Reference Model for Generic Capabilities in Maturity Models

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REFERENCE MODEL FOR GENERIC CAPABILITIES IN MATURITY MODELS

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ABSTRACT

Context - Many Maturity Models (MMs) have been designed for over 40 years now but selecting the constructs which chart the application areas is at variance. When comparing MMs, application area-specific constructs appear to be divers. Nevertheless, some constructs are often similar.

Objective – This research aims at finding generic constructs in existing MMs as reference for constructing MMs.

Method - We conducted literature research for generic MM constructs in organisational readiness MMs. We applied card sorting as a classification method and sorted cards according to Metaplan technique with peers.

Results - This research resulted in a limited set of generic capabilities for constructing MMs. Organising these capabilities according to widely accepted reference models in Information Systems (IS) literature results in the Generic Capability Reference (GCR) model.

Conclusion – The GCR model serves as a reference model for (re-) designing MMs for the part of the generic capabilities in MMs besides application area-specific capabilities.

CCS Concepts

Software and its engineering → Software creation and management → Software development process management → Software development methods → Capability Maturity Model

Keywords

Maturity model; reference model; organisational readiness; capabilities.

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1. INTRODUCTION

In Information Systems (IS) research, many maturity models (MM) have been developed over the years [1]. MMs measure an organisations status quo by means of a model with separate maturity stages for a set of constructs outlining a specific application area [2], [3]. Designing a MM requires the selection of the proper constructs [4]. When designing MMs, most researchers start from scratch in identifying constructs for their MM.

However, that is not necessary because, when comparing existing MMs, generic constructs to design MMs seem to exist. That implies a reference model in which these generic constructs could be useful. Maybe such a reference model already exists, but we could not find one in literature, and therefore this is a knowledge gap. To fill this gap and add new knowledge, our research objective is to find generic constructs in existing MMs and compose a reference model of generic constructs. Consequently, our research question is: what are generic constructs in existing MMs?

The theoretical relevance of this research is to compose a new reference model which serves to construct MMs generic constructs. With these generic constructs already given, researchers only have to select the appropriate generic constructs from the reference model suitable for their MM and complete it with application area-specific constructs. The practical relevance is that MM designers save time in finding proper generic constructs and only have to find constructs which specifically outline their application area. Also, the quality of the MMs improves because MM designers do not overlook relevant constructs.

To find generic constructs, we conduct a literature review and classify the constructs found. Below we describe the theoretical background of our research. Then we describe our LR method and research findings. Next, we present the results of our classification with the resulting reference model. Finally, we offer further discussion and implications.

2. THEORETICAL BACKGROUND

In IS history, Maturity Models have been developed for almost 50 years. In 1973, Nolan presented his staged model with the first notions of a MM model [5]. Nolan's stage hypothesis about growth towards a final maturity stage in tasks for managing the computer resource in organisations started by differentiating four stages at first and six stages in a later version [6]. Also, in 1979, Crosby's presented his quality management maturity grid aiming at the organisational improvement of quality using five different maturity stages [7]. In 1993, Paulk and Curtis designed the widely recognised Capability Maturity Model (CMM) which they developed into CMMi later on. This MM measures how a software development organisation matures its development activities and maintenance processes [8].

All three models presented differentiated maturity stages, where a different set of activities identified each stage. Furthermore, maturation was achieved by growth from stage to stage for the entire organisation. Later on, many MM designers followed the

example of the CMM(i) model. Although most of them identify activities per maturity level per application area, this granulation enables different maturity scores per organisational aspect within a single organisation [1], [4], [9].

Around 2010, MM design became more structured with a MM design procedure model [2], [10], [11]. According to this research, MMs determine the status quo of an organisations capability by activities occurring in the organisation. MMs also describe possible organisational improvements by naming activities for all maturity levels. To measure maturity, a set of maturity levels is applied to a relevant set of application area constructs often represented in a tabular format.

MM designers are quite uniform in selecting their four to six maturity levels. But they are very diverse in naming their application area constructs which chart the chosen application area [4], [12]. MMs name these constructs capabilities [13]–[16], capacity, category, dimensions, factors, accountabilities [17]–[20]. For clear language reasons and because capability expresses readiness, we choose to name the constructs capabilities. We base this on the definition of organisational capabilities in recent literature: "a partial representation of the collective ability to carry out specific business processes across a network in a cyclical, efficient, and relatively predictable manner to contribute towards organisational performance" [21]. The resulting table is used as an assessment tool operationalised by assessment criteria in each table cell. See figure 1 Maturity Model format.

Maturity Model

Constructs \ maturity levels	1	2	3	4	5
Capability A					
Capability B					
Capability C					

Figure 1 Maturity Model format

MM designers also seem to select their capabilities only depending on the chosen application area, which results in apparently very diverse MMs. But there might be commonalities between MMs. We see quite some MMs with the same capabilities indicating that generic capabilities in MMs exist next to specific capabilities. For example, Luftman's Business-IT alignment MM describes specific application area capabilities, but also generic capabilities, e.g. communication or strategy planning [17]. We also see that articles describing MMs with the same capabilities mention organisational readiness quite often. We agree with researchers who interchange organisational maturity with organisational readiness [22]. So, we suppose that MMs containing generic capabilities can be found in articles mentioning organisational readiness.

However, we have searched the literature and could not yet find a reference model that reveals these generic capabilities in MMs. The absence of such a reference model presumes a knowledge gap in describing generic capabilities in MMs. Although, a reference model of generic capabilities (GCs) is useful to guide MM design based on earlier MM research.

3. METHOD

To find GCs in literature, we use the following strategy. First, we search IS literature for existing MMs to identify GCs and to verify if these even exist by comparing MMs. Next, we apply classification as a strategy for structuring the capabilities found. We select open card sorting as an approach. Open card sorting merges various inputs into a single list of groups. Each group is described according to the generic pattern of the cards in that group. With abstracting the generic pattern from the grouped capabilities, we differentiate generic capabilities from application area specific capabilities. Last, we organise the GCs found into a reference model to show the overall structure between grouped GCs and the relationships with other IS models.

3.1 Literature Research

Finding relevant generic capabilities in existing MMs requires literature research (LR). We base our LR method for finding generic capabilities on literature of Kitchenham and Okoli [23], [24]. We conduct our LR in three steps iteratively to balance and refine the results while gaining insights.

1. **Search for articles** in IS literature in the Dutch Open University online library and also Google Scholar including all relevant articles of all times and not just a sample. We identify other relevant articles with back and forward snowballing e.g. SLRs on MMs. We choose organisational readiness limiting criterium because MM literature in IS is too extensive for a full search and articles mentioning organisational readiness include MMs that not only deal with specific but also generic capabilities. After learning from other MM SLRs and conducting example searches, we define the final search query with the keywords ("*maturity model*" OR "*capability model*") AND ("*organizational readiness*" OR "*organisational readiness*") where organisational both with UK and American English (s/z) keywords.

2. **Practical screening** of found articles and remove duplicate studies for selecting relevant literature. As exclusion criteria, we only select articles which describe the constructs of the proposed MMs. Also, we choose only research presenting MMs based on proper empirical MM testing to follow up on the criticism of the lack of empirical testing of MMs [25]. This critic advises to reconcile existing MMs and prove its validity and usefulness in experimental studies. Next, we screen title, abstract and keywords of the retrieved studies for focus on our research question. We review potentially relevant studies and discuss its selection. At last, we identify and list the final set of relevant studies.

3. **Quality appraisal** by identifying literature will be based on applicable quality criteria and exclusion criteria from Systematic LR literature for clean and precise results [23], [24], [26]. For quality criteria, we select blind peer review juried journal or conference articles written in English. Furthermore, we select on traceability of used literature, rigour in research method, the credibility of the findings and relevance for research and practice.

4. **Data Extraction** will be achieved by reviewing the entire content of the selected studies. We will extract our research data by listing all the capabilities from all the MMs described in the selected articles.

3.2 Capabilities Classification

For classification, we proceed with our research according to the two following steps.

5. **Analysis** of the selected studies and listed capabilities will be achieved by using the classification strategy to harmonise different levels of abstraction in MMs for clear language. To understand and categorise all the capabilities found, we choose the open card sorting approach, which can handle a large number of results from literature [27], [28]. We choose card sorting because it allows all

involved persons together to simple and quickly structure large quantities of results by only handling surface characteristics like capability names. Still, agreement among participants demands tacit knowledge from each of them to find structure. We also will not predefine groupings because there is no knowledge about this topic

Metaplan technique is selected as the technique to execute the card sorting [28]. Metaplan is a proven technique to cluster many ideas in a short period effectively and was invented to improve group meetings effectiveness. Preventing deadlock as researchers bias and error, we will select a group of at least three researchers who conduct research and are familiar with the selected research field, thus also achieving a degree of intersubjectivity. They work actively together in clustering ideas into categories rather quickly without too much arguing thus being effective and efficient. The timeframe should not extend three hours for concentration reasons [28]. Our Meta-plan group protocol distinguishes three steps. First, one of the group members prints each capability of each maturity model found on separate paper cards. Second, all group members together cluster the paper cards in category stacks based on a peer discussion. The discussion is led by one of the group members who divides the cards into stacks. Clustering is achieved by adding each card individually either to an existing group or by creating a new group (whereby the first card by definition forms a new group). Third, we code the resulting stacks on basis of the meaning of the cards in the category.

3.3 Reference model design

Designing the reference model will be achieved in the final step 6.

6. **Syntheses** of the coded card stacks into a conceptual model is grounded in literature by using the category codes from the referenced literature to build the resulting model. Also, we try to align our resulting model to other reference models and theory in literature.

4. RESULTS

Conducting research according to above method resulted in LR outcomes, classification outcomes and resulting reference model as follows.

4.1 LR Results

In 2019 we conducted above described LR method iteratively while gaining more insights and found the following results. For step 1, while experimenting, we identified additional selection criteria and excluded “management for change” as being a different research field. For step 2, practical screening and selection on general organisational readiness capabilities relevance led to the choice of only 12 articles of the 905 found. Backward snowballing from MM SLR studies resulted in eight extra articles on Organisational Readiness MMs. For step 3 quality appraisal, the reviewed articles were screened for the selection criteria and for empirically validated MMs. The number of relevant articles found according to step 1 to 3 is shown in table 1 LR article selection steps.

This funneling resulted in the list of selected articles as given in table 2 *Maturity Models Article Selection*. The 21 MMs from these articles cover a diverse variety of application areas within and outside the IS research domain. The list of researched organisations includes not only commercial enterprises but also government organisations indicating the broad perspective of the scope of organisations. Moreover, application areas are outlines by from different types of constructs varying from generic areas to specific CSFs and generic or specific capabilities. Also, the used maturity levels have different origins than CMM, which contains rather specific capabilities. So the set of considered MMs found in our LR is not too limited to a specific application area but wide enough to conclude on generic capabilities.

As column *Application area* together with column *Application area Construct types show*, many MMs used application area-specific capabilities [1]. A MM outlines an application area by several capabilities abstracted from processes, areas, critical success factors (CSFs) or other relevant capabilities. Although, when comparing capabilities in the selected MMs, we noticed similar capabilities reoccurring among MMs. More specifically, we see a variety of application area-specific capabilities but also quite some similar GCs. We conclude that MM designers use the same GCs more often across models.

Table 1. LR article selection steps

	Step 1 Article Search	**Step 2 Practical Screening**	**Step 3 Quality Appraisal**
Dutch Open University library	67	2	2
Google Scholar	838	12	11
Backward snowballing SLRs	-	8	8
Total	**905**	**22**	**21**

4.2 Classification outcomes

For data extraction, all MMs were extracted from the selected articles. The capabilities were registered, resulting in a list of 127 capabilities. In 2019, we held the Metaplan session together with the three authors of this article while executing the protocol steps, see figure 2 *Card sorting*.

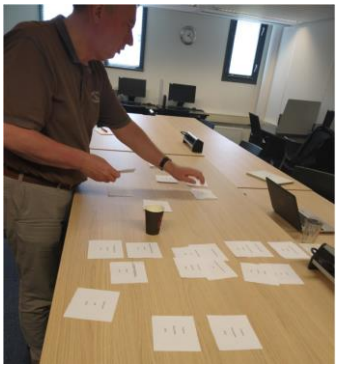

Figure 2 Card sorting

The session took about two and a half hours. Clustering the 127 cards with all three peers resulted in 13 stacks of various numbers of paper cards but clear grouping based on meaning. Then, the card stacks are coded based on the meaning of the cards in the stack. The meaning of the capability stack codes is quoted from the capability descriptions in the referenced articles, or from well-known reference models if present, as given in table 3 *Capability descriptions*.

Table 2. Maturity Models Article Selection

#	Author	Ref	Application area	Application area Constructs types	Maturity level origin
1	Karandikar, Fotta, Lawson, & Wood, 1993	[29]	Concurrent engineering	Generic areas	CMM
2	Luftman, 2003	[17]	Business IT Alignment	Own areas	CMM
3	Rosemann & Bruin, 2005	[30]	Business Process Management	CSFs	CMM
4	Batenburg, Helms, & Versendaal, 2006	[31]	Product Life-cycle Management	Generic areas	CMM
5	Hammer, 2007	[15]	Process and Enterprise Maturity	Capabilities	Self-defined
6	R. Batenburg & Versendaal, 2008	[32]	Procurement	Procurement areas	Purchasing MM
7	Tapia, Daneva, Van Eck, & Wieringa, 2008	[33]	Business IT Alignment	Generic areas	CMM
8	Rohloff, 2009	[18]	Business Process Management	CSFs	CMM
9	Abu Khadra et al., 2009	[19]	IT Governance	Cobit areas	Cobit
10	de Bruin, 2009	[3]	Business Process Management	CSFs + capabilities	CMM
11	Mouzakitis & Askounis, 2010	[34]	Business 2 Business	Capabilities	Self-defined
12	Hidayanto, Shihab, & Kristianto, 2012	[35]	Business Intelligence	CSFs	eGov procurement
13	Dyk van & Schutte, 2012	[36]	Telemedicine Implementation	eReadiness areas	CMM
14	Cleven et al., 2014	[16]	Business Process Management	Capabilities	CMM
15	Janom, Arshad, Zakaria, Syed Aris, & Salleh, 2014	[37]	B2B E-commerce	CSFs	Self-defined
16	Ossama Matrane & Talea, 2014	[38]	Information Security	CSFs	CMM
17	Mirarab, Fard, Reza, & Kenari, 2014	[39]	Service oriented architecture	Capabilities	Self-defined
18	Hejazi et al., 2016	[40]	Business Intelligence	CSFs	CMM
19	Schumacher, Erol, & Sihn, 2016	[41]	Industry 4.0	Generic areas	CMM
20	Brennan et al., 2018	[21]	Data Value Chains	Capabilities	CMM
21	Lak & Rezaeenour, 2018	[42]	Customer knowledge management	CSFs	CMM

MMs may describe more generic capabilities [8], [15], [30], [43]. And these general generic capabilities are validated more than once in several MMs over the years. In other words, when (re-)designing a MM, a MM designer could select generic capabilities relevant for his topic and complete the MM with specific application area capabilities.

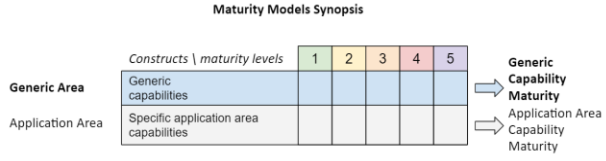

Figure 3. Maturity Model Synopsis

Furthermore, a mature organisation possesses an ability for managing a process [8] p.2., or an application area or even the organisation itself. As opposite of specific application area capability maturity, generic capabilities indicate a more generic capability maturity. Therefore, we could introduce a new concept generic capability maturity which is the ability of an organisation to manage the organisation for the area specific application of the generic capabilities. How generic capability maturity is distinguished from application area capability maturity is shown in figure 3 *Maturity Models Synopsis*.

4.3 Generic Capability Reference model

Finally, all the coded card stacks are organised into a conceptual model, see Appendix *Generic Capabilities Classification.* Thus synthesising the GCs resulted in our generic capability reference model as given in *figure 4 Generic Capability Reference (GCR) model* with the number of cards given per category.

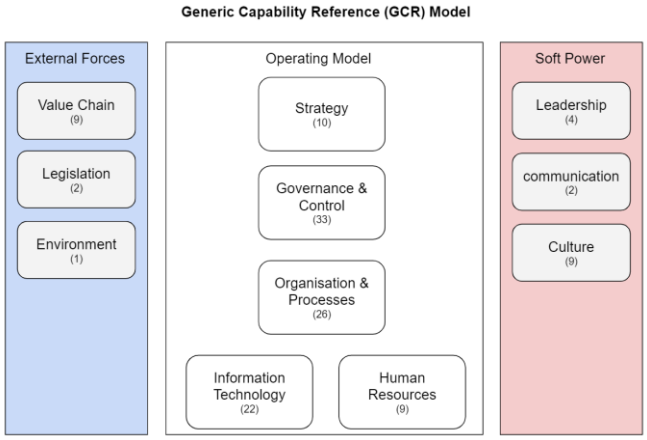

Figure 4. Generic Capability Reference (GCR) model

The coded stacks are grouped into three capabilities clusters according to three organisational models in IS literature; operating model, external forces, soft power.

The first cluster *Operating model* resembles McKinsey's 7S model and Scott Morton's MIT90s framework nearly [44], [45]. But this cluster is arranged differently according to the strategic planning logic strategy – tactics – operations as applied in the strategic alignment model of Henderson & Venkatraman and Maes' generic framework for the business IT relationship [46], [47]. The cluster title *operating model* is chosen because it contains all the hard factors strategy, structure and systems of the 7S-model. This category also resembles the organisational operating model with people, processes and technology as core capabilities [48]–[50].

The second cluster *External Forces* is clustered according to the five forces model of Porter with five forces grouped as value chain. The cluster is completed with legislation as part of Porter's fifth force market entry and also with environment for other factors from the external environment [51]. The cluster name *external forces* is chosen because all these GCs are exercised outside the organisation borders, although within the zone of influence.

In the third cluster, *Soft Power*, we clustered communication with the factors leadership and culture after Schein and Maris et al. who categorise leadership, culture and communication as soft collaboration in their BPM MM [53], [55]. Culture is grouped as researched by Schein in his three levels of culture model [53]. The cluster name *soft power* is chosen because all these human capabilities are rather intangible after the soft power theory [56], [57]. Also, leadership and culture are internal matters, just like communication.

Table 3. Capability descriptions

Capability	*Description*	*Source*
Strategy	"the adaptive organization—the organization aimed externally, yet depending upon the full utilization of each of its people", or "those actions that a company plans in response to or anticipation of changes in its external environment- its customers, its competitors...How we will create value"	[45], [52]
Governance & Control	"Mechanisms for managing complex projects and change initiatives. Companies can use their evaluations of the enablers and capabilities, in tandem, to plan and assess the progress of process-based transformations"	[15]
Organisation & Processes	"practices, actions, business process, the flexibility, working rules, collaborations and communications, procedures that compliment and accommodate activities within and between organizations", or "Structure divides tasks and then provides coordination. It trades off specialization and integration. It decentralizes and then recentralizes."	[37], [45]
Information Technology	"availability of technology infrastructure, the flexibility and the capability of existing organizational system", or "all the procedures, formal and in-formal, that make the organization go, day by day and year by year: capital budgeting systems, training systems, cost accounting procedures, budgeting systems."	[37], [45]
Human Resources	"people…skills: a company's crucial attributes", or "how to hire and fire, motivate, train and educate, and culture. Going beyond the traditional considerations such as training, salary, performance feedback, and career opportunities. ...factors that include the organization's cultural and social environment."	[17], [45]
Leadership	"Willingness of leaders, management competences and methods, existence of central coordination", or "the basic personality of a top-management team and the way that team comes across to the organization"	[41], [45]
Communication	"Effective exchange of ideas and a clear understanding of what it takes to ensure successful strategies, ensuring ongoing knowledge sharing across organizations"	[17]
Culture	"a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems."	[53]
Value chain	"an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the costs or effectiveness of other activities"	[54]
Legislation	"Governmental and institutional policies and procedures, standardization and security"	[36]
Environment	"Environmental context focused on the ways of which the firm conducts its business operations"	[37]

5. DISCUSSION

The numbers of GCs found in the selected models are presented in *Table 4 Distribution of capabilities per author*. It summarizes the number of the capabilities per GC group over the years, which means the number of GCs per coded stack of (cards of) capabilities. It also summarizes the number of stacks per MM which reflects the capability coverage of an MM.

Some GCs are well substantiated because these are often mentioned in organisational readiness MMs: Governance & Control, Organisation & Processes and IT and are found more than 20 times and almost in every article. Strategy, Human Resources, Culture form a middle group with nine or ten capabilities found. The other OCs turns up five times or less. We conclude that Governance & Control, Organisation & Processes and IT are often seen as relevant generic capabilities. Also, the Operating Model Cluster represents

100 of the 127 capabilities and these capabilities were present in MMs for over 20 years. So cluster Operating Model forms the often seen as relevant group of generic capabilities. Moreover, the authors who addressed the most coded stacks were in descending order Schumacher(8), Lak(7), and Janom(6) and Karkainen(6). Our model includes more capabilities (11) than each of the models and may serve as a reference model for (re-)designing MMs.

Table 4. Distribution of capabilities per author

Cards per Author		Ye	Au																						
		1993	2003	2005		2006	2007	2008			2009		2010	2012		2014						2016		2018		Totals
Cluster	Stacks	Karandiker	Luftman	Bruin	Rosemann	Batenburg	Hammer	Batenburg	Rohlof	Tapia	Khadra	Rohlof	Mouzakitis	Hidayanto	Van Dyk	Cleven	Karkainen	Matrane	Mirarab	Janom a	Janom b	Hejazi	Schumacher	Brennan	Lak	
External Forces	Value Chain		1							1					2		1				2		1		1	9
	Legislation														1						1					2
	Environment																			1						1
Operating Model	Governance & Control		2	2		1	1	2	1	1	2	3	1		1		1	5	2			1	1	2	4	33
	Organization & processes	1		1	1	1		2		1	1	4		2	1	2	1		1	1	2		2	1	1	26
	IT	1	1	1	1	1		1		1	1	1	1	1	1	1	1		3	1	1		1		2	22
	Strategy				2	1		1								1	1					1	1	1	1	10
	Human resources		1		1		1				1		1								2	1	1			9
Soft Power	Culture			1	1	1	1									1	1					1	1		1	9
	Leadership						1						1										1		1	4
	Communication		1								1															2
Totals		2	6	5	6	5	4	6	1	4	6	8	4	3	6	5	6	5	6	3	8	4	9	4	11	127
Number of Stacks		2	5	4	5	5	4	4	1	4	5	3	4	2	5	4	6	1	3	3	5	4	8	3	7	97

When following the logic of the reference models mentioned, enterprise leadership teams or executive boards mature their organisations with capacities from the *operating model* cluster. Their strategy determines which assets to govern and to control. To execute the strategy, governance determines organisation & processes: defining roles & responsibilities and processes & tasks. And control checks whether the governance is effective or needs adjustment. In IS, Information Technology and Human Resources are the essential resources making the organisation and processes happen. Moreover, the management of application area X is established by X governance [58], where the *operating model* GCs answer the *why*-question of doing the right things and specific application area capabilities answer the *how*-question of doing things right [59]. An organisation needs to respond to its *external powers* by organising itself with its *operating model* capabilities. And this organisational activity is carried out by the *soft power* capabilities leadership and culture using communication. Here, SWOT analyses might raise insights on which strategy to follow an on how to balance both external and internal capabilities or [60].

The GCR-model consists out of capabilities extracted from existing maturity models validated in practice. However, despite empirical validation, researchers bias might still not be excluded, and knowledge gaps in literature might still exist, resulting in incomplete MMs. Organising the uncovered capabilities according to existing reference models enables cross-checking with the selected maturity models. During clustering of the coded card stacks, it appeared that some factors in the reference models were not mentioned as capabilities in the selected maturity models. When matching the GRC-model with the other reference models on capability groups, the match appears as in table 5 *Matching GRC-model against reference models.*

In cluster *operating model*, the factors style and shared values in the 7S model are not mentioned. Also, in cluster *external forces*, the factors competitors and products in Porter's five forces model are not present. Unlike internal capabilities, the concept of external capabilities is more difficult to grasp. According the model of Porter and the GCR-model, we see external capabilities as an organisations ability to influence or react on external powers. In cluster *operating model*, Maes distinguishes data and information from IT for the IT capability. In cluster *soft power*, Schein's culture model mentions hard artefacts, shared values and underlying assumptions. We classify artefacts as being hard and tangible under cluster *operating model* for that reason. But again, the factors shared values, which is also mentioned in the 7S Model, and factor underlying assumptions are not found as capabilities in selected MMs. All this might indicate possible blind spots in MM research. We also conclude that we can study on how to enrich existing MMs with the missing factors.

Table 5 Matching GRC-model against reference models

Cluster	Stacks	Porter	ScottMorton	McKinsey	Maes	Maris	Schein
External Forces	Environment		V				
	Legislation	V					
	Value Chain	V	V				
Operating Model	Governance & Control		V				
	Human resources		V	V			
	IT		V	V	V		
	Organization & processes		V	V	V		
	Strategy		V	V	V		
Soft Power	Communication					V	
	Culture			V		V	V
	Leadership			V		V	V

6. CONCLUSIONS

We researched literature for generic capabilities in existing and validated maturity models mentioning organisational readiness. We found relevant generic capabilities in literature which we classified and organised into the Generic Capability Reference model according to reference models in IS literature. We recommend using this GCR model as a reference model for (re-)designing MMs concerning the generic capabilities besides adding application area-specific capabilities.

Nevertheless, our research is limited to the MMs selection made in our LR. Including more MMs with generic capabilities might confirm or extend the presented coded stacks and clusters and the GCR-model. And further research is necessary to validate the outcomes of this research. Validation is typically achieved by validating the GCR model in real-life organisations with designing an MM. In the design of this MM, the given GCs can be used as a basis for selecting relevant capabilities and MMs can completed with more application area specific capabilities like CSFs, processes or other application-specific capabilities.

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Appendix Generic Capabilities Classification

Value Chain	Market forces	Janom	2014	Strategy	Goals & Strategy	Batenburg	2008	Leadership	Leadership	Hammer	2007
	Customer orientation	Karkainen	2014		Governance	Rosemann	2005			LAK	2018
	Customers	Schumacher	2016		Strategic alignment	Rosemann	2005			Schumacher	2016
	Individual users	Van Dyk	2012		Strategy	Cleven	2014		Leadership & Strategy	Mouzakitis	2010
	Interaction/involvement with community	Van Dyk	2012			Hejazi	2016	Culture	Culture	Bruin	2005
	Social Customer	LAK	2018			Schumacher	2016			Cleven	2014
	Partnering structure	Tapia	2008		Strategy	LAK	2018			Hammer	2007
	Partnership Maturity	Luftman	2003		Strategy & policy	Batenburg	2006			Hejazi	2016
	Supporting industries	Janom	2014		strategy capabilities	Brennan	2018			LAK	2018
Legislation	Government:	Janom	2014		Strategy&policy	Karkainen	2014			Rosemann	2005
	Policy and legislation	Van Dyk	2012							Schumacher	2016
Environment	Environmental	Janom	2014						People & Culture	Batenburg	2006
				Governance & Control	Accountability	Bruin	2005			Karkainen	2014
IT	E-Technology	Batenburg	2008		Assessment	LAK	2018	Communication	Awareness and communicatio	Khadra	2009
	Information Technology	Batenburg	2006		Business Management	Matrane	2014		Communications Maturity	Luftman	2003
		Karkainen	2014		Competency/Value Measurements Maturity	Luftman	2003				
		LAK	2018		Control	Batenburg	2008				
	Information Technology and Systems (IT/IS)	Bruin	2005		Coordination	Tapia	2008				
	Infrastructure	Mouzakitis	2010		Finance	Mouzakitis	2010				
	Integration	Mirarab	2014		Goals and measurement	Khadra	2009	Organization & pr	Business Process:	Janom	2014
	IS architecture	Tapia	2008		Governance	Hammer	2007		Methodology	Bruin	2005
	IT	Cleven	2014			Schumacher	2016		Methods	Rosemann	2005
		Rosemann	2005		Governance and Management	Mirarab	2014		Methods & Tools	Rohlof	2009
	IT Architecture	Rohlof	2009		Governance Maturity	Luftman	2003		Operations	Schumacher	2016
	Resources	LAK	2018		Management	Hejazi	2016		Organization	Batenburg	2008
	Technical Infrastructure	Mirarab	2014		Management& Control	Batenburg	2006		Organization & processes	Batenburg	2006
	Technology	Hidayanto	2012			Karkainen	2014			Karkainen	2014
		Janom	2014		Performance	Bruin	2005		Organizational	Hidayanto	2012
		Karandiker	1993		performance	Brennan	2018			Janom	2014
		Schumacher	2016		Planning and financial sustainability	Van Dyk	2012		Organizational features	Janom	2014
	Technology and maintenance	Van Dyk	2012		Process Optimization	Rohlof	2009		Organizational processes	Van Dyk	2012
	Technology Scope Maturity	Luftman	2003		Process Performance Controlling	Rohlof	2009		Organizational support	Mirarab	2014
	Technology:	Janom	2014		Responsibility and accountability	Khadra	2009		Policies, plans and procedures	Khadra	2009
	Tools and automation	Khadra	2009		Business Intelligence	LAK	2018		Practices	Cleven	2014
	Use of Standards	Mirarab	2014		Data Management	Rohlof	2009		Proces & Practices	Karandiker	1993
					data value management	Brennan	2018		Process	Batenburg	2008
Human resou	Competency:	Janom	2014		Incident management	Matrane	2014			Hidayanto	2012
	Expertise	Hammer	2007		Information	Batenburg	2008			LAK	2018
	Human resources	Mouzakitis	2010		Knowledge Management	LAK	2018		Process architecture	Tapia	2008
	Individual	Hejazi	2016		Operations Management	Matrane	2014		Process Documentation	Rohlof	2009
	People	Rosemann	2005		Problems management	Matrane	2014		Process Management Organization	Rohlof	2009
		Schumacher	2016		Program Management, Qualification, Commu	Rohlof	2008		Process Portfolio & Target Setting System	Rohlof	2009
	Personal traits	Janom	2014		Risk Management	Matrane	2014		processes and human factors oriented	Brennan	2018
	Skills and expertise	Khadra	2009		Security	LAK	2018		Products	Schumacher	2016
	Skills Maturity	Luftman	2003			Mirarab	2014		Structure	Cleven	2014