defined together with dynamic capabilities to set the phase for the research. Digital transformation and the associated terms' definitions are briefly covered in a broader scope than taking a specific detailed route, which is not the objective of this thesis. The identification and presentation on the dynamic capabilities is very much from the literatures related to digital or IT driven transformations that are predominantly gathered from the IS Basket of Eight journals. However, added literatures from other sources such as strategic management journals have also been reviewed to give a clear background of the evolution of dynamic capabilities into IS studies, and their roles in digital and technology driven transformations.

3.1 Digital Transformation, Strategy and Innovation

The definition of digital transformation, digital innovation and digital transformation strategy are needed to clearly set the foundation for our research and to highlight the research scope and direction in the IS space where dynamic capabilities are studied. These terms have either been used interchangeably or the definitions are clearly part of the research documents when setting the stage for digital transformation studies to clear any ambiguity in understanding these conceptualized terms. For example, digitization and digital transformation has been used interchangeably in the everyday IS quorum (Bloomberg, 2018). Even the digital transformation is conceptual. Prior research documents have used these words and defined them either as a concept or to suit their research agenda. The definitions and the background theoretical concepts here are necessary in relations to where dynamic capabilities play in the strategic digital transformation realm.

3.1.1 Digital Transformation

The importance of organizational transformation is a necessity that has been practiced and studied in the business, strategy and management fields with different names (Besson & Rowe, 2012). It has recently been given ample research agendas from an IT-driven organizational transformation perspective that has even caused failures (Sarker & Lee, 1999) and also positively impacting the business with value creation (Hess et al., 2016).

While studying the IT enabled organizational and business value creating transformations, researchers have proposed in-depth understanding on the transformation

aspect with detailed and phase-wise presentations. For example, Besson and Rowe (2012) stated that transformations driven by information systems are strategically structured with "organizational inertia, process, agency and performance" from a "strategy, organization theory and IS perspective".

Transformation when taken with digital is not so much of alignment in business and IT (Sabherwal & Chan, 2001; Henderson & Venkatraman, 1999) but to strategizing resources, capabilities, organizational objectives to dynamically perform catering the process changes with agility. A term referred to as *Digital Business Strategy* discussed in *Section 3.1.2*. The scope, speed, scale, and sources of strategic digital transformation are adequately captured creating a *fusion* between business and IT (Bharadwaj et al., 2013; Pereira & Sousa, 2005) for transformation driven by digital business strategy.

"Digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which may result in changed products or organizational structures or in the automation of processes" (Hess et al., 2016). Often as a result of the internet-based media and connectedness that also can involve consumer and producer collaborations as in the product development process (Arakji and Lang, 2007).

Generally digital transformation is understood as the changes "precipitated by a transformational information technology" (Lucas et al., 2013). This transformation is encompassed in the operational routines (Chen et al., 2014) which are the daily activities that drive the business forward and could be supported by the transformation in the firm's business processes (Venkatraman, 1994) and its competencies and capabilities (Tan et al., 2015) to enable the firm to either perform in its operating market competitively or enter new markets (Dehning et al., 2003).

Vial (2019) identified 23 unique definitions of digital transformation from 28 different sources. The definitions as identified relates to 3 observations; *organizations, technology (types) and information nature* and the *existence of similarities* as in the use of *digital technologies* in the definitions despite the industry and firm differences.

The conceptualized definition of digital transformation we employed is, "*a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.*" (Vial, 2019). It captures three elements: *organization-centric* encapsulating the society and industry, "*improvement* as an expected outcome of digital transformation without guaranteeing its realization", and the "acceptance of the primitive use of *digital technologies*" as enablers of transformation (Vial, 2019). More importantly it also captures the dynamic changes and disruptions in the transformation enabled by digital technologies. We took this definition of digital transformation as our basis when discussing about the dynamic capabilities that not only discusses resources but processes and the wider environment to digitally innovate and deliver a product or service. The

conceptual framework of digital transformation (Vial, 2019) is presented in Figure 3 that covers all the building blocks of digital transformation. ”The arrows do not represent a statistical relationship or a causality found in variance models. Rather, they detail an overarching sequence of relationships described by the literature on digital transformation” (Vial, 2019).

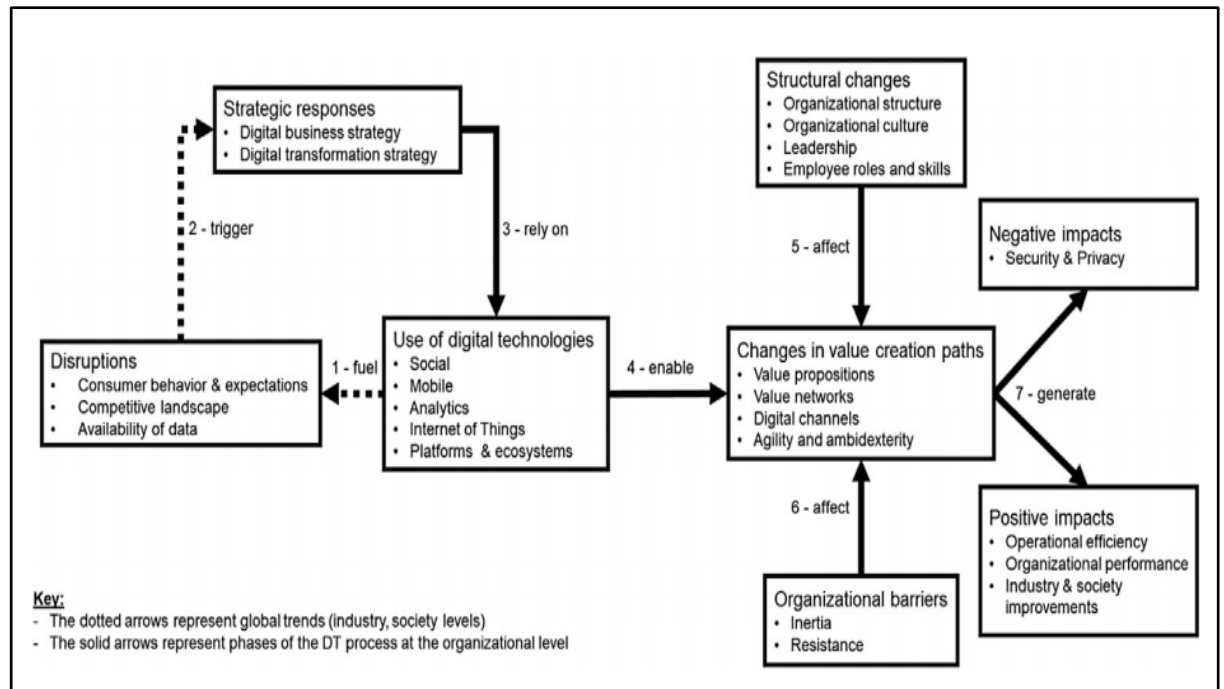


Figure 3 - Building Blocks of the Digital Transformation Process (Vial, 2019)

3.1.2 Digital Transformation Business Strategy

Firms embarking on digital transformation have developed strategies to implement the transformation and innovation. digital transformation success is not so much on the resources and technology but the strategy (Ismail et al., 2017). In this research we keep the concept of digital transformation business strategy or digital transformation strategy that includes the *transformation* term to cover for the disruptions rather than digital business strategy. Not a single research document specifically differentiates them. They are basically used interchangeably and we do the same here.

The digital transformation business strategy “serves as a central concept to integrate the entire coordination, prioritization, and implementation of digital transformation within a firm” (Matt et al., 2015).

The large part of an organization is affected by exploitation and the coordination of computerized advances and strategic choices. This also go beyond the boundaries and

affects the “products, business processes, sales channels, and supply chains” (Matt et al., 2015).

Business models are reshaped to carry out digitalization which has many potential benefits that includes “increase in sales, innovation in value creation, and novel forms of interactions with customers among others” (Matt et al., 2015). With respect to this agenda and further outcomes, digital transformation business ”strategies seek to coordinate and prioritize the many independent threads of digital transformation” (Matt et al., 2015). Digital transformation strategies go beyond other business strategies and align with them to account for wider firm objective (Matt et al., 2015). Digital transformation business strategy centers around the products, business proces and the organisational dimensions, affability of the new advances driven by a well functional strategy (Matt et al., 2015).

IT strategy basically focuses on the internal aspects of the information systems delivery but doesn’t necessarily cater for the broader scope of product innovations, processes, and structures including the external impacts of the transformation on the customers (Chanas et al., 2018). Digital transformation strategy caters for the wider spectrum that also introduces the business model of the firm (Matt et al., 2015), and the scope can be differentiated between different organizations (Singh and Hess, 2017). Figure 4. shows the relations between the digital transformation strategy and other strategies.

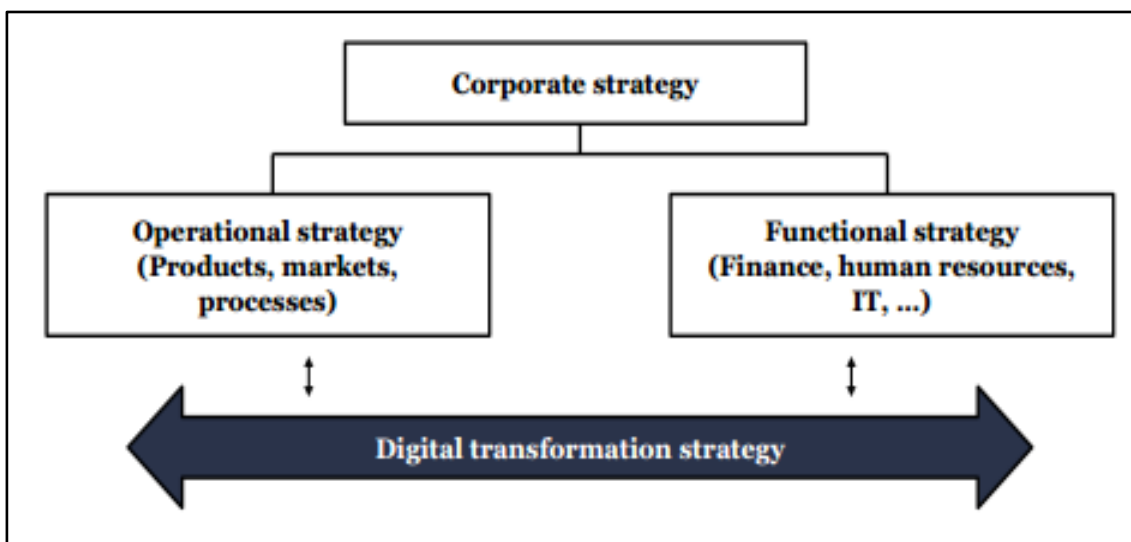


Figure 4 - Relations between Digital Transformation Strategy and Other Corporate Strategies (Matt et al., 2015)

Digital business strategy captures four elements in common namely, ”*use of technologies, changes in value creation, structural changes and financial aspects*” (Matt et al., 2015; Hess et al., 2016). Figure 5 shows the digital transformation framework balancing the four transformational dimensions. All exclusive of the industry or the firm. The use of its

capabilities and resources to exploit its technical resources and do innovation to create changes in value of the firm driven by structural changes. These is all possible with the evolution of the financial aspect of the firm (Matt et al., 2015).

In the structural changes, the adoption of the digital transformation business strategy has prompted organizational changes to include often digital business units (DBU) headed by a Chief Digital Officer (CDO) (Singh & Hess, 2017; Tumbas et al., 2017) to drive DT and innovation. Somewhat still not a definite term as Chief Information Officer (CIO) yet exclusively used by organizations (Matt et al., 2015) as a strategist. CDO, supported by other digital officers don't necessarily perform a functional role and report for marginal lost and gain as a CIO, but the role covers a wider organizational space with digital innovation and implementation plans and strategies. (Singh & Hess, 2017). It is "business-oriented, customer-centric and involves the entire organization" (Chanias et al., 2018). Further scope of digital transformation business strategy is not just around technology. Thus, such wider activities as adherence to risk management associated with digital technologies is paramount (Singh & Hess, 2017) and captured in digital transformation transformation strategy.

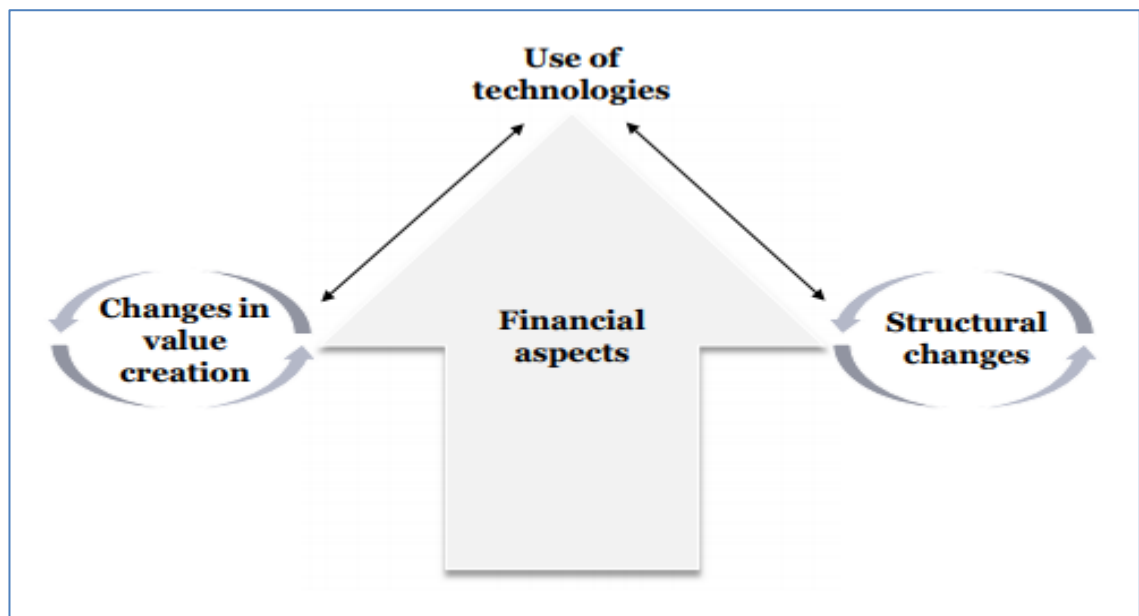


Figure 5 - Digital Transformation Framework: Balancing Four Transformational Dimensions (Matt et al., 2015)

The need to dynamically manage the products, processes, structures, financial aspects and the technologies as strategic resources is challenging as just as a new systems implementation challenge. This is often with the ever evolving changes in every aspects of the organization which are to be managed dynamically. The digital transformation strategy challenge lies not only in the products design and implementation but also in the

process being managed agilely. Dynamic capabilities play importantly in mapping out the strategic choices in a fluid business domain.

3.1.3 *Digital Innovation*

Generally “digital innovation is the use of digital technology during the process of innovating.” (Nambisan et al., 2017). Also digital innovation describes the results of innovation. It is termed as “sociotechnical phenomenon” (Nambisan et al., 2017) with consideration to the dynamic nature of the innovation that impacts the business and its clients, environments and the IS research community. Yoo et al., (2010) however, sways from the process innovation to specifically concentrating in product innovation using digital technologies.

The term of innovation is not so specific to a staged period of time as the dynamism continue to evolve. The outcome of innovation can evolve even after it has been implemented. Thus, making innovation not so a “well-rounded phenomenon” with digital transformation (Nambisan et al., 2017). The Innovation processes also have no specific boundary when it ends, as it can be congenitally repeating or evolving (Nambisan et al., 2017) even after a strategic project phase as the period of digital transformation.

In this innovation realm, the “dependence between innovation processes and innovation outcomes are so complex” (Nambisan et al., 2017). Digital innovation also scopes a wider range with “distributed innovation, open innovation and network-centric innovation” (Nambisan et al., 2017) born out of heterogeneous actors (Lyytinen et al., 2016) all driven by digital transformation strategy of the firm or a race to value creation and operational success. The “innovation processes and innovation outcomes” (Nambisan et al., 2017) are yet still complex.

While embarking on a digital innovation, in their extant literature study, Svahn et al (2017) identifies 4 competing concerns incumbent firms face, innovation capability that are in existence and the prerequisites, striking a balance in the product and process innovation to set the innovation focus, innovation collaboration with internal and external partners in resource sharing and organizational collaborations, and the innovation governance of control and flexibility. Yet, *innovation capability* is at the helm of the quest for digital innovation.

Innovation can be so disruptive that other firms who doesn't do innovation can be affected. Agility in responding to disruptive digital innovation is achieved with development of capabilities as the use of technology and strategic agility to change the dynamic capabilities to meet the innovation need upfront. This should be enacted (Chan et al., 2018).

With this complex background in digital innovation process and the outcome (Nambisan et al., 2017), the deep knowledge to understanding customers (Weill & Woerner, 2015), collaborators in a networked innovation ecosystem (Lyytinen et al., 2016; Nambisan et al., 2017) and the impacts of innovation in the “sociotechnical phenomenon” (Nambisan et al., 2017), the concept of dynamic capabilities is necessary to know the extent of the impacts in a changing transformational environment driven by the firm’s strong digital transformation business strategy.

3.2 Dynamic Capabilities in Technology Driven Transformations

A firm’s resource base as technology and competence drives organizational transformation. The dynamic capabilities necessary for digital transformation that may see digital innovation driven by a digital transformation business strategy has loosely been studied specific to the scope and problem concerned in the extant literatures. For example, the dynamic capabilities necessary for e-business transformation supported by strong “ability to integrate new and existing IT systems without stifling innovation” (Daniel & Wilson, 2003).

Digital transformation is pushing incumbent firms to create capabilities and utilize resources optimally to achieve the strategic firm objective. Dynamic capabilities play important roles in the digital transformational pursuits of the firm. Thus, the dynamic capability assessment is essential for digital transformation.

3.2.1 *Dynamic Capabilities*

Capabilities in general term is the resource strength that a firm may possess to create present value and be competitive in its given market share. Capabilities has been openly referred to as the operational capabilities converting routines and processes that are performed to carry out a specific routine task to make a present living (Cepeda & Vera, 2007).

Dynamic capabilities studied in strategic management (Eisenhardt & Martin, 2000; Helfat et al., 2009; Teece, 2007) has been to understand how firms respond to changes by creating, extending, and modifying the processes and routines to adequately response to the pressing change (Eisenhardt and Martin, 2000). It has recently been a research area in the IS management field with the adverse impact of the technological changes surrounding the business environment (Pavlou & El Sawy, 2006; Sambamurthy et al., 2003; Wheeler, 2002).

The two mostly quoted strategic management documents for dynamic capabilities are that of Teece et al., (1997) and Eisenhardt & Martin (2000). Peteraf et al. (2013) clarifies the dynamic capabilities in light of these two documents with three dimensional view from *Boundary conditions*, *Sustainable* and *Competitive Advantage*.

		TPS	EM
Dynamic capabilities and the question of:	Boundary conditions	The framework applies to environments of rapid technological change <i>The “approach is especially relevant in a Schumpeterian world” (TPS: 509)</i>	The framework encounters a boundary condition in such environments <i>The TPS logic “encounters a boundary condition in high-velocity markets” (EM: 1118)</i>
	Sustainable advantage	Dynamic capabilities can be a source of sustainable advantage under certain conditions <i>Sustainability depends on “how readily a [dynamic] capability can be cloned by competitors” (TPS: 518)</i>	Dynamic capabilities cannot be a source of sustainable advantage under any conditions <i>As simple rules, dynamic capabilities “are themselves unstable” (EM: 1118);</i> <i>As best practices, “dynamic capabilities are substitutable” (EM: 1110), thus violating a key VRIN condition</i>
	Competitive advantage	Dynamic capabilities can be a source of competitive advantage <i>“Dynamic capabilities . . . reflect an organization’s ability to achieve new and innovative forms of competitive advantage” (TPS: 516)</i>	Dynamic capabilities can be a source of only limited competitive advantage <i>Dynamic capabilities are “more homogeneous . . . than is usually assumed” (EM: 1116)</i>

Figure 6 - Critical difference between Teece et al. (1997) and Eisenhardt and Martin (2000) extracted from Peteraf et al. (2013)

The definitions of dynamic capabilities were conceptualised in the specific research agendas in the extant literatures. For example, Eisenhardt and Martin (2000) defines dynamic capabilities as a “set of identifiable processes such as product development, strategic decision making and alliancing”. Dynamic capabilities that evolved from the resource based view of organizations (Peteraf et al., 2013) as opposed to normal operational innovation capabilities are value creating and long term. Dynamic capabilities encompasses both the “broad organizational capabilities and specific actions that work together to effect organizational changes” (Yeow et al., 2018). They impact the business and its clients that changes the performance of the business and caters for disruptions.

Dynamic capabilities tackle a change and it’s dynamic with respect to time response considering every aspect of the market environment for sustainability and competitive advantage (Helfat et al., 2009; Teece et al., 1997). Thus, Dynamic capabilities can be distinguished with long haul pledge to specialized resources from the operational or ordinary capabilities that pertain to the present operations of an organization (Drnevich & Kriauciunas, 2011). A dynamic capability is not a specially appointed critical thinking occasion or an unconstrained response. It must contain some designed component, that is, it must be repeatable (Winter, 2003; Schreyögg & Kliesch-Eberl, 2007). Zollo and

Winter (2002) point out that dynamic capabilities are persistent and that "an organization that adapts in a creative but disjointed way to a succession of crises is not exercising a dynamic capability". *Dynamic* is asserted to the changing environment and not the capability of the firm (Ambrosini & Bowman, 2009).

Two different views on dynamic capabilities have been identified by Di Stefano et al (2014). The first one in line with organizational study entailing *Behavioral theory*. Particularly the organization's response to changes to gaining wider objectives of the organization such as growth, learning and organisational transformation. *Resource Based View* drives the second view that focuses on the competitive dynamics leading from a competitive strategy in amalgamation to company performance (Di Stefano et al., 2014). But both work in a complementary manner acting as a dynamic system to cover the underlying incompatibilities (Di Stefano et al., 2014).

Dynamic Capabilities studied coupled with "Resource Based View" (Peteraf et al., 2013) is applied in specific sectors as in home health study by Singh et al. (2011). Dynamic Capabilities not only consider the attributes of the RBV but how they are being applied while managing changes in dynamic business environment, both internal and external aspects of the operational environments that impact the organization; the processes and the resources necessary for transformation and the continuous management of the changes (Drnevich & Kriauciunas, 2011).

While "dynamic capabilities are concerned with strategic change, they are not a synonym for it. They are about one type of change, the intentional change of the resource base." (Ambrosini & Bowman, 2009). They capture the whole organizational view to manage changes (Teece, 2012) such as that driven by a digital transformation business strategy that results in digital innovations and acquisitions for competitive advantage for the firm.

3.2.2 First and Second Order Dynamic Capabilities

From the management strand, there have been studies on the level of capabilities and the identification of the dynamic capabilities. For example, Winter (2003) identifies zero level capabilities or operational capabilities as the resources and competencies to 'earn a living' currently and dynamic capabilities as those that modify and change zero-level capabilities. Wang and Ahmed (2007) provides a four level of capabilities. Resources as the *zero-order* for gaining competitive advantage with VRIN traits, capabilities as *first-order* which is the capacity of the firm to deploy resources to accomplish an ideal goal, core capabilities as *second-order* which are the bundle of the firm's resources and capabilities to integrate in accordance with the firm's strategic direction, and dynamic capabilities as the *third-order* for "a firm's constant pursuit of the renewal,

reconfiguration and re-creation of resources, capabilities and core capabilities to address the environmental change” (Wang & Ahmed, 2007).

However, two main levels of dynamic capabilities have been theorized, although the levels have been very much progressive. They are based on specifically identifying and categorizing the resources and capabilities. These two are the *first and second order* dynamic capabilities (Schilke, 2014). The first-order dynamic capabilities “extend, modify, change and/or create ordinary capabilities” (Drnevich & Kriauciunas, 2011). Without the first order, the operational capabilities may readily become core rigidity (Barton, 1992). Second order “performance is indirect and mediated by the first-order dynamic capabilities” (Schilke, 2014). The second order or the higher order dynamic capabilities are deployed with the present methodology or totally in a new way when the first order use is insufficient (Daniel & Franken, 2014). The first order enables quicker responsiveness to new circumstances in shakeout conditions (Daniel & Franken, 2014; Yoo et al., 2010). Theoretically, an inexhaustive movement of the levels of dynamic capabilities may be available, but practically, the second order dynamic capabilities is only realised and the higher orders are less inclined to be maintained (Daniel & Franken, 2014; Yoo et al., 2010). With various mechanisms, the organizational ordinary and dynamic capabilities have influenced firm performance at firm and process levels.

The Second-order dynamic capabilities is associated with strategic changes and it affects performance mostly with transformation of the first order. First order is associated with the transformation of the resource based view of the firm to gain competitive advantage (Schilke, 2014).

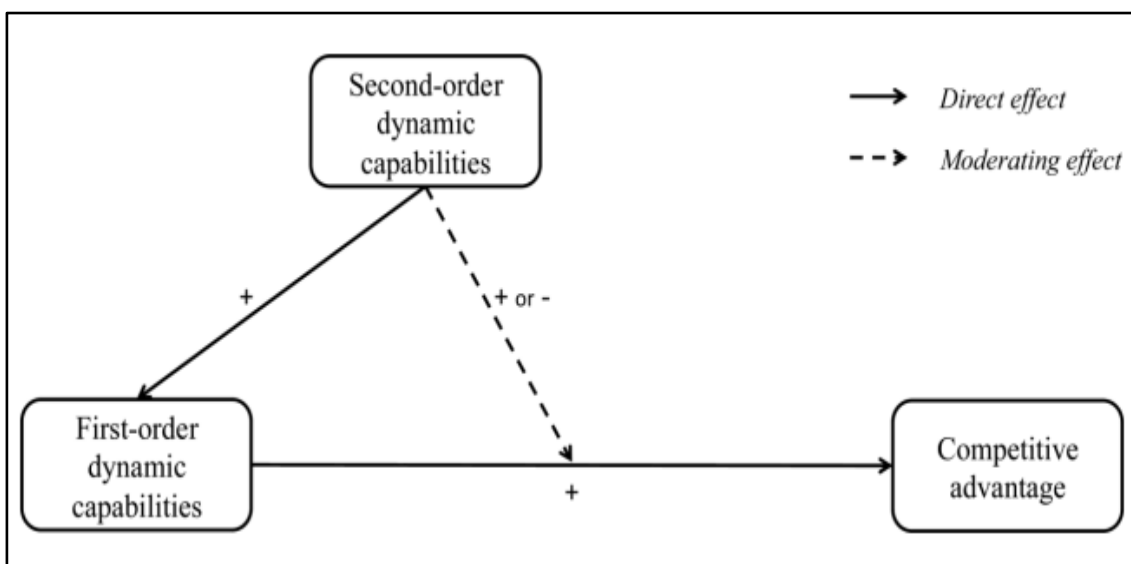


Figure 7 - Second-Order and First Order Dynamic Capabilities Relationship
(Schilke, 2014)

3.2.3 *Dynamic Capabilities in IS Studies*

The whole foundation for what basically is digital transformation, digital transformation business strategy and digital innovation associated with dynamic capabilities study has been outlined. The transformation business strategy drives digital transformation that can result in a digital innovation for the firm's value creation and competitive advantage. The quest for digital transformation is possibly driven by a strong resource base and competences for routine processes. However, technology-driven transformations that is impacted by both the internal and external business dynamic environment calls for a wider capability analysis in dynamic capabilities for the firm.

With respect to dynamic capabilities in transformations propelled by technology and digital transformation strategies, it's all about the competence and response skills of the management to use the firm's VRIN resources to adequately address changes affected by the dynamic environment for value creation and competitive advantage.

Determined dynamic capabilities have been identified in the digital transformation and IS studies (Pavlou & El Sawy, 2006; Sambamurthy, et al., 2003; Wheeler, 2002). Yeow et al. (2018) presents another view of the dynamic capabilities with emphasis to the broad organizational alignment perspective and exclusively on the distinct actions taken to reconfigure its resources. Specific concentration on the digital alignment strategy in the context of discussing the capacities of *sensing*, *seizing* and *transforming* actions is also presented by Teece (2007). These are cluster of activities or actions that are carried out by the organization using the dynamic capabilities to sustain itself (Teece, 2012).

With the *sensing* action, it is to sense the full encompassing environment and not being bound by technical chances but rather enveloping other market changes or interior choices that ought to be shaped (Teece, 2007). This is important for digital transformation strategy to adequately incorporate the ongoing changes and steer through uncertainty while scanning, learning and calibrating to cater the environmental changes in the digital strategy. Then *seizing* to mobilize the resources adequately to recognize the actions determined by sensing activities and capture value those activities by specific actions as designing and selecting among other options. For example, designing includes actions taken to design organizational structures and processes. Finally, *transforming* includes "continued renewal involving asset alignment, co-alignment, realignment, and redeployment" to maintain the digital transformational strategy (Yeow et al., 2018). Basically the realignment of the organizational resources and processes with specific actions in leveraging the existing resources, creating new resources and processes to serve a particular market or customer, assessing external shared resources to adding value to existing resources, and releasing resources present resources not necessary for the digital strategy (Yeow et al., 2018; Teece, 2007).

In this extant literature review, we have identified dynamic capabilities from the 13 Bo8 literatures reviewed that are associated with digital transformation and IS studies only (refer to Table 3-1 is an exclusive summary of the dynamic capabilities). These dynamic capabilities have either been directly developed or borrowed from previous literatures both in the IS and management domains.

From the extant literatures, its obviously mentioned that “dynamic capabilities are imitable, can be developed through multiple learning paths, and have commonalities across firms and industries” (Wheeler, 2002) for (1) rapid response to innovation and (2) effective redeployment and coordination of internal and external resources. However, there are very specific dynamic capabilities that can be used by the specific firm concerned. For example, Daniel and Wilson (2003) identifies 8 specific dynamic capabilities for e-business transformation. Yet still, the broad organizational capabilities (Yeow et al., 2018; Li et al., 2018; Bharadwaj and Grover, 2003) and IS capabilities (Tan et al., 2015) has very distinct sub-capabilities that are associated with the dynamic capabilities traits to perform in a changing and dynamic environment.

Table 3-1 - Dynamic Capabilities Associated with IS Studies

<i>Dynamic Capability</i>	<i>Definitions and Specific Dynamic Capabilities</i>	<i>Source</i>
Net-Enabled Innovation	Its referred to as the Net-Enabled Business Innovation Cycle (NEBIC). Network is the primary determinant as the capability for innovation and firm performance (Wheeler, 2002; Zahra & George, 2002). NEBIC is identified as “Applied dynamic capability” (Wheeler, 2002).	(Wheeler, 2002; Zahra & George, 2002)
Dynamic Management Capabilities	From an extant literature background, it is referred to as the “capabilities with which managers, build, integrate, and reconfigure organizational resources and competencies” (Li et al., 2018). Dynamic Management Capabilities is viewed in 3 dimensions: <ol style="list-style-type: none"> 1. Managerial Cognition - “beliefs and mental models for decision making”. Termed again as Management Cognition Renewal. Its a new way of thinking and doing. e.g.: learning from benchmarking practices. 2. Managerial Social Capital - “formal and informal relationships managers have with others”. 	(Li et al., 2018)

	<p>3. Managerial Human Capital - “knowledge, experience, skills, & education of both individual managers and teams of managers.”</p> <p>Recommendation is made for the top managers with keeping their managerial cognition skills dynamic with sufficient social and human capital that would be needed for digital transformation (Li et al., 2018).</p>	
Dynamic Strategic Alignment	<p>The co-evolution of IT and Business. Strategic alignment that is sustained over time, can be understood as a dynamic organizational capability upon which competitive advantage can be built. Dynamic Strategic Alignment addresses the discussion that pits spontaneous creation, good fortune, and base up input against arranging and top-down control. It gives vital adaptability to firms. Vital adaptability has both proactive and responsive structures, every one of which empower improved authoritative execution.</p>	(Baker et al., 2011)
e-Business Transformation Capabilities	<p>Daniel and Wilson (2003) identifies 8 specific dynamic capabilities that are part of the e-business transformation. Immutable and distinct capabilities that responds to changes adequately to create value for the firm and avoids duplication for possible imitability and yet competitive in a high velocity or dynamic market. (Daniel & Wilson, 2003).</p> <ol style="list-style-type: none"> 1. <i>A rapid strategy implementation cycle to meet the dynamic e-business changes.</i> 2. <i>Developing a business case incorporating substantial changes to the business model with uncertain information.</i> 3. <i>Building internal and external commitment to a strategic change.</i> 4. <i>Iterative development of the value proposition melding planning and experience.</i> 5. <i>The ability to reconfigure the sales/service process.</i> 6. <i>Integration with existing systems without stifling innovation.</i> 	(Daniel & Wilson, 2003)

	<p>7. <i>Integration across channels to enable multi-channel service.</i></p> <p>8. <i>Tautly coupled corporate strategy and e-business strategy formulation.</i></p>	
Absorptive Capability	Absorptive capacity has been described as a dynamic capability that is tied to a firm's knowledge management processes and IT resources. (Zahra & George, 2002).	(Zahra & George, 2002)
Two other high level capabilities that are not specifically mentioned as dynamic capabilities but most of their sub-capabilities possess the characteristics of being useful in a dynamic environment driven by IS transformations that worth mentioning are below.		
<i>Capability</i>	<i>Definition</i>	<i>Source</i>
Broad Organizational Capabilities	<p>Broader firm capabilities that enable it to perform in a dynamic environment. Not so specifics of the dynamic capabilities are mentioned. Dynamic capabilities encompasses both the “broad organizational capabilities and specific actions that work together to effect organizational changes” (Yeow et al., 2018) in a “reliable and least minimally satisfactory manner” (Li et al., 2018) . They impact the business and its clients that changes the performance of the business and caters for disruptions.</p> <p>Dimensions in this dynamic capabilities and resources includes “<i>Dedicated Financial Resources</i>”, “<i>Dedicated Human Resources</i>” and “<i>Senior Management Support</i>” (Yeow et al., 2018) with enabling strategic choices such as Staged Allocation of Resources to earn better from less investment; Autonomous Growth Group to work to creating new processes; “innovative culture” and common language for their business mission’s achievement mindset (Li et al., 2018). Specific capabilities would include <i>agility, digital options</i> and <i>entrepreneurial adaptation</i> from an IT perspective of organizational capabilities. (Bharadwaj & Grover, 2003). The identifying mark is that of the use of the firm’s broad resources and capabilities coupled with specific tasks to manage</p>	(Yeow et al., 2018; Li et al., 2018; Bharadwaj & Grover, 2003)

	change, disruptions and innovate in a dynamic environment.	
IS Capabilities	<p>“Refer to an organization’s ability to mobilize and deploy information technology (IT) based resources in combination or co-present with other resources and capabilities to enhance its overall efficiency, effectiveness, and/or flexibility in accordance to business needs.” (Tan et al., 2015).</p> <p>This covers the topologies of “Outside-In” IS capability that includes External Relationship Management and Market Responsiveness. “Inside-Out” IS capabilities that includes the IS infrastructure, IS Technical Skills, IS Development, and Cost Effective IS Option. “Spanning” IS Capabilities for competitive nature. IS Capabilities include: IS Strategy Alignment and IS Planning. The identifying mark is that of the use of the firm’s IS resources and capabilities coupled with specific tasks to manage change, disruptions and innovate. Not so much mentioned as a dynamic capability specifically except meeting the criteria of “sensing, seizing, and transforming” it’s IS resource base and capabilities in a dynamic environment.</p>	(Tan et al., 2015)

4 EMPHIRICAL FINDINGS

In this section, we present the empirical findings based on the secondary data - the firm employee interviews and archival data that have been gathered and analyzed. The dynamic capabilities that have been mentioned to be developed or needed for digital transformation and how it could be developed with a strong capability and resource base.

The firm's static resources are not enough to adequately launch into a digital transformation. The interviewees and the archived documents describe how they had to reconfigure existing resources or gain additional competencies in order to realize a successful digital transformation. It would therefore seem the implementation and performance of digital transformation is realized through appropriate dynamic capabilities which are captured in specific actions carried out through "integrating, building or reconfiguring its internal and external competencies" (Teece et al., 1997) or "creating, extending or modifying its resource base" (Helfat et al., 2007).

4.1 Resource Base and Competence

ManuftX has unique resources and capabilities that are specific for value creation which is envisioned in "customer value and financial value" (refer to Figure 8) (Archival Document). The company has identified its current static capabilities and outlined them either as a core capability or a resource for production and support services to their clients, driven by a strategic choice to achieve digital transformation.

The firm has defined the different competence levels. "*Capabilities can be defined as a combination of a set of organizational resources that collectively enable the organization to perform well in specific areas. Strategic Capabilities are capabilities important for the chosen strategy. Core competencies are capabilities that are uniquely excellent as well as central for the chosen strategy.*" (Archival Document). The current resources have been identified in 5 main high level categories from where the firm capabilities are derived. (Archival Document):

1. Human Resource - The sub categories or the strategic capabilities included education, technical knowledge, skills, attitudes, motivation, flexibility, commitment, and creativity.
2. Relational Resource - The sub categories or the strategic capabilities included, customer relations, supplier relations, reputation, trust, contractual and informal relationships alliances and partners.
3. Structural Resource - The sub categories or the strategic capabilities included culture, processes, tacit routines, organizational structure, governance, management, approach, social capital, patents, copyrights and data.

4. Physical Resource - The sub categories or the strategic capabilities included property, plant, location of buildings, information and infrastructure, and office design.
5. Monetary Resource - The sub categories or the strategic capabilities included cash, loans, equity, etc.

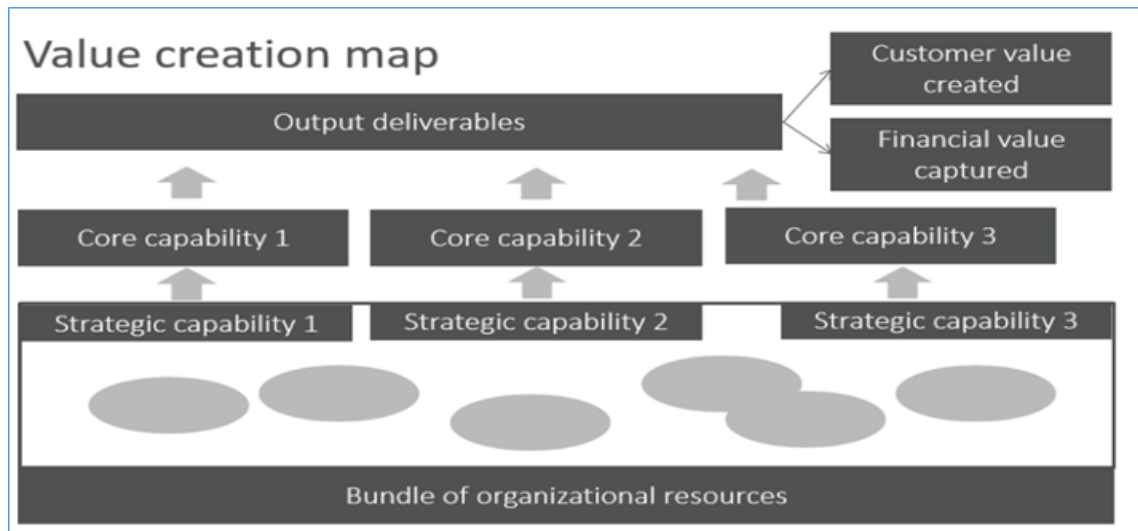


Figure 8 - Value Creation Map (Archival Document)

These resources and capabilities are of strategic importance if they establish a competitive advantage and sustenance of competitive advantage is maintained. These are weighed to be true based on the resource or capability being scarce and relevant, durable, difficult to copy and transfer (Archival Document).

Though the resources and capabilities have been identified to address operations prior to digital transformation (refer to Figure 9 for results of the internal capability analysis), the dynamic capabilities are not explicitly identified except the “*well functioning performance improvement process*” in its strategic performance management concepts and plans (Archival Document).

The findings in the preceding presentations are the dynamic capabilities taken solely from the interview data being analyzed and the company documents aligned with literatures reviewed. The dynamic capabilities here have either been used in doing the digital transformation or are said to be needed by the firm to achieve the aims of the digital transformation through “integrating, building or reconfiguring its internal and external competencies” (Teece et al., 1997) or “creating, extending or modifying its resource base” (Helfat et al., 2007).

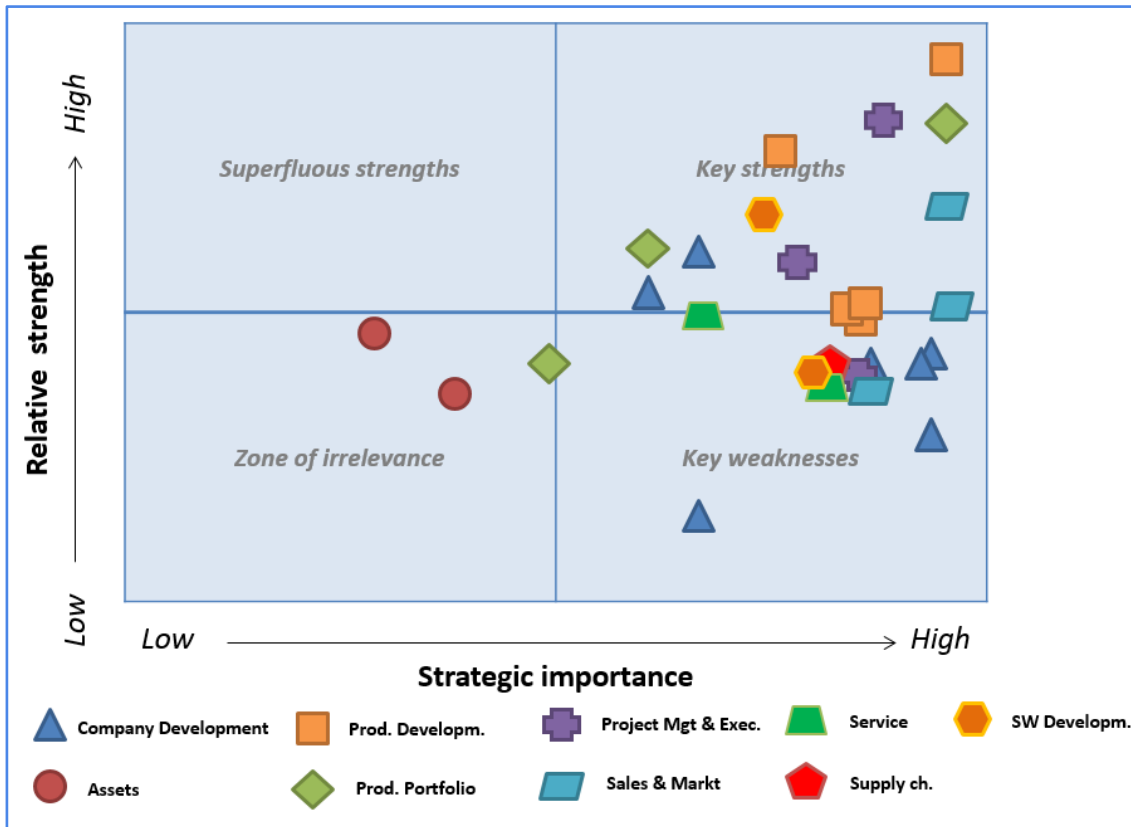


Figure 9 - ManuftX Resources & Capabilities Analysis: Strategic Importance vs Relative Strength (Archival Document).

4.2 Dynamic Capabilities Development

There are few strategic activities that were necessary to be done to identify and develop the dynamic capabilities for digital transformation. The dynamic capabilities do not born out of mere thought process but the actions that are pursued by the firm from their digital transformation business strategic objectives and plans. There were 6 distinct dynamic capabilities necessary for a manufacturing firm that were identified and developed which are presented in the preceding writings, together with the specific actions taken to develop the dynamic capabilities.

4.2.1 *Commitment to Customized Service Provision for Individual Customer*

This dynamic capability is the capability to being committed to the enhanced customer support and provision of services that boost the customers' own current service in a dynamic environment meeting the specific need of the firm and maintaining value creations.

In the early planning and road-mapping of digital transformation in ManuftX, the firm has considered meeting customer specific needs to be one of the core tasks to be performed. While talking about digital transformation, "listening instead of just fixing problems, coaching and giving hints of what to do, offering customized solutions and basically just having the me to meet the customer will be even more valued than today" (Archival Document), is of paramount importance to the firm.

The basis of its operation and innovation is very much driven by the market environment and its clients' unique needs to providing specific products and services to each client firms. So ManuftX has developed the firm capability to be very considerate and committed to its clients to meet their specific needs which is engraved in one of its value creation objectives, "Customer Value Creation" (see Figure 8). This has led to few customer based dynamic activities as creating clusters to meet their clients where they are operating and providing enhanced support services.

"We have those seven clusters, and inside those seven clusters, the market is basically, as we said, it's unlimited. So, defining the customers inside those clusters, understanding their businesses, and going after them. That is the key. And of course, expanding the offering for them. And that's all about the digitalization as well, when it comes to expanding the offering and how well we can serve those existing customers, and the customers who are in those clusters. So we don't need to create anything that extraordinarily new, when it comes to product offering. The only thing that we need to do is to expand it in the way that we are able to go for digitalization and stuff like that." (Sales & Marketing Representative).

Commitment to customized service provision for the customer not only calls for selling the needed manufacturing package but the ongoing support as it happens real time. This has led to the firm to perceive and take specific actions to seize the need for distinct service as "predictive maintenance" development going forward than the usual "proactive" which was developed to come off from the previous "reactive" support. An extended service provision.

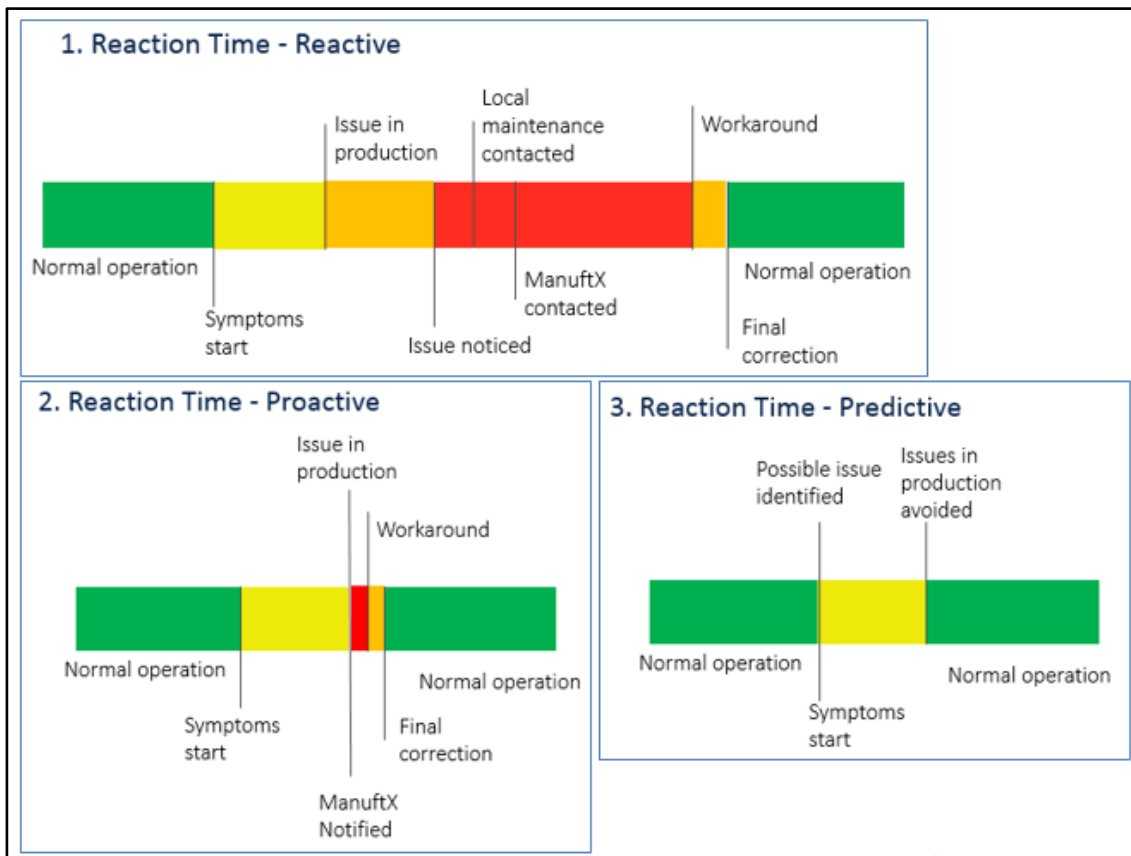


Figure 10 - Customer Support Reaction Time from “Used To Be” To “To Achieve” With Digital Transformation (Archival Document)

“And the more you are digitalized, the more data you produce. Okay? So those data you can use. And you can, for example, let’s say, for monitoring, or predictive maintenance. This is something what you can offer in addition, to you customer.” (Marketing Director).

Though the company value creation with internal processes management improvement is the need for its business operation, ManuftX also takes its client seriously and continuously develop systems and processes to meet the client’s specific needs where they arise. This is one of their primary objective and take pride as a firm operating in the manufacturing industry. They see themselves as their own competitor to delivering the customer-centric request.

“I would say that if you are asking what is our main competition, it’s actually, again, what we can really deliver by ourselves. Our capability is to provide what the customers are requiring. I don’t know if you saw.... you have to be able to offer for the customer, what they truly need and what they require. I mean, you have to be able to meet their needs.” (Marketing Director).

The “commitment to customized service provision for customer” as a dynamic capability needed to be developed further than currently being done to serve the client

specifically with each unique needs for manufacturing automation. This meant understanding the processes and each of their manufacturing hiccups.

“And I would say that the second core capability or maybe it’s even the first, what we should have, we should be even stronger than it is at the moment, is the understanding of customer’s processes, and the customers manufacturing dilemmas. That’s maybe somewhere we are not really good at the moment. Or not good enough, or we could be significantly better.” (Vice President).

The dynamic capability in meeting the customer’s specific need is especially associated with the involvement of clients in the requirements analysis and providing the specific products and support at an optimum level, while addressing the systems, organizational and process changes that impacts the firm.

Specific Actions Taken: To identify and develop this dynamic capability, ManuftX has created the 7 clusters for customers where all the clients are centered around for provision of specific services that would meet the clients’ distinct needs, even from business process understanding to extending a particular service support. The cluster creation includes specific activities as geographical based mapping of the clients for enhanced support.

4.2.2 Developing and Integrating Existing Systems

The developing and integrating of existing systems is a dynamic capability that defines the competence of ManuftX for the integration and enhancement of systems that is uniquely customized to automate client production unit, and also collaborate for service delivery in a shared environment.

The IS department has embarked on few systems and platform development and implementations. Two recent and most outstanding of the implementations included a cloud based platform, Think Works to connect all clients in the cloud and access data in real time for enhanced support and maintenance, and an IoT driven platform development internally while sensing the current opportunities that is provided by the IoT and big data and how they can maximize their production and support. For example, the monetization of the authorized data collected from the clients to provide support going forward with the integrated IoT platform which has to be even reconfigured.

“...if we would collect data from 50 different systems to big data and then grind it further to small data, and could then bring added value by summarizing the data and sell the outcome to our customers, then we haven’t even started the data monetization.” (DBU Business Manager).

The firm also saw the need for integration of the different systems into an ecosystem to maintain systems and data centrally and provide a dynamic platform to the users. They

have systems that have been developed for silo solutions but that could not be integrated for central management.

“About this digitalization and digital agenda, more widely, what we aim to do is that we aim to create collaborative factory to our customers, so that throughout this integration, we provide tools for real-time decision making to customer products and to sales, to CEO, to management, to maintenance etcetera, and create an environment that customer would have first time common language to discuss about...And what we aim to do with integrating the data systems and production machinery is that our customer won't have the 17 excel sheets to manage their operations...So, basically, there is in-built traceability and transparency in the software that we provide, and that's the umbrella that we do”. (DBU Business Manager).

Currently the automation of client's production system is very much being provided, but ManuftX also looks at even furthering the opportunity with digital transformation in integration. The clients source different systems from different other providers and they need to be integrated for optimal outcome. ManuftX has developed the capability with its systems to provide the integrated solution.

“It means that in the case of ManuftX, we provide automation to any tool brand. So, it means that we can integrate pretty much any machine tool in the market to our automation system. Then the machine tool builders have similar products as we do, but they integrate only their own machines to those solutions.” (LCS Director).

Essentially, ManuftX is not only looking at its own competitive advantage gaining but its clients' production boost to maintain its integrity as a credible firm that provides manufacturing automation systems. Thus, the need to integration and automation development is two fold. The internal system integration and the client ecosystem creation for services such as data extraction via IoT services being provided.

Specific Actions Taken: To develop this dynamic capability ManuftX has created an IoT Platform for internal use and also to centrally support customers. They also implemented a cloud based Think Works system to centrally connect all clients for better support and service. The competence to integrate different systems from different providers is always a high priority retention and development consideration for ManuftX.

4.2.3 Structural Adaptation and Business Case Development

It's the ability of the firm to develop business units and teams collaboratively organizational wide with the business case at hand for value creation. The business cases and models are developed to address business requirement.

A digital business unit (DBU) has been created and team members reshuffled to occupy the new unit. This was not done in isolation as to adding a new business unit only

to meet a specific department's goal but a company wide overhaul of the structure. The ultimate aim "the new Digital BU will create and run new digital business and support thriving existing business" (Archival document).

The new business unit is headed by a Chief Digital Officer who provides the strategic leadership for the development of digital services and innovation. This new change meant also that the processes and working ways of the officers within the different business units have been affected, though the change directly accommodates the digital transformation quest. Consequently, new specific business cases and models are to be identified and developed for an enhanced service provision and innovation, which is very much a focus for the digital business unit.

"We need to think about the new business models, how to do this, how we are able to align the offering, and so forth. And then, Proposal Management is the team that takes care of the offerings, so basically the TTO project offerings." (Chief Digital Officer).

Seizing the new structural changes also helped the firm to adopt new specific business models. For example, the pricing model of software provision with specific product offering to the client to meet each client's specific requirement.

"We are going to do the proposal for software intensive products, which means that they can't be offered in a better way. It means that we aim to understand the problem first. We aim to understand to use cases first, and only then we are going to make the offer. And, also, we aim at using new pricing models, variable, Software as a Service, licensing and so forth. There has to be new pricing models, instead of the only selection we have now, which is fixed. It doesn't work, if we talk about software deliveries, software products or something else." (Chief Digital Officer).

These changes have not been made a concern for the new digital business unit only but it has been channeled company-wide through the restructure. The different business units collaboratively working to achieve a common goal of digital transformation and innovation is determined to be of paramount importance.

"Well, I think that the business model creation would need to improve a lot. So, the business size of service concepting, how we are going to monetarize the services, how we are introducing those services to our customers. That needs to be improved a lot." (CIO).

"Yeah, cultural leadership of course, and I, again I come back to these value creation map, so... it says here that leadership and culture is there, kind of the foundation, and then we have stated, applying new leading innovations, business models and technologies." (HR Director).

"Some value added stuff that digitalization can bring, that it's not only about the hour price. What is the how many hours spent multiplied by hour price, but we can maybe make some new services customers, that are based on new business model, like some pay per outcome, or pay per use." (LCS Vice President).

The findings of the business case development revealed that most talked change is the “pricing model” of the software and products sold to the clients that can be extended easily from what has been built. This capability needs to be developed to cater for the ongoing pricing while providing different services to each client. Thus, ManuftX has indicated its dynamic structural adaptation and business case development capability with the restructuring and business model or case development respectively to perform its digital transformation. Very specific business models and case development would be an ongoing work for the firm to provide the best service for its clients and create value for itself.

Specific Actions Taken: For identifying and developing this dynamic capability the firm has created a new digital business unit which is headed by a CDO. Structural change channels the management of business models and cases collaboratively yet responsibly. Each business case and model has to be developed. One that would be pursued is the pricing model of the software services. A business model development for the mobile app that has also been developed that monitors the systems functions on the customer’s production environment is needed to be pursued.

4.2.4 *Strategic Commitment to Change Practices*

This dynamic capability is the ability of the firm to quickly respond to strategic change and support the projects at hand. The adherence to strategic change practices to implement innovation is to be enhanced and developed for a better change management. This is a core dynamic capability needed going forward as mentioned highly by few interviewees. The agility in accommodating changes driven by internal business cases and external market requirements for a competitive advantage. It has not been so effectively done in the past, yet while providing robust and unique services to its clients.

“I would say in general we are rather slow. I would say. But on the other hand side, we still consider ourselves to be a front runner in the technology of the automation, but I think we should be even more agile as we are at the moment. So it should be possible.” (Vice President).

Collaborative agility has been an issue too. Tasks were not done collaboratively in an agile manner to sense and seize the change opportunities to further business advantage and create customer value. Implementation with ease of the research findings in the operations has been one of those dynamic change management capability challenges.

“...one of the challenges ManuftX has had in the past is that the research activities are a little bit off, or somehow, detached from the operational doing, and that’s something we need to avoid. We need to be able to tie the research activities together with the

operational doing, and make sure that we're able to implement also findings from the research to actual products and services.” (CDO).

However, in the quest for digital transformation, every changes from business models, systems, and organizational changes are to be managed well and captured within project management paradigm arising from each business case. Unfortunately, this is one of the main dynamic capabilities ManuftX still has to improve for better value. They have already indicated to start with the project management for change practices.

“Business units are responsible with deliveries. We will have ad-hoc project teams in TTO projects, which means that the project team is formed based on the content instead of some predefined idea what should be”. (CDO)

Specific Actions Taken: To develop this dynamic capability, the firm’s cultural change in the way of project management operation and delivery is necessary and is to be pursued within the firm. Not static but being agile in working on the content than pre-defined idea of the projects. Agility in project delivery is to be encouraged in the projects work. This includes the improvement of the existing Gate Model for project management.

4.2.5 Dynamic Process Management

It’s the ability of the firm to managing the business processes within the firm in a changing environment to adequately address the internal and external business tasks.

The structural changes and the creation of the new Digital Business Unit has also impacted the way processes have been done and managed. Previously the firm has relied on a structured process management with detailed manuals and process documents, but this has had its drawbacks. For example, a new staff requesting for a laptop needed to go from HR to IT that required form filling which then needed to be approved at some stage. The business managers often didn’t use the HR system to request for the new laptop and it was a bit of an inconvenient work for the responsible IT officers who often were required to build the Laptop for the new staff, bit under pressure and less time. This has created delays and tedious work processes.

The need to have a dynamic process management to cater for work process automation and agile implementation of services is more of a firm strategy. For example, a new excel form has been created to trigger the HR department to gather the required information for the staff before IT officers are advised to build the new laptop as per request. It helps the IT officers to only receive the fully completed request and schedule its staff accordingly to the task resolving the delays.

Process management approaches are automated with systems such as the ERP and the intranet being integrated and updates being synchronized. The updates from ERP is

reflected on the intranet. Though, it is not very effective and done manually, this is one of the main areas of effective process management capability displayed by the firm.

“Intranet has the page which soles the gate status. But actually information is in ERP. And is updated on the ERP side. Intranet is only reflecting that. So it’s not... You can check the project page we have the gate status. But it’s directly thinking from the ERP...It’s dynamic...Now it was the intranet... It’s directly the ERP information. If I go and update something in ERP and rest the page or it’s updated”. (Project Manager).

However, the updated information is one sided from which the internet page is updated from the ERP data and can’t be reciprocated. But the dynamics of it is that, going forward this can be done for both ways as indicated. Same with other systems as Jira. Thus, the process management capability of the firm is as per the change at end to sense the opportunities with digitalization and reconfigure the existing system where needed for process efficiency.

Specific Actions Taken: To develop this dynamic capability the firm’s officers have indicated to identifying specific processes and routine tasks within the firm and updating via the intranet which is stored in the ERP. This is to be further developed to work 2 way easily (reciprocal). Most of the major processes are to be done in this manner.

4.2.6 *Dynamic Management Capabilities*

This dynamic capability if the competency of the leadership and management from the top-down in accommodating disruptions, changes and managing innovation projects to achieve the strategic goal of the firm and deliver digital transformation. It has been an anticipated discussion in the past that is to be realized. For Example, the IT department has been perceived as a support function. Thus the leadership in the IT department were accustomed to think like a support officer than a strategic thinker.

“...typically in ManuftX before my time ICT was just taking care of the laptops basically. What we tried to do is that we, do this change management that ICT is more than just supporting with the laptops and that was the target way in October 2015. We partner with business to develop business capabilities, we deliver solutions, not hardware and software only meaning that laptops and installing applications. We manage company information and protect it and we have this ICT.” (CIO).

The management has been somewhat static in their roles. The digital transformation quest has seen a change in the way the leaders have to shift their management capabilities to deliver projects that changes the way the firm operates. From the basis of a good “leadership and culture” KPIs are to be tied to the roles of achieving 2 of the other firm’s values, “customer competitiveness” and “taking control of production”. (Archival Document).

To assist in building the skills set of the strategic management thinking employees, the firm has set up specific leadership programs for its strong staff base resource. This has to be an ongoing program to meet the demands of the strategic changes.

“...we have a leadership program ongoing. And we, for example, now we have strategy works of upcoming and of a clue, two days of work to form strategic teams and middle management, managers, here in Finland...what kind of workshops or series of workshops we will have without managers, so that they’re understanding their important role and are able to develop their leadership.” (HR Director).

“The point is to look at the company as a whole and develop the capabilities. That’s anyways in the long run, it will be more profitable at the end of the day if we get the whole company working in an effective way. It’s all about that. It’s all about leadership, actually, not ending up in a competition situation.” (CDO).

The dynamic management capability also changes the way the officers work and how projects have been managed and delivered. Regardless of the complexity and magnitude being taken for a project, the management must have the strategic capability to assign project management on-the-go to work on the projects even as small.

“BPM refers to business project management. It means that these kind of high-level project managers will focus on certain kind of customer projects instead of... Because, in the previous organization we used to have a model where even small projects like small software task required a project manager, which doesn’t make any sense. So, for example, in the software production we are going to have so called quick response scrum team, which is taking care of smaller software tasks, customer projects, basically, independently, for us to be able to act quickly. Not having to mobilize the whole company, because it used to be that we had, let’s say, 200 software projects that required 200 hours of software development, which is small case. So, it required a project manager, a project plan and bla bla bla. A loss of overhead, and that’s something we need to get rid of.” (Chief Digital Officer).

“But now, I think it’s very good that we’re going to have this kind of business project management team which will take care of the delivery projects, and then we have the freedom of, basically, take the innovation out of that kind of a picture, because that’s completely different. It’s so different. The operational model of delivering projects, it requires a completely different type of mindset, running those kind of operations.” (Chief Digital Officer).

In essence, the leadership and management capability drawn down to the staff level to implement systems change and support the digital transformation is a dynamic capability needed to be reconfigured and improved to manage strategically every projects and deliver with success. It is not about following routine procedures but dynamically adhering to disruptions for the achievement of the strategic organizational goal.

Specific Actions Taken: The firm has developed specific strategic leadership workshops and training to train the leadership team and the officers for certain ways of performances than the static descriptions as in their job profiles. For example, 2 specific programs mentioned are the “Leadership Program” and “Doping Kitchen” (Archival Document). The officers are encouraged to perform in a scrum mode with ambitious delivery as in the doping kitchen.

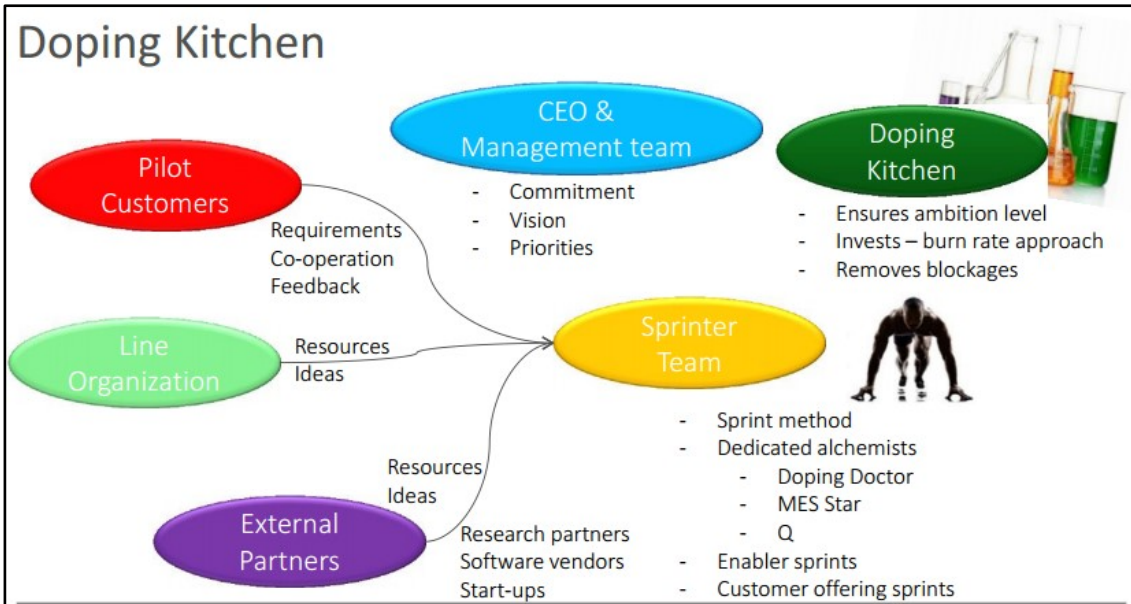


Figure 11 - Doping Kitchen (Archival Document)

5 ANALYSIS AND DISCUSSION

The internal research and capability analysis includes the general resources and capabilities to very firm specific capabilities that can be immutable and distinct that are the basis for the digital transformation to create value for the firm and its clients. A prospect to avoid duplication for possible imitability and yet competitive in a high velocity or dynamic market (Daniel and Wilson, 2003).

The resource base and capabilities are part of the company's VRIN resources and competencies (Barney, 1991). However, dynamic capabilities can be both imitable and distinct, and can be developed through the course of digital transformation.

Strategic actions performed associated with the dynamic capabilities to manage the transformation can determine whether its a "creation, extension and modification of its resource base" (Helfat et al., 2007) or an "integration, building and reconfiguration of its internal and external competencies to address rapidly changing business environments" (Teece et al., 1997) resulting from digital transformation. In Table 5-1, the dynamic capabilities identified with their strategic actions performed either on the resource base or competence are provided. These dynamic capabilities are then associated to the extant literatures if they are available to be found in this study. None existence of extant literature is indicated with a hyphen (-) in the *Literature Support Source* column.

Table 5-1 - Dynamic Capabilities for Digital Transformation

<i>Dynamic Capability</i>	<i>Enabling Strategies/Actions for Digital Dransformation from Resource Base & Competence</i>	<i>Actions Associated with DC (Teece et al., 1997) or (Helfat et al., 2007)</i>	<i>Literature Support Source</i>
Commitment to Customised Service provision for Customer	The internal firm competence to reconfiguring specific customer offering relationships that boosted the client's production. It included extending client system support in a more enhanced way by creating new enhanced support services such as predictive maintenance.	Build extended support capability.	-
Developing and Integrating Existing Systems	Development of net-enabled internal and client ecosystem. This includes development of new systems and infrastructure such as	Create new IoT systems, and extending the support service	Daniel & Wilson, 2003;

	IoT platform supported by a strong networked infrastructure. Also reconfigure existing systems to enhance support service and boost performance.	through net-enabled systems implementations.	Wheeler, 2002.
Structural Adaptation and Business Case Development	Organizational structure change that is agile to create business models and cases to implement specific changes.	Reconfigure organisational structure and create new business cases.	Daniel & Wilson, 2003.
Strategic Commitment to Change Practices	Agility in change management. Project Management office to oversee and assign projects in ad-hoc basis to agile teams and resources. This is driven by a strong dynamic management and organisational capabilities.	Reconfigure change practices.	Daniel & Wilson, 2003; Li et al., 2018
Dynamic Process Management	Business process coordination and management to meet the specific change applied within the firm.	Reconfiguration and extending of the existing business processes.	-
Dynamic Management Capabilities	Enterprise-wide management capability to accommodate change. Doesn't depend on an individual's ability to follow routines but corporate strategic goal achievement fostered by a high level of change accommodation.	Build strategic management capabilities.	Li et al., 2018.

The analysed resources, and the identified and developed dynamic capabilities can be strategically categorised. For the capabilities, though the level of categorisation have been progressive, the first and second order labelling have been theorised under dynamic capabilities (Schilke, 2014). Basing on this analytical framework the dynamic capabilities found in this thesis have emerged from a strong resource base, though the dynamic capabilities identified have to be with competence that can enable firms for digital transformation. For example, the *structural adaptation and business case development* dynamic capability arised from the structural resource, namely organisational structure identified in the resource analysis.

These dynamic capabilities are identifiable with alignment on specific actions of "creating, extending or modifying its resource base" (Helfat et al., 2007), associated with the definition of the first order dynamic capabilities (Schilke, 2014). The others that didn't fall into the extended modification from the resource base and have been identified during digital transformation are the results of the digital transformation business strategic choices and innovations. These are the second order dynamic capabilities (Schilke, 2014) that are developed and utilized in completely a new approach when the first order dynamic capabilities are insufficient (Daniel & Franken, 2014).

In manufacturing firms' pursuit to digital transformation, there are dynamic capabilities that are still distinct and it is expected to meet the pressing change. They evolved as a result of the digital transformation and the changes that could not be easily performed with the routines reconfiguration of its resource base (Schilke, 2014). For example, *commitment to customised service provision for customer* and *dynamic process management* were not in the extant literatures of Table 3-1. They have been found in this study, though generally the later dynamic capability would be anticipated and assumed to be present in a digital transformation study as this. Others were expectedly realised as similar to those in the extant literature. For example, *developing and integrating existing systems* was present in this study as it would have been expected with digital transformation. Though it is mentioned with a different relevant name in our research to categorise the coded themes, the attributes of the capability is driven by a strong net-enabled infrastructure. It is even referred to as "applied dynamic capability" (Wheeler, 2002) in the extant literature, a name not so synonymous with the found dynamic capability in this study but all around integrating and configuring the existing infrastructure for digital transformation. Thus, a clear margin on which dynamic capabilities are first order and which are second that evolved in this study is as shown in Table 5-2. (- Indicates dynamic capability is not applicable in the specific order in this study).

Table 5-2 – Categorized Dynamic Capabilities

	<i>First Order Dynamic Capability</i>	<i>Second Order Dynamic Capability</i>
1	-	Commitment to Customized Service Provision for Individual Customer <i>This includes activities such as specific customised cluster creation for meeting client's requirements.</i>
2	Developing and Integrating Existing Systems	Developing and Integrating Existing Systems

	<i>Utilization of its technical strong resource base to do intergration of its different systems for enhanced support.</i>	<i>In the quest to enhance integration, new systems are developed and implemented, a reconfiguration of the first order dynamic capabilities. For example, IoT Platform development into existing strong integrated systems environment.</i>
3	Structural Adaptation and Business Case Development <i>Reconfiguration of its existing structure to create a new structure with the inclusion of CDO in a new DBU (Structural Adaptation).</i>	Structural Adaptation and Business Case Development <i>The second order dynamic capability part includes the development of new models and business cases to perform digital transformation (Business Case development).</i>
4	Strategic Commitment to Change Practices <i>Reconfiguration of the cultural settings to managing change and projects implementation. For example, the extention of the existing Gate Model for project management practices. Greater determinant is if the firm would be a project-oriented.</i>	-
5	Dynamic Process Management <i>The automation of existing business processes procedures' information and manuals.</i>	-
6	Dynamic Management Capabilities <i>Reconfiguration and retraining of the existig strategic leaders with programs such as Leadership Programs.</i>	Dynamic Management Capabilities <i>Specific leadership development and recruitment such as Doping Kitchen Development and CDO recuritment to fill the gap of strategic leadership in driving digital transformation strategies.</i>

The categorization of the dynamic capabilities is very much driven by the strength of the resource base for manufacturing firms doing digital tranformation. Those with strong resources such as integrated systems and technology, they would have lesser number of second order dynamic capabilities than those with less resource base. For example, *structural adaptaion and business case development* dynamic capability is more of a first

order than second order when the firm already has a strong organisational structure that needs to be reconfigured to incorporate a new business unit as DBU to cater for the digital transformation. The *business case development* that comes with the new DBU creation makes it a second order dynamic capability as cases are developed for the implementation to meet the digital transformation business strategies and to perform innovations. Similar for *dynamic management capabilities* and *developing and integrating existig systems*.

Another notable case is that those dynamic capabilities in the second-order dynamic capabilities' categories are mostly specific and distinct to firms than those in the first-order because they were not mentioned in the extant literatures. This is not so surprising as many firms in specific industries as manufacturing have somewhat similar resource base from where first order dynamic capabilities evolve but second order dynamic capaility is developed to meet changes brought about by the digital transformation. For example, in the high end manufacturing industry, firms embarking on Industry 4.0 obviously have implemented Industry 3.0 (Sanders et al., 2016) and are coming to implement this new technology to exploit its capability and being competitive. The second order dynamic capability would result in the implementation of the Industry 4.0 where specific changes to the existing routines are being done.

When comparing Table 5-2 with Table 5-1, the full second order dynamic capabilities are not mentioned in the extant literatures. Those that are partly second ordered dynamic capabilities with less deep inclination to the first order like *structural adaptation and business case development* are not so *popularly* mentioned in the extant literatures reviewed except very idiosyncratic to manufacturing firms. However, *dynamic process management* dynamic capability is an exception. Though it is found to be in the first order in the categorization, in our study in the extrant literatures, nothing is mentioned of this except by Daniel and Wilson (2003) in a very specific e-business transformation of SME, the fifth dynamic capability as "*the ability to reconfigure the sales/service process.*"

6 CONCLUSIONS, LIMITATIONS AND FUTURE WORK

In this section we present the conclusion, limitation and future research direction necessary to be taken after this thesis to pursue the study of dynamic capabilities in digital transformations. We present a high level conclusion of our findings and answer the main research question on a similar fashion. The limitations are specific to our research scope that we have taken, same with the future research work recommendation that is to be pursued.

6.1 Conclusions

The objectives and plans outlined in the digital transformation business strategy is the foundation on which the results of digital transformation and innovation are measured against to evaluate and ascertain the achievement of the digital transformation activities performed. Firms have either succeed or failed in digital transformation due to the volatility and dynamism brought about by the disruptive technologies in "SMACIT (social, mobile, analytics, cloud, and internet of things)" (Ross et al., 2016). A motivation for the strategic assessment of the resources and capabilities.

The firm pursuing digital transformation need to establish its dynamic capabilities clearly as would be done for the VRIN resources and capabilities prior to doing digital transformation so it can actually extend from the existing dynamic capabilities to another level. This is to establish the capabilities necessary to operate competitively and create value for its clients and stakeholders alike while also adequately coping the disruptions brought about by the changes and innovations, both from internal and external environment. This has driven us to this study on "*How dynamic capabilities are being identified and developed through resource base to achieve digital transformation in manufacturing firms?*"

The study has identified six distinct dynamic capabilities for digital transformation in manufacturing firms. These dynamic capabilities are developed through strategic actionable tasks either by "creating, extending and modifying its resource base" (Helfat et al., 2007) or "integrating, building and reconfiguring its internal and external competencies" (Teece et al., 1997). Most often competencies integration, building, and reconfiguration resulted in "second order" dynamic capabilities (Schilke, 2014) identification and development. Highly likely to be idiosyncratic and industry or even firm specific in the quest for digital transformation. "First order" dynamic capabilities (Schilke, 2014) are results of the creation, extension or modification of its strong resource base prior to or even during digital transformation. They are found to be imitable on a high level having specific resources such as a strong technical infrastructure. Yet still,

some dynamic capabilities can be in both categories when it has not been visibly and fully developed in the first order but it's use is obvious to managing the change with added actions as reconfiguration of the first ordered capabilities for a specific pressing change management. Overall, digital transformation is driven by a strong dynamic business environment, and these dynamic capabilities play strategic role in managing these changes rapidly to achieve the objectives of the digital transformation business strategy. As such, the development of dynamic capabilities is inevitable with digital transformation, and firms would perform specific activities to develop the dynamic capabilities.

6.2 Limitation

As with any research work, our thesis has limitations that we would like to present. The study of dynamic capabilities has recently been adopted into the IS strand (Pavlou & El Sawy, 2006; Sambamurthy et al., 2003; Wheeler, 2002). Therefore, the literature sources available for the dynamic capabilities studies associated with digital transformation was very limited. The extant literatures could not be specific to a empirical research that outlines the distinct capabilities but also with conceptual studies to identify the dynamic capabilities in previous technology-driven transformational studies. The following are the major limitation of the study:

- The dynamic capabilities identified herein are higher level based, and were studied from a single firm's data source. These dynamic capabilities need to be verified with more data from different firms in the same industry or across varying industries to find out the specific dynamic capabilities necessary for digital transformation.
- Data collected was very rich yet it was used as a secondary data source for this research. Primary data through interview targeted for the specific research question in identifying the dynamic capabilities necessary for digital transformation needs to be conducted to gain a clear firm perspective, as it wasn't the case in this research.
- We could not directly liase with the firm to gather latest company documents and the current status on the digital transformation. This we believe limited the possible exploitation that we could have done to gather further progressive information on the digital transformation results in the firm if there were any that were achieved.

6.3 Future Research Direction

There are 3 future research work that we would like to propose. Firstly, our research was based on data from a single firm. It would be interesting and necessary to do a simialar research to find the specific dynamic capabilities necessary for digital transformation across multiple firms either in one industry or several industries. This would clearly outline the high level exact resource base that would be homogenous across firms and then pursue to develop dynamic capabilities necessary for digital transformation. The second proposition would be to know whether the dynamic capabilities are useful after digital transformation phase has ended or do they become extinct. This is to clarify the extant literatures on the levels of dynamic capabilities to see if there are transitions from one order to another that happens without even much confusions and disruptions. Finally, a research on how these dynamic capabilities actually affect the digital transformation outcome and to what extent do they affect the results would be a necessary study. This is a proposition made by Vial (2019) and we realise that need in our research so support it for further research.

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8 APPENDIX I – LITERATURE SEARCH

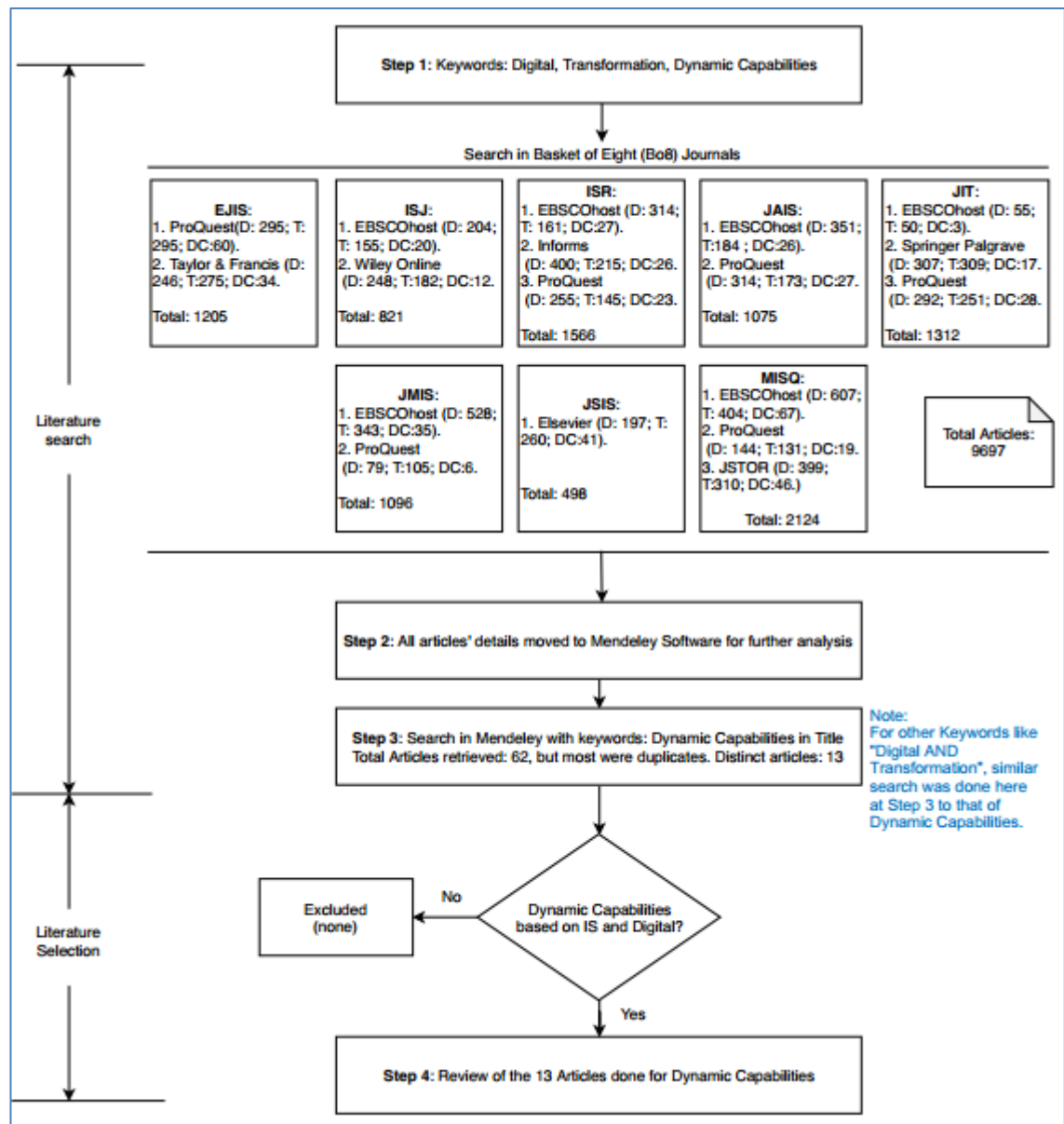


Figure 12 – Extensive Literature Search Process

Table 8-1 – Literature Search Results from Mendeley Software

<i>Keywords</i>	<i>Literatures Returned</i>	<i>Literatures Selected</i>	<i>Selection Criteria</i>
Dynamic Capabilities	62	13 distinct articles	Search done on Title where the keywords were mentioned.
Digital AND Transformation	58	11 distinct articles	Search applied was on the title and 19 distinct articles were returned. But based on abstract

			reading, the 11 were on corporate transformations.
Digital AND Innovation	93	10 distinct articles	Editorials, duplicates and articles that didn't meet our research agenda based on the title, abstract and even introduction reviews were removed. Also articles selected in previous search results were removed. For example, Sambamurthy et al., (2003)
Digital AND Strategy	48	9 unique articles	Most of the articles were also included in the previous searches and selections.

Table 8-2 - The 13 Bo8 Articles for Dynamic Capabilities

	<i>Title</i>	<i>Authors</i>
1	A Dynamic Capabilities Theory for Assessing Net-Enablement	Wheeler, (2002)
2	Aligning with new digital strategy: A dynamic capabilities approach.	Yeow et al., (2018)
3	The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry	Karimi & Walter, (2015)
4	The elephant in the room of dynamic capabilities: Bringing two diverging conversations together.	Peteraf, (2013)
5	The role of IS capabilities in the development of multi-sided platforms: the digital ecosystem strategy of Alibaba. com.	Tan et al., (2015)
6	Clarifying the conditions and limits of the contributions of ordinary and dynamic capabilities to relative firm performance.	Drnevich & Kriauciunas, (2011)
7	The innovator's solution: Creating and sustaining successful growth.	Christensen & Raynor, (2013)

8	Dynamic Capabilities in Home Health: IT-Enabled Transformation of Post-Acute Care.	Singh et al., (2011)
9	Conceptualizing the dynamic strategic alignment competency.	Baker et al., (2011)
10	The net-enabled business innovation cycle and the evolution of dynamic capabilities.	Zahra & George, (2002)
11	The role of dynamic capabilities in e-business transformation.	Daniel, & Wilson, (2003)
12	Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms.	Sambamurthy et al., (2003)
13	From IT leveraging competence to competitive advantage in turbulent environments: The case of new product development.	Pavlou & El Sawy, (2006)

9 APPENDIX II – DATA ANALYSIS IN NVIVO SOFTWARE

The steps for the “auto-coding” of the interview data within the NVivo 12 software.

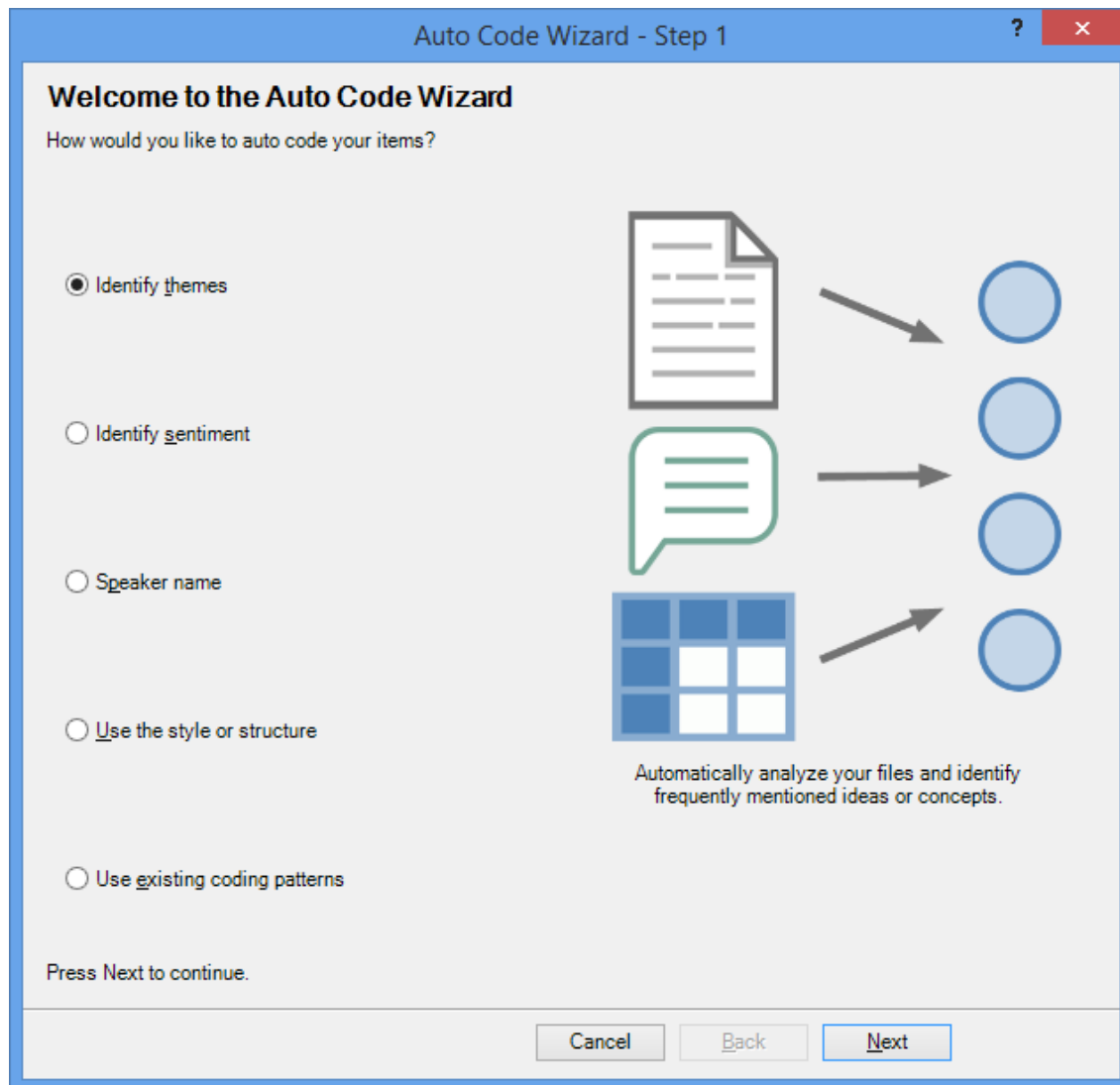


Figure 13 - NVivo 12 Screenshot of the Auto-Coded Step 1 - Identify Themes coding

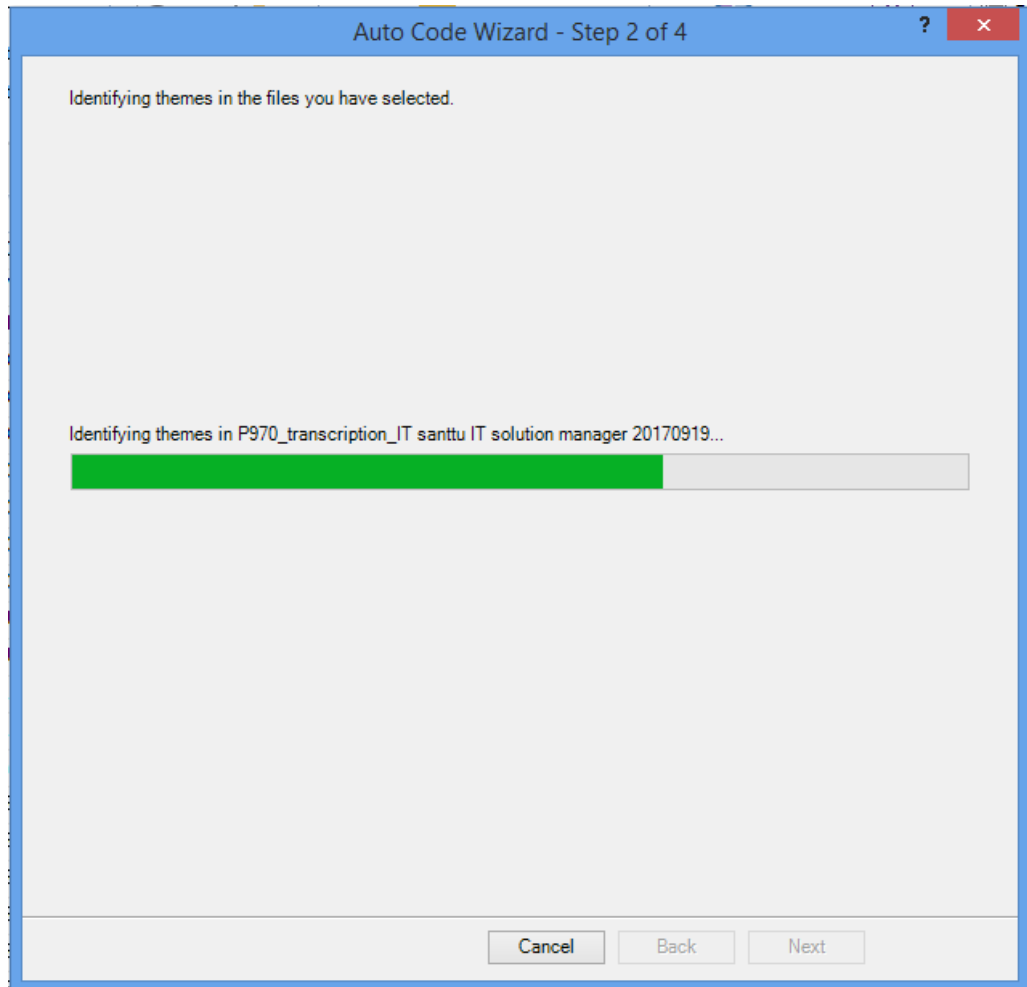


Figure 14 - NVivo 12 Screenshot of the Auto-Coded Step 2 – Processing the Themes

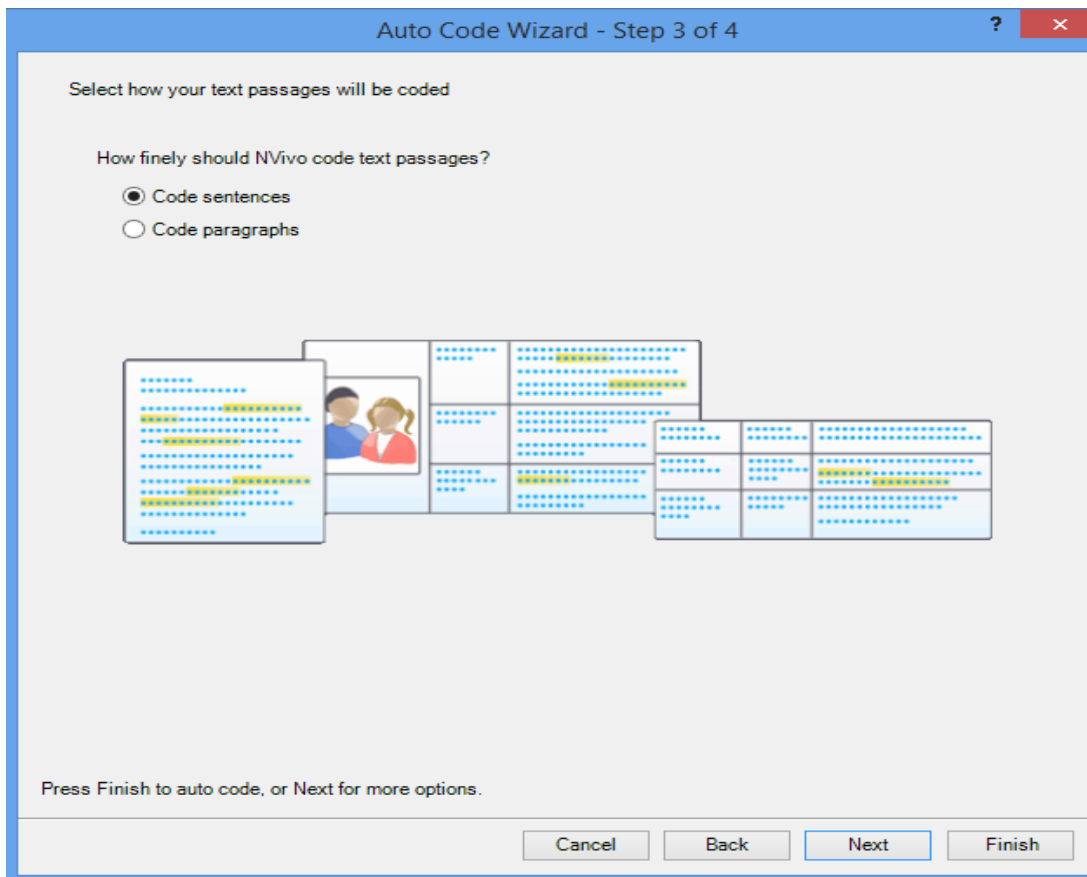


Figure 15 - NVivo 12 Screenshot of the Auto-Coded Step 3 – Code Sentences selection

Autocoded Themes - All Interviews			
Name	Files	References	
1. Commitment to Customised Service provision for Customer		0	0
2. Developing and Integrating with Existing Systems		0	0
automation		31	108
control		22	51
data		33	76
development		38	98
solutions		32	58
system		47	203
Systems Enhancements		0	0
3. Structural Adaptation & Business Case Developments		0	0
4. Strategic Commitment to Change Practices		0	0
change		31	58
delivery		32	60
digital		37	110
project		40	129
time		33	57
5. Dynamic Process Management		0	0
6. Dynamic Management Capabilities		0	0
8. All other Nodes Generated_Not Used		0	0
Resource Base and Capabilities		0	0

Figure 16 - NVivo 12 Screenshot of the Auto-Coded – Themes of Coded Nodes

