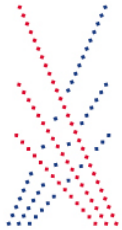

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Towards a Capability Maturity Framework: Adopting the universal elements of Digital Capability Maturity as an Organisational Strategy

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Abstract

As technology continues to evolve, there is a need for organisations to develop the ability to assess themselves and find ways to not only survive but also flourish in the dynamic economy. This paper reports part of the findings from a more extensive research work that aims to develop a Digital Capability Maturity (DCM) Framework for Higher Education Institutions (HEIs). Such a framework would allow organisations to leverage their capabilities for differential value. A systematic review was undertaken to uncover the key elements contributing to DCM, to stand as a baseline for the Maturity Framework. The objective of this paper is to report on the proposed standardisation for elements of DCM. A universal taxonomy is proposed suggesting these themes should be present in any organisational attempts to formalise digital initiatives. Furthermore, to maximise the impact of DCM on quality of output, the proposed framework must adopt the ecological systems perspective.

Keywords: digital capability, digital capability maturity, organisational efficiency, continuous improvement, internal processes, procedures, institutions, organisations, scenario planning, ecological system perspective, decision support, competitive advantage, organisational management

Paper word count: 4,298 words

1 Introduction

As technology and online resources permeate all areas of life in working, living, learning and social contexts, organisations are increasingly concerned about the utilisation of their technological investments (Capital Expenditure) to ensure successful integration into today's dynamic economy. For organisations and employees, digital skills are especially vital, but increasingly there is a need to know how to use digital tools, to carry out organisational processes, find good quality information and be critically aware of the strengths and shortcomings of such information (Van Laar et al., 2017). There is also a need to develop the ability to make sense, interpret and apply information for specific needs, communicate and potentially develop both confidence and creativity in using and engaging with tools and resources (Binkley et al., 2012).

New entrants into the business playing field come armed with game-changing innovations, strategies and business models that have disrupted whole industries and created even more ingenious ways to sustain growth while delivering value to stakeholders (Berghaus and Back, 2016). In the wake of such revolutionary trends, there is a need for businesses and organisations to develop the ability to assess such disruptions and find ways to not only survive but also flourish in a dynamic environment (Berghaus and Back, 2016). According to Carnall (2018), the capability to manage change effectively is a crucial attribute to a successful organisation (Carnall, 2018).

Development of digital capabilities has gained momentum in the last decade, with the notion of Digital Capability Maturity (DCM) being introduced into various industries/ disciplines. Stemming from concerns over the digital divide and attempts to bridge the gap between those who have, and those who do not have access to technology (Sidney Howland, 1998). However, as more of the population has gained access to technology, the digital divide not only decreased but evolved from a focus on practical computer use to an emphasis on more complex learning literacies that may apply to individuals and organisations alike. The scope of definitions for Digital Capability has progressively moved to target skills, utilisation, socio-economic impacts and even human behaviour related to the use of digital technology (Van Dijk, 2012). Digital capability is defined as 'the extent to which the culture, policies and infrastructure of an organisation enables and supports digital practices' (Killen et al., 2017).

The development of capability maturity frameworks is essentially an attempt to formalise organisational procedures. One of the main benefits of maturity models is enabling organisational process improvement, through a self-assessment on the maturity of different parts of their processes against established reference points, allowing them to strategise a roadmap to continuous improvement (Marshall and Mitchell, 2007). Recent studies concede the application of capability maturity as a tool to support organisations in maximising output through the efficient use of technology (Sandberg, 2014).

This paper is the first of a series of papers towards the development of a DCM Framework. In this paper, we report on preliminary findings from a systematic review of the current body of knowledge in DCM as part of a larger research work. This study asserts that a DCM Framework may be used as a strategy to support the development of organisational capability, paving the road to higher levels of maturity ergo improvement in overall process productivity and product quality. Towards the greater research effort, there is a need to underpin the key components of DCM further than the high-level factors that have been identified in existing models and frameworks; therefore, this paper proposes a taxonomy that attempts to standardise the elements of DCM for simpler formalisation.

2 Theoretical Background

Organisational change and digital transformation have been at the front line of research in various disciplines for a long time now. The dynamic nature of the digital era has adverse effects on human behaviour as well as organisational performance and industries, and in turn, these influences have given rise to new 'simultaneous and dynamic' challenges (Matt et al., 2015, Berman, 2012). In the past, many theories such as Punctuated equilibrium (Romanelli and Tushman, 1994), and Continuous change (Brown and Eisenhardt, 1997) have been suggested to aid the understanding of change mechanisms. However, the term 'digital transformation' is still at the forefront of research today (Berghaus and Back, 2016).

2.1 Digital transformation

The term "digital transformation" can be applied to both changes at the industry and organisational level and is inclusive of process improvement, focusing on efficiency, and digital innovation concentrate on improving existing physical products with digital capabilities (Yoo et al., 2009). The speed at which technology is evolving has been a catalyst for organisational transformation over the past decade (Yoo et al., 2009). Organisations are in a position where they must keep up with these changes if they are to achieve their set goals and objectives. Many organisations, across multiple industries, utilise technology to gain a competitive edge. Managers and decision makers are seemingly under pressure to transform organisational processes and procedure to meet the dynamic challenges of the digital era (Berghaus and Back, 2016).

Matt et al. (2015) stated that 'While a digital strategy consolidates and aligns the IT and business strategy, a digital transformations strategy specifically contains the vision, planning, and implementations of the organisational change process (Matt et al., 2015). A DCM framework would be well aligned to the different stages of the digital journey from customer experience, connected products and systems and intelligent analytics providing the foundation to drive successful business and organisational outcomes (Berghaus and Back, 2016). Furthermore, for organisations to be 'successful and gain optimal value', they must have a reliable method for managing the cultural, behavioural and organisational changes required for implementation and optimisation (Horlacher, 2016).

The term transformation refers to a fundamental change within the organisation, which has a significant impact on organisational strategy and structures (Matt et al., 2015, Kotter, 1995). It, therefore, requires companies to realign and initiate a change process regarding their internal structures as well as their business models, which is without a doubt a challenging organisational learning process (Schuchmann and Seufert, 2015). Digital transformation is a change process that is actively designed and executed (Besson and Rowe, 2012), and therefore, it is necessary to understand the mechanisms of digitisation and establish a common understanding within the company.

2.2 Maturity Models

Maturity models are used in two ways. In their descriptive functionality, maturity models reveal the dimensions which need to be designed, and in their prescriptive functionality, they enable companies to define courses of action or capabilities required to reach the desired stage of maturity. Maturity models are a topic of growing interest in academic research (Becker et al., 2014).

Maturity models consist of dimensions and criteria, which describe the areas of action, and maturity stages that indicate the evolution path towards maturity. These models serve as a tool that mainly enables

assessment of the status quo (Becker et al., 2014) and indicates a potential, anticipated or typical development path to the desired outcomes (Pöppelbuß and Röglinger, 2011, Paulk et al., 1993).

The CMMI (Team, 2006) typically has five levels, each specifying new foundation of practices on which higher levels are built upon - essentially building maturity. Valdes et. al (2011) eloquently concluded that although CMMs were designed initially for software products and services, over the years the structure of the maturity levels and the mechanisms used to determine the standards have been adopted by other models in several subject areas. Organisations need a roadmap towards the maturity of digital capabilities and to be able to measure the level of implementation of their strategic plans (Valdés et al., 2011). To achieve this, the notion of using digital capability as a tool for organisational improvement must be examined meticulously. An assessment of the composition of digital capabilities to develop a roadmap towards organisation efficiency and maturity is equally vital.

Considering the continuously evolving nature of technology, and the positive outcomes that have been associated with implementation maturity models in various industries, this study asserts that a DCM framework based on CMMI will serve particularly useful for organisational assessment and evaluation. The tool could lend insight into the level of preparedness or required investment in digital infrastructure needed to attain maturity, which in turn translates to competitive advantage for the organisation and value to other stakeholders. The outcome of this study provides a valuable understanding of the composition of digital capability for organisations. The results stand to support organisational improvements in all areas, by having a clear understanding of elements that affect the development of DCM, and the relationships between such elements. Thus, allowing organisations to see a clear path to reaching higher levels of organisational maturity.

The primary objective of this study is to identify the elements contributing to DCM and further examine the relationships between such elements. The following research question *will guide the study.*
RQ1: What elements contribute to digital capability maturity?

The next section of this paper documents the methodology used to arrive at the answer to this research question.

3 Methodology

3.1 Data collection and sample

The study employed a systematic review to uncover the elements of digital capability to set the landscape for research on maturity of the concept as an organisational strategy. The methodology used for the review was heavily based on the guidelines outlined by Kitchenham (2004), where the review process is defined as 'a means of identifying, evaluating and interpreting all existing research in a given area (Kitchenham, 2004).

An initial manual search was used to establish the availability of information in the subject area, using Google Scholar, Scopus and IEEE search engines. The process involved looking at grey literature as well as open access material to get a clear understanding of the common terms used in relation to the research topic. Then an automated search was carried out, which involved writing a comprehensive search string to pass through the selected search engine. The data sample included publications from only one search engine, Scopus. It is the largest abstract citation database, indexing publishers from other databases,

including Elsevier, IEEE, Science Direct, SAGE, Taylor & Francis, among others (Elsevier, 2014). Reasoning that it is a sufficiently powerful search engine to use for the literature search. The scope of the review was limited to studies published between 2012 to 2017. The full search string was constructed based on the research question and using a combination of alternate words and synonyms of the key terms identified, and Boolean logic.

3.2 Data Analysis

3, 904 studies identified in the automated search were subject to analysis by applying two sets of inclusion and exclusion criteria. The first set of criteria were question specific, while the second set of criteria were more general.

3.2.1 Questions specific criteria

The question specific criteria included the use of Boolean logic to create statements of terms that were deemed as irrelevant to the question and topic area in general. These criteria were applied to the result set within the search engine itself, as an extension of the original search string.

3.2.2 Inclusion/ Exclusion criteria

studies identified were subject to further analysis through the application of the inclusion/exclusion criteria presented in table 1 below.

Table 1: Inclusion/ exclusion criteria

Inclusion Criteria	Exclusion Criteria
1. Papers published in the last five years (between October 2012 to October 2017)	1. Papers that were not originally written in English language
2. Paper answers research question	2. Incomplete papers or abstracts of an unfinished paper
3. Focuses on the elements of digital capability framework	3. In the form of books and overhead presentations
4. Defines the elements that contribute to digital capability	4. Opinion pieces or viewpoints

3.3 Data Refinement

The study employed a systematic and comprehensive methodology to refine the data sample through a screening and eligibility process.

3.3.1 Phase One Refinement (Screening)

The screening process discarded studies easily identified as unrelated to the subject area. This screening was done by reviewing the title and abstract of each study and deciding to mark it as 'accept', 'reject', or 'not sure' according to the inclusion and exclusion criteria in the table above. The accepted sudies and those undecided on twere then included in a peer review process. The 'accept' and 'not sure' studies were screened again between two researchers to decide on a complete set of studies to be included in this phase of the study, while all the rejected studies were excluded. The screening process reduced the data sample by 80%, accepting 796 studies for the next phase of the study.

3.3.2 Phase Two Refinement (Eligibility)

The eligibility phase discarded studies from the data sample that did not answer the research question. In addition to the screening stage, eligibility involved reading the studies in full detail. This process resulted in a final data set that fully addressed the research question and complied to the criteria. This process further filtered the data set to 115 studies to be included in the review process.

3.3.3 Data extraction

A subjective analysis of the data sample was undertaken to extract elements contributing to digital capability. The process identified elements as terms explicitly mentioned, including a few that were implied as factors. Elements were extracted even if the paper did not go as far as directly addressing the element in its own right; the simple presence of the element justified extraction.

3.3.4 Additional Papers Included

A set of twenty-five additional studies were added to the sample. These studies were hand selected from studies identified during the initial manual search of the subject area. The decision was made to include them after reading the full text, on the basis that intelligence derived from these additional studies provided added value to the data sample and results. The additional studies expanded the size of the data sample to 140 studies.

A total of 498 elements of digital capability were extracted from 140 studies. The next section of this paper documents an interpretation of the results.

4 Results

An analysis of the results found a high number of tautologies. The terms instructors, educators, facilitators, trainers, tutors, lecturers and teachers are all used in different contexts to describe staff whose role is to train, teach or impart knowledge. In literature, various terminologies are used to refer to the same or similar concepts. These tautologies resulted in a large number of underrepresented elements, where tutor alone had a weighting of 26, but when combined with the additional eight terms of similar meaning, it had an overall weighting of 54. A thematic analysis was used to resolve tautologies. The data from the initial result set were further analysed and consolidated according to themes so that elements using different words to mean the same element or elements that belonged to the same general category were classified together. Tautologies were maintained to prevent bias from compromising the integrity of the result set, and to preserve transparency.

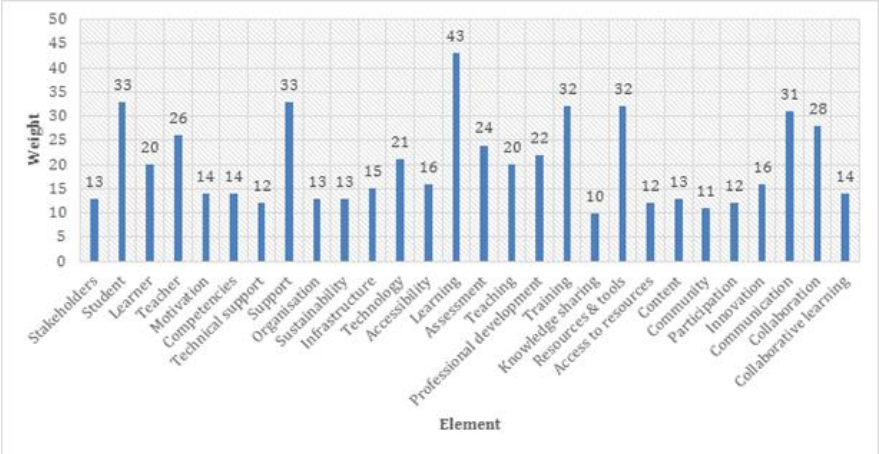

Figure 1: most frequently occurring elements

Synthesis of the results was an iterative process, with the first round resulting in 21 sub-themes. Subsequently, the final consolidated result set contained ten general themes. Table 2 shows the general themes and sub-themes.

Table 2: 10 general themes and constituting elements

	Theme	Consolidated elements	No. of elements	Total weighting	%
1	**External Factors**	External factors	26	54	
		Ministry	11	24	4.6512
2	**Stakeholder**	Stakeholder	1	13	
		Learner	3	55	
		Tutor	9	54	
		Others	21	38	9.5408
3	**Personal skills**	Personal	45	114	
		Technical skills	18	39	9.1234
4	**Digital Identity & wellbeing**	Wellbeing	12	26	
		Support	12	69	5.6649
5	**Organisation**	Organisation	84	188	11.2105
6	**Infrastructure**	Infrastructure	13	32	
		Connectivity	14	31	
		Technology	45	131	
		Usability	7	14	12.4031
7	**Learning, training & development**	Learning	50	158	
		Pedagogy	11	41	
		Training & development	21	114	18.6643
8	**Resources, tools & content**	Resources & tools	34	114	
		Content	13	39	
		Online communities	25	77	13.7150
9	**Digital creation & Innovation**	Innovation	6	27	
		Content[7]	*13	*39	3.9356
10	**Collaboration**	Communication	8	50	
		Collaboration	9	59	
		Online communities[8]	*25	*77	11.0912

** NB. The percentages are based on the thematic analysis; therefore, individual elements can belong to one or more themes. As a result, the total number of elements in the table adds up to more than 498.*

The distribution of weightings in figure 2, shows that 18.7% of the literature is on learning, training & development, closely followed by resources, tools & content (13.7%), and collaboration (11.1%). The least attention in literature is given to digital creation and innovation (3.9%), external factors (4.7%) and then digital identity and wellbeing (5.7%). The study is yet to explore the possibility of these weightings being used as an indication of significance, or as the level of impact that each theme has on the organisation.

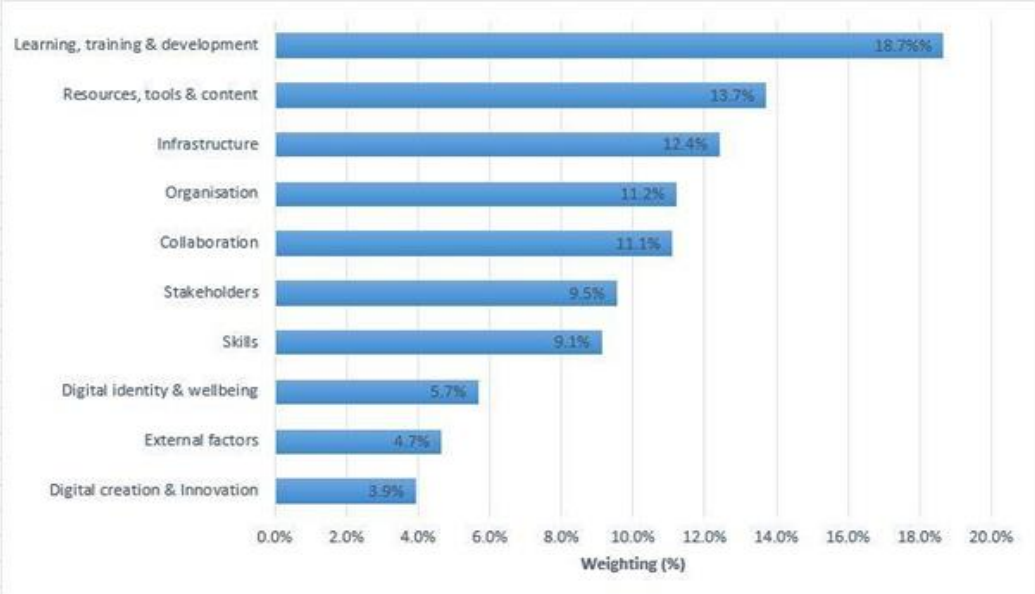

Figure 2: Distribution of theme weightings

The following is an account of the body of knowledge that has been acquired from reading the full text of the 140 studies included in this study (See Appendix for the full list of references):

RQ1: the elements contributing to digital capability are:

1. *External Factors: External factors*
   The External factors are those external to the digital environment, more specifically the country, or society within which the organisation operates. These external factors shape the development of Digital Capabilities. These include socio-economic factors of the country, the educational system of the country, social norms of the society, among others. It also covers issues like public policy on the use of ICT in public service delivery and the role of the relevant ministries in supporting the successful implementation of digital goals.

2. *Stakeholders: Learner/staff | Tutor/trainer | Manager | Administrator*
   Stakeholders are considered as any people or groups of people, affected by the actions of the organisation. Staff are stakeholders since the organisation would influence the learner's skills or abilities. The trainer is also a stakeholder since they are employed by the organisation to train/re-train the staff. Managers, administrators and all employees that are part of an organisation may be considered as stakeholders, particularly those in more technical roles, sometimes referred to as instructors. In some cases, governmental bodies are seen as stakeholders.

3. *Personal skills: Interpersonal skills | Technical skills*
   Personal skills are the ability of an individual (stakeholder). These skills include interpersonal skills, IT skills and technical competencies, as well as problem-solving skills, attitude towards learning and use of digital technology and self-efficacy. Socialisation and readiness/willingness of the individual to improve their abilities is vital. The individual's level of education, professional and transition to digital, as well as demographics, are factors that come into play here. Personal abilities can be enhanced with training and development.

4. *Digital wellbeing: Wellbeing | Support*
   An individual's identity is part of the foundation of self-actualisation, as association/belonging to a community. The sense of belonging to a digital environment forms part of digital wellbeing. Wellbeing is the ability to achieve personal goals and benefits while maintaining a healthy work-life balance in a digital environment. This includes health and safety, relationship management, self-motivation and self-management. Wellbeing also involves the avoidance of excessive multitasking, fragmentation of daily time and overconsumption of new media, which pose a threat to an individual's wellbeing and providing techniques to cope with digital overabundance. An integral part of this wellbeing is a support framework, which involves management support from the organisation, technical support for new media and family support to help individuals maintain a healthy work-life balance. The assurance of security and privacy gives users comfort and confidence in adopting new technology.

5. *Organisation*
   The organisation is the digital environment within which all the other elements operate. This organisational environment considers the organisational structure, size, and facilities. Mission development frameworks, corporate strategy, leadership any inclusive organisational goals and practice guidelines that the organisation may have set out. Cultural and social values, ethical guidelines, accountability measure, and how they play a part in the organisations' environment. Division of labour, organisational rewards, recognition of skills, adoption of best practices, and creating a teaching excellence culture, are all factors that are specific to the organisation itself. Manageability, sustainability and finances are the organisations' keys to ensuring momentum for continuous improvement.

6. *Infrastructure: Infrastructure | Connectivity | Technology | Usability*
   Infrastructure is the ability to support a digital environment with relevant network, technology, hardware, software and any other tools required to perform digital tasks efficiently. Connectivity is having access to the networks, both local and external, that support the digital infrastructure of the organisation. In using digital technology, usability plays a role because user experience in using technology has a direct impact on their willingness to continue using it.

7. *Learning, training & development: Learning | Pedagogy | Training & Development*
   Learning and teaching practices and methodologies are a crucial part of digital capabilities. Teaching and training methods, practices, strategies and delivery techniques have been described as the way a tutor delivers new knowledge.
   It is through learning, training and development that personal skills can mature. Learning involves the use of pedagogical methodologies to acquire new skills. Although it is apparent from the literature, that methods used for traditional classroom learning vary for eLearning. There is a need

for adequate training of stakeholders in line with new digital technologies and social networking tools. Learning has many forms, self-directed, traditional education, distance learning, eLearning and staff training are all considered a form of learning since the outcome is to acquire new knowledge/skills. Some of the other elements that come under this theme include assessment of learning outcomes, evaluation, reflections, reporting, learner feedback and transferability of skills, among many others.

8. *Resources, Tools & Content: Resources & tools | Content | Social Networks*
   Resources, tools and content include learning resources such as digital libraries, digital management systems, and other online training resources. The mere existence of these resources and tools is not enough, ease of access to the content and the availability is crucial. Resource monitoring and management must also be considered, as well as the recent categorisation social networking as a collaborative tool because of their power to facilitate communication, information transfer and other collaborative activities.

9. *Creation & Innovation: Content | Innovation*
   Digital creation refers to the creation/ implementation of digital content; this includes learning content used for learning, training & development. Digital content includes basic content like Word documents and PowerPoint presentations. It also includes media production such as images, audio, video, applications, websites and more. Innovation is the ability to create new ideas, projects and content. Innovation can take different forms - for example, it can relate to the design of a new type of digital artefacts such as Voice User Interfaces (VUIs) or new approaches to make digital artefacts available to users.

10. *Collaboration: Communication | Collaboration | Social networks*
    Collaboration is an essential process in a digital environment for both learning and knowledge management. Collaboration involves working as part of a team to achieve set goals. Collaborative working, collaborative learning, collaborative training also belongs to this theme. Drivers of collaboration are participation, cooperation and this is facilitated through excellent communication and connectivity. Enablers of collaboration are then the collaborative tools supporting the process, including social networks.

5 Conclusion

It is important to note that this paper does not offer the solution space to the greater research work of developing a DCM framework. However, it does provide a moderate steppingstone towards developing the framework by assembling the composition of the notion of DCM in the form of a universal classification. The solution space will become more apparent as the future work unfolds. However, here we offer the preliminary findings towards the formalisation of digital capability initiatives:

While digital capability is a well-established concept, the term is modern in relation to organisations. Capabilities are discussed in several different contexts from government, e-commerce and education, although the emphasis placed on individual elements is dependent on the type of organisation and their goals or objectives. Implementation of digital capabilities has been most popular within the education industry. This study highlights the fact that digital capability is a widely applicable term that can be used in any organisation to enhance efficiency, improve quality and overall continuous organisational maturity (Sandberg, 2014).

The elements contributing to DCM are presented in the form of a universal taxonomy that is customizable to any organisation, asserting that the concept of DCM is universally applicable to most industries. Capability maturity refers to a set of processes that have been standardised and institutionalised (Chrissis et al., 2003), and when implementing a DCM framework, the elements involved in the sets of processes and procedures will vary from institution to institution. The study concludes that themes (sets of elements) in the proposed taxonomy should be present in any organisation attempts to formalise Digital Capability initiatives.

The web of elements that form the composition of digital capability can best be described as ecological systemic change theory as documented by (Shengquan and Li, 2006). Significant changes in one element require consideration and, in most cases, some changes in other elements. Elements contributing to digital capability are not mutually exclusive, and division of elements into separate parts without relationships will not necessarily lead to improvement. The role of capability maturity as a lever would lead organisations to a strategy where the elements and themes are matured in parallel – to result in overall process maturity (Shengquan and Li, 2006) further corroborating Matt et al (2015) on his findings solutions to 'simultaneous and dynamic' challenges (Matt et al., 2015). Towards the development of a capability maturity framework, this study concludes that it is necessary to develop a model that adopts the ecological system perspective.

6 Limitations

While digital capability is seen as an established concept, research into the general subject area from a holistic view, not limited by the type of industry or institution, is still a formative angle of research. Studies often discuss elements without referring to the term 'digital capability'; one reason for this may be a general assumption that it is known to all. However, this limited use of the term in academic literature meant that the data extraction process of this study required a considerable level of subjectivity. To add credence to the results discussed in this paper, an inter-rater reliability test is currently being undertaken, comparing reliability between 3 raters to give statistical validity to the elements uncovered.

7 Future work

As part of the future work planned for this research, the elements identified will be validated through a perception study to compare theory to real-world practice. The validated taxonomy of elements will then be operationalised using observation and documentation analysis, assessing hardware, software, connectivity and other elements within the taxonomy to determine the level of capability maturity within a given organisation. For more complex capabilities, alternative methods of measurement may be considered. Furthermore, there is need for a clear distinction to be made between measuring of individual capabilities, and organisational capabilities. Lastly, the results of this study serve as a segue for future researchers in the area of DCM.

This study is part of a PhD research project, and as such, the results will be used to inform the endeavour towards a maturity framework for Higher Education Institutions.

8 Acknowledgements

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