A MODEL FOR ASSESSING DIGITAL TRANSFORMATION MATURITY FOR SERVICE PROVIDER ORGANIZATIONS

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ABSTRACT

The research presented aims to close a gap in the measurement of digital maturity for the domain of service which was identified through a systematic literature review. The study provides a holistic Digital Service Transformation Maturity Self-Assessment Model for service provider companies in a B2B-context based on analysis of different digital maturity models and by means of a qualitative approach through expert feedback in a Delphi-process and additional complementary literature review to define maturity assessment items. The presented Digital Service Transformation Maturity Model comprises 8 factors, 27 subfactors and 403 related specific assessment items describing digital maturity from a holistic point of view. The model has been further converted into a simple and practical tool to self-assess and visualize current state of digital maturity. The assessment model finally was pilot tested and the outcomes are also outlined in this article. The designed model provides practical implications for the ease of evaluating and improving digital maturity levels in every aspect of its factors and contributes to the successful management of digital transformation in service provider organizations by offering effective guidance how to move to the desired future maturity level based on a solid understanding of current digital maturity accomplishments.

KEY WORDS

digital transformation, digital service transformation, digital maturity, digital maturity assessment model, digital maturity matrix

JEL CODES

M14, M15, O31, O32

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1 INTRODUCTION

Digital technology causes disruptions and calls for strategic responses from organizations that change the value creation (Vial, 2019). By 2030 it is estimated that approximately 70% of new value creation in the economy will be reliant on digitally enabled platform business models (World Economic Forum, 2020). Hence, embracing emerging new opportunities coming from digital technologies and new industries require companies to continuously transform (Gimpel et al., 2018) to stay competitive. So digital transformation will stay an ongoing and increasingly complex journey for organizations (Verhoef et al., 2021) involving different aspects. Technology is just one part of it (Vial, 2019) but the first stage towards digital transformation (Ragnedda, 2017; van Deursen and van Dijk, 2019). Moreover, digital transformation needs a comprehensive view (Peter et al., 2020) involving several dimensions like strategy, HR, culture, process management, IT and others (Neff et al., 2014; DXC Technology Company, 2017). Peter et al. (2020) identified in their research study seven strategic action fields for digital transformation, where just two are linked to technology. A survey with 1700 respondents across different countries reported that 62% of respondents consider especially culture as the number one hurdle to digital transformation (Buvat et al., 2017; Leipzig et al., 2017). Hence, it is inevitable for organizations to address and manage the different dimensions of digital transformation and to view the progress and achievement of digital transformation in a holistic way (Haryanti et al., 2023).

Still today a lot of companies do not know where they exactly stand with regards to digital transformation and lack a distinct plan and path for their transformation initiatives. Some research states that executives are aware of the urgency but are not sure how to develop and deploy a digital agenda as there is a lack of guidance to determine the right course of action (Bughin and van Zeebroeck, 2017). Other research identified a lack of an integrated approach when formulating a company-wide digital transformation strategy (Hess et al., 2016; Hyvönen, 2018; Ismail et al., 2017). Digital immaturity as a consequence can potentially turn into a business problem, especially for companies in traditional industries as improvements regarding digital maturity have been made less rapid than in industries like software industry (Štolfa et al., 2019) – due to the fact that these companies have been quite successful in the past and they have not been realizing the benefits of digitalization (Fitzgerald et al., 2013). Also, in some cases managers do not know how to approach digitalization and how to respond to it (Hess et al., 2016; Bumann and Peter, 2019) and therefore start initiatives very isolated (Tumbas et al., 2017).

Thus, the need to systematically assess the status of digital maturity and to develop a clear strategy and roadmap for the required future transformation to stay competitive is notably growing in companies. There is evidence that companies which achieve higher digital maturity and therefore manage their transformation more effectively, have a digital advantage and outperform competitors related to financial performance (Westerman and McAfee, 2012). However, despite of the awareness that digital transformation provides potential advantages, a lot of companies have been facing challenges in creating a clear roadmap to adapt existing processes and business models in line with new digital technologies (Gökalp and Martinez, 2021).

In this context models to evaluate digital maturity are gaining importance and are developed to guide companies by providing a comprehensive roadmap for improvement (Gökalp and Martinez, 2021). Today it is a necessity to measure the maturity level of digital transformation as a kind of guidance for companies (Haryanti et al., 2023) through systematically assessing the status-quo (Becker et al., 2009) and to develop a distinct strategy and roadmap related to required digital transformation activities to reach a desired future state (Berghaus and Back, 2016; Pöppelbuß and Röglinger, 2011; Paulk et al., 1993). More specifically a digital maturity model helps companies to better understand the capabilities needed to encounter and success-

Tab. 1: Digital maturity models developed by practitioner and academia (Teichert, 2019)

Study	Model character. (# dimensions / # maturity levels)	Model approach (focus of model, maturing approach, application method)	Domain	Culture
Practitioner				
Valdez-de-Leon (2016)	7 / 6 stages	Domain specific, linear, self-assessment	Service	Yes
Kane et al. (2017)	4 / 3 arch.typ.	General, n.a, n.a		Yes
Westerman and McAfee (2012)	6 / 4 arch.typ.	General, non-linear, self-assessment		No
Geissbauer et al. (2016)	7 / 4 stages	Domain specific, linear, 3rd party assisted	Manufac.	Yes
Gill and van Boskirk (2016)	4 / 4 arch.typ.	General, linear, self-assessment		Yes
Catlin et al. (2015)	4 / "Dig. Quotient"	General, non-linear, 3rd party assisted		Yes
Bloching et al. (2015)	4 / "Digital Gap"	General, linear, 3rd party assisted	Industry	No
Friedrich et al. (2011)	4 / "Digitiz. Index"	General, linear, 3rd party assisted	Industry	No
Azhari et al. (2014)	8 / 5 stages	General, linear, 3rd party assisted		Yes
Shahiduzzamann et al. (2017)	9 / 4 arch.typ.	General, non-linear, self-assessment		Yes
Academia				
Lichtblau et al. (2015)	6 / 6 stages	Domain specific, linear, 3rd party assisted	Manufac.	No
Erol et al. (2016)	9 / 5 stages	Domain specific, non-linear, self-assessment	Manufac.	Yes
Colli et al. (2018)	5 / 6 stages	Domain specific, non-linear, self-assessment	Manufac.	No
Remane et al. (2017)	2 / 5 clusters	General, non-linear, self-assessment		No
Berghaus and Back (2016)	9 / 5 stages	General, linear, self-assessment		Yes
Canetta et al. (2018)	5 / n.a.	Domain specific, non-linear, self-assessment	Manufac.	No
Uhl and Gollenia (2016)	6 / 4 stages	General, linear, self-assessment		No
Sharma et al. (2016)	7 / 4 arch.typ.	General, non-linear, self-assessment		Yes
Leyh et al. (2016)	4 / 5 stages	Domain specific, linear, 3rd party assisted	Manufac.	No
De Carolis et al. (2017)	4 / 5 stages	Domain specific, linear, self-assessment	Manufac.	No
Leino et al. (2017)	6 / 4 stages	General, non-linear, self-assessment		Yes
Schuh et al. (2017)	4 / 6 stages	Domain specific, linear, 3rd party assisted	Manufac.	Yes

fully manage digital transformation holistically as per various dimensions, criteria and maturity levels, which indicate a pathway towards desired maturity (Berghaus and Back, 2016).

A systematic literature review (Tab. 1) as part of this work identified 22 various digital maturity models, which were analysed in detail regarding domains addressed, type of dimensions used, and specific cultural attributes included in the different models.

The findings showed that domain-specific models focus more on the digital-technological aspect and related capabilities, and that general digital maturity models address more the managerial aspect and related transformational capabilities in the assessment of digital maturity of an organization. A few of the identified general models (Westerman et al., 2012; Shahiduzzamann et al., 2017; Berghaus and Back, 2016) include already both aspects and cluster their dimensions accordingly, which clearly underlines the importance of the more soft and transformational aspect of digital transformation. These models propose a comprehensive description of digital maturity and were used as guiding models for this research. Out of the 22 identified digital maturity models just half of it addresses "Culture" as a dimension, although organizational culture is seen as a critical enabler for a successful digital transformation (Buvat et al., 2017; Leipzig et al., 2017). Among the examined digital maturity models just one is addressing specifically the domain of service (Valdez-de-Leon, 2016). This fact is surprising, because more and more industrial companies started to shift their focus from goods-centric offerings to service as digital technology and advanced analytics are especially revolutionizing services and are creating new sources of value for industrial companies (Ananthakrishnan et al., 2018). Also, the aspect of digital business model is hardly addressed in any of the 22 reviewed digital maturity models.

This research aims to close the identified gap in the measurement of digital maturity for the domain of service. The study provides a Digital Service Transformation Maturity Self-

Assessment Model for service provider companies in a B2B-context based on analysis of different digital maturity models and a qualitative approach through expert feedback in a Delphi-process. It addresses 3 research questions regarding digital transformation maturity:

1. How the "as-is" position should be assessed in a holistic way for service provider companies (diagnostic function)?
2. How the "to-be" position should be determined to develop a roadmap for improving the position from the "as-is" to their desired "to-be" position (roadmap function)?
3. How critical attributes of a digital culture should be addressed to reflect the criticality of organizational culture for the success of digital transformation efforts?

The paper is structured as follows. In Section 2 the adopted development framework and the designed DSTM-Meta Model are presented. Furthermore, the Delphi-process applied is outlined. In Section 3 the DSTM-Assessment Model and related details as result of this research are introduced. In Section 4 the findings from pilot-testing the model in several service provider companies are outlined. Section 5 continues with the discussion of the research work. Finally, the conclusion about the main findings, the limitations of the model and recommendations for future research will be found in Section 6.

2 METHODOLOGY

A proven standard development framework used to guide the design of maturity models in other domains (de Bruin et al., 2005) was adopted (Fig. 1).

The scope of this research was limited to the first four phases of the framework. In phase "Scope" and phase "Design" the meta-model for the DSTM was developed. The proposed basic design of the DSTM-Meta Model is consisting of factors, subfactors and 6 well defined maturity stages including a default level zero which reflects business-as-usual and a "state of inactivity trying to keep the status-quo and believing that it remains the solution to digital relevance" (Solis, 2016). The factors are describing the success-crucial levers of digital transformation. The number of factors for this model was limited to a maximum of 10 factors to avoid complexity. The factors are further broken down into subfactors, which represent the critical abilities and enablers within a factor and specify what should be measured by the model for each factor. The number of subfactors per factor was limited to a maximum of 5 factors. Hence, the proposed model can represent a maximum of 50 subfactors describing digital maturity and therefore enable a quite comprehensive assessment of digital maturity.

After defining scope and design of the model, in the phase "Populate" the content of the maturity model was decided. The goal of this phase is to decide what needs to be measured in the maturity assessment and how this can be measured. The outcome are the factors and subfactors that are mutually exclusive. Due to the fact, that the domain of digital transformation maturity for service-provider organizations was not established properly and that there was not sufficient literature available, a Delphi method with an expert panel was applied to develop the critical success factors (levers

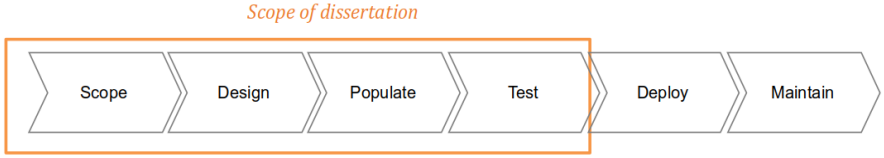

Fig. 1: Development framework and scope of research work (de Bruin et al., 2005)

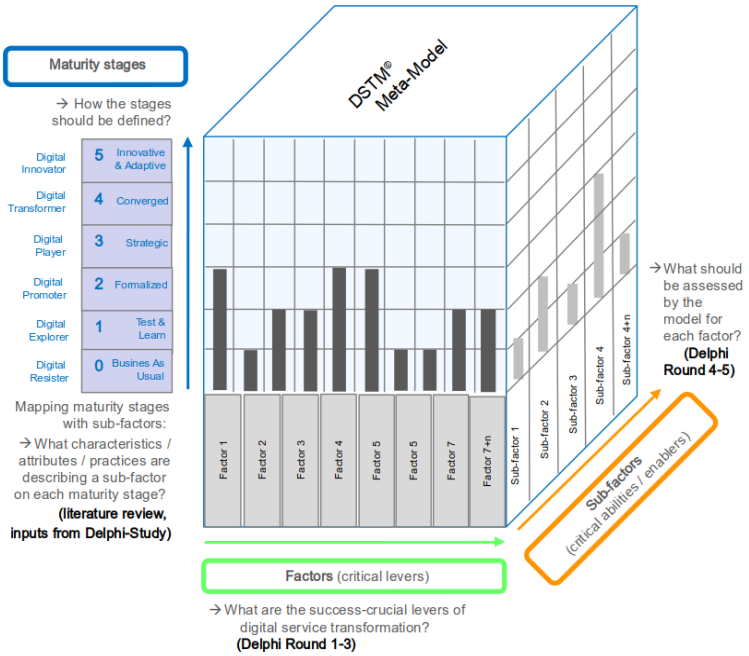

Fig. 2: Proposed Digital Service Transformation Maturity (DSTM) Meta Model

Tab. 2: Expert panel for Delphi-study

Company (Country)	Industry	#	Role of participants
Company A (Austria)	Elevator and Escalator products & Services	2	P1: Director Sales & Marketing P2: Director Field Operations
Company B (Austria)	High-end Domestic Appliances and Commercial Equipment & Services	1	P1: Director Technical Services
Company C (Austria)	Print and digital document products & Services	2	P1: Managing Director P2: Customer Service Expert
Company D (Austria)	Building Technology & Solutions	1	P1: Business Development Manager
Company E (Austria)	Ventilation, Heating, Air-Conditioning, Commercial Refrigeration, Equipment & Services	2	P1: Managing Director P2: Director Customer Services
Company F (Germany)	Automatic Door Systems & Services	1	P1: Business Unit Manager
Company G (Austria)	Food & Beverages B2B	1	P1: Director B2B
Company H (Germany)	Facility Management	1	P1: Technology & CDO, Member of Executive Board
Company I (Austria)	Automation Solutions for Production & Logistics	1	P1: Corporate Head of Service Relation Mgmt.
University of Applied Science A (Austria)	Institute Industrial Engineering & Innovation	1	P1: Professor Industrial Engineering
University of Applied Science B (Austria)	Institute Industrial Engineering & Innovation	1	P1: Professor Industrial Engineering
Consulting Company A (Austria)	Innovation Strategy Consulting	1	P1: Managing Director
Consulting Company B (Austria)	Customer Experience & Service Consulting	1	P1: Managing Director

Tab. 3: Delphi process applied to develop the DSTM-Model

Researcher	Export Panel	Time
Round 1 • Request 5 success-factors and hinders/barriers considered critical for digital transformation efforts	*Round 1* • Propose 5 success-factors and hinders/barriers considered critical for digital transformation efforts in service organizations	15 work days
Round 2 • Consolidate success-factors and hinders/barriers considered critical (maximum 10) → derive list of factors for model • Compare, match and complement with list of model factors identified in a systematic literature review (Teichert, 2019) • Propose a consolidated list of model factors (maximum 20)	*Round 2* • Rate list of consolidated factors for the model • Provide commentaries, suggestions and other important input	18 work days
Round 3 • Propose final list of factors for the model based on ratings and commentaries provided (maximum 10) • Request factor definition and identification of critical elements to be included in each factor (max 5 per factor)	*Round 3* • Inform about final list of factors based on ratings • Rate satisfaction of final factors and provide comments and suggestions • Propose definition for final factors by identifying elements considered critical for inclusion in factors (max 5 per factor)	21 work days
Round 4 • Consolidate/aggregated elements considered critical for inclusion in factor definition (maximum 10 per factor) • Provide aggregated themes per factor and propose first draft of definition per factor to review	*Round 4* • Review aggregated list of elements considered critical for definition • Review and comment on first draft of definition per factor • Propose critical abilities and enablers within the factors to be included and assessed in the model	33 work days
Round 5 • Consolidate comments and suggestions related to definitions per factor • Propose revised definitions per factor • Consolidate critical abilities/enablers (subfactors) within the factors to be included and assessed in the model • Propose a consolidated list of critical abilities/enablers (subfactors; max 5 per factor)	*Round 5* • Review revised definitions per factor • Review consolidated list of critical abilities/enablers (subfactors) within the factors to be included and assessed in the model • Comment on proposed list of critical abilities/enablers (subfactors) • Rate satisfaction per factor with final results and provide comments and further suggestions (factors, definition, subfactors)	30 work days
Summarize findings • Summarize final factors and definition (critical levers for digital transformation maturity) • Summarize final list of subfactors (areas within the factors for assessment by the model → critical abilities/enablers)	*Information about findings* • Information about final list of factors and definitions • Information about final list of subfactors (areas within the factors for assessment by the model → critical abilities/enablers)	10 work days

for digital transformation) and its subfactors (capabilities/characteristics) in more detail.

The DSTM-Meta Model was the guiding model for the Delphi-process to establish a common understanding and language among the experts and to provide overview and orientation related to the scope and tasks for each Delphi-round. The factors and subfactors were derived from clusters of themes generated by the experts during the process. The DSTM-Meta Model and the elements addressed by each of the Delphi-rounds are illustrated in Fig. 2.

Along the five Delphi-rounds 16 experts reflecting 10 different companies and two Universities of Applied Sciences were involved. To link the model to the context of a service-provider organization the expert panel (Tab. 2) was recruited mainly from service provider companies. Due to the innovativeness of the model to be developed and the lack of research in the domain of DSTM, the focus was laid on practitioners (76% industry, 12% consultants, 12% academia). All selected practitioners from industry offer a product-service system to their

customers. The functions in the expert panel vary from managing directors, country managers, service managers and technical service specialists to consultants. Three experts are from Germany, the rest is Austrian.

In the first 3 rounds the factors reflecting the critical levers for the digital transformation in service were developed. In round 4–5 the subfactors reflecting critical abilities and enablers per factor were clustered and mapped out. The entire Delphi process applied to develop the DSTM-Model is summarized in Tab. 3.

The average duration of each Delphi-round was 24 days and the average response rate was at 89%. The outcome of the Delphi process were factors, their definition and related subfactors described by associated topics and themes generated by the experts.

The overall satisfaction of the expert panel with all developed factors, subfactors and their definition along the Delphi-process was quite high, with 74% of respondents being very satisfied, 25% quite satisfied and 1% being neutral.

The mapping of each subfactor with 5 maturity stages, which represents the third dimension of the model, was the last step to finalize the DSTM-Model. By using the specific inputs from the Delphi-study and from a complementing literature review related to each subfactor, all identified subfactors were described and characterized by specific and assessable attributes for each of the maturity stages. Because of this granularity the model is on the one hand descriptive, which is important for understanding the status-quo of digital maturity ("as-is" position), and on the other hand prescriptive ("to-be" position), what is important for developing specific paths and action plans to improve digital maturity. This model approach enables a very comprehensive and holistic view of digital transformation for service provider organizations.

In phase "Test" the maturity model and the assessment instrument of the model were pilot tested by members of the expert panel involved in the Delphi-study. In this way the application could be tested, and the achievement of the desired design objectives was validated. The digital maturity levels of the participating companies were evaluated and visualized in the Digital Maturity Matrix. The deployment in the industry and ongoing maintenance of the DSTM-Model were not in the scope of this research. In the following chapters the developed DSTM-Assessment Model and the first pilot-test result as outcome of this research work are presented.

3 RESULTS

3.1 Factors and Subfactors of the Digital Service Transformation Maturity Model

Finally, 8 factors and 27 subfactors describing "Digital Service Transformation Maturity" were developed during the Delphi-study. All 8 factors and associated subfactors were further grouped into two main dimensions reflecting digital enabler (technological aspect) and transformation enabler (managerial aspect) as proposed by some comprehensive digital maturity models (Shahiduzzaman et al., 2017; Westerman and McAfee, 2012) identified in the systematic literature review (Teichert, 2019). Finally, the two dimensions adopted to measure digital maturity are "Digital Capabilities" and "Digital Impact", in line with the digital maturity model of PWC (Shahiduzzaman et al., 2017). This model was used as a guiding model for the "Digital Service Transformation Maturity Model" developed in this research work, as it is one of the most comprehensive models identified in the systematic literature review (Teichert, 2019). This allows that digital maturity is measured in these two dimensions and therefore guarantees a more holistic approach of digital maturity also underlining the criticality of the managerial and "soft" aspects for the success of digital transformation initiatives. "Digital Capability" should reflect "the strength of the organization's digital foundation", and "Digital Impact" how "digital technology is leveraged in the organization to respond to customer demand and changes in

Tab. 4: Digital Capability Indicators (Source: Delphi-study)

Factors	Subfactors	Number of assessment items
Digital Service Strategy	Digital transformation scenario for service	12
	Market analysis of digitalization in service	12
	Digitalization fields in service	9
	Roadmap for digitalization	9
Digital Competence	Profiles of digital competence	23
	Digital talents	17
	HR-development agenda for digitalization	13
Customer Experience	Personalization of service	17
	Simplification of interactions	17
	Management of expectations	23
Digital Technology	Adoption of new digital technology	14
	Digital IT-architecture	10

Tab. 5: Digital Impact Indicators (Source: Delphi-study)

Factors	Subfactors	Number of assessment items
Digital Service Business Model	Framework of digital service business model	19
	Service Engineering & Innovation	21
	Digital service ecosystem	24
Smart Services	Smart product	12
	Smart data	11
	Digital service platform	12
Digital Leadership & Organization	Creating the organizational frame	14
	Providing orientation	15
	Managing change	18
	Digital savvy	15
Digital Culture	Digital-first mindset	7
	Innovation	15
	Agility	10
	Data-driven decisions	21
	Collaboration	13

the environment through new product and service offerings and hence make transformation impact in the market" (Shahiduzzaman et al., 2017). "Organizations reach the highest level of maturity when they have both a strong digital foundation and a good understanding of how to leverage this foundation for a strategic business advantage" (Shahiduzzaman et al., 2017). Final grouping of factors and related subfactors into Digital Capability Indicators and Digital Impact Indicators is outlined in Tab. 4 and Tab. 5.

3.2 Maturity Levels

To define the digital maturity levels of the DSTM-Model three digital maturity models addressing different perspectives were adopted. Two of the applied models were identified during the systematic literature review (Teichert, 2019). The third model adopted was identified during additional literature research and reflects more the perspective of business and IT alignment to drive digital transformation. The first underlaying model developed

Tab. 6: Digital Maturity Levels (Solis, 2016; Whalen, 2015; Valdez-de-Leon, 2016; adopted by the author)

Stages	Description of stages
Level 0 Business-as-Usual	• *Organization:* Organization operates with an intimate legacy perspective of customers, processes, metrics, business models and technology, believing that it will remain the answer and solution to digital transformation. • *Digital Initiatives:* No steps taken by the organization yet to transform. • *Business and IT alignment:* There is a disconnect between business and IT digital initiatives, which are also poorly aligned with company strategy. Customer experience is not focused at all. • *Business Outcome:* Business provides weak customer experiences. Digital technology is just used to riposte threats.
Level 1 Testing & Learning	• *Organization:* Imagination and experimentation is triggered by new technology. Experimentation is driving digital skills and creativity throughout the organization, although disparately, while aiming to improve specific touchpoints and processes. • *Digital Initiatives:* The organization is taking intentionally first steps to move toward a digital business. • *Business and IT alignment:* The organization has discovered the need to evolve a digitally enhanced business strategy. Execution still is on a project basis and progress cannot be predicted or repeated. • *Business Outcome:* Digital enabled customer experiences, products and services are inconsistent and poorly integrated.
Level 2 Formalized & Enabling	• *Organization:* Sense of urgency accelerates, more formalized investments with greater impact. Programs become more intentional. More organized and cross-functional pilots. Digital literacy becomes primary focus. Executive sponsor for DT is established. • *Digital Initiatives:* The organization is implementing initiatives within the factor that will form the foundation of its digital business. • *Business and IT alignment:* Organization has started to evolve a digitally enhanced business strategy in a more formal way. Execution is on a more intentional and programmatic basis by connecting business and digital IT initiatives. • *Business Outcome:* Digital enabled customer experiences, products and services are more consistent and better integrated.
Level 3 Strategic & Integrated	• *Organization:* Strive for relevance escalates. Change starts to be recognized and appreciated by the entire organization. DT becomes intentional with short- and long-term goals supported by investment and infrastructure. More ambitious efforts formally organized. DT efforts span every category (DCX, sales, service….). Digital literacy is a mandate. • *Digital Initiatives:* To support end-to-end capabilities all digital initiatives are being integrated across the business. • *Business and IT alignment:* Business and IT goals are aligned at company level related to the creation of digital products, services and experiences. Business is still not focussing on the disruptive potential of digital initiatives. • *Business Outcome:* Products, services, and experiences are provided consistently but they are not truly innovative.
Level 4 Converged & Managed	• *Organization:* To guide strategy and operations a dedicated transformation team is formed. The new organizational structure takes shape. Roles, models, processes and systems to support transformation gets consolidated. • *Digital Initiatives:* Digital initiatives are being fine-tuned and utilized to further drive overall business performance. • *Business and IT alignment:* Integrated business and IT management disciplines exploit synergies and deliver digitally enabled products, services and experiences on a continuous basis. • *Business Outcome:* Business is providing world-class digital products, services, and experiences and is a leader in its markets.
Level 5 Innovative & Adaptive	• *Organization:* Digital transformation becomes a way of business for the organization and its executives. A new ecosystem is established to identify and act upon technology and market trends in pilot and eventually in scale. Culture of innovation becomes a priority. • *Digital Initiatives:* The organization is breaking new ground with its digital initiatives and is advancing the state of the practice within the factor. • *Business and IT alignment:* The organization is very disruptive in the use of new digital technologies and business models. Ecosystem awareness and feedback drives business innovation continuously. • *Business Outcome:* Business renews existing markets and develops new ones to its own advantages. The company is a fast-moving target for competitors.

Tab. 7: Example of assessment attributes per level for subfactor "Profiles of Digital Competence" (ability of the service company to develop systematic digital skills management to identify existing and future required digital skills and to implement targeted measures to close the identified skills gaps)

Maturity	Description
Level 0	• There is no awareness of required digital capabilities in the service company and no effort to address them.
Level 1	• The awareness of and need for individual digital skills is recognized ad hoc during the first digital pilot projects. • Digital "hard skills" or more technologically oriented skills are in the foreground (e.g. cloud computing, analytics, big data, digital tools). • It is recognized that employee profiles need to be updated in terms of their digital skills. Job descriptions need to reflect the required digital skills.
Level 2	• The systematic assessment of digital skills is initiated and driven forward at management level. • A recognized digital skills framework is used to ensure currency and completeness (hard/soft digital skills) of digital skills. • A thorough inventory of digital skills that already exist in the service company is available. • Required digital skills for the relevant functions are defined in light of the first planned digitalization initiatives and programs.
Level 3	• The service company sees digital skills for employees and managers as a key enabler for the digital strategy and a competitive factor. • In addition to digital "hard" skills (e.g. cloud computing, analytics, big data, etc.), digital "soft" skills (e.g. collaboration, change management, etc.) and digital leadership skills are playing an increasingly important role. • Digital skills are anchored in job/function descriptions based on a unified digital skills framework. • Digital skills required in the future are derived from the digital strategy. • The majority of employees and managers conduct a self-assessment of their existing and required digital skills. • Descriptions of digital skills and their assessment play an important role in the recruiting process.
Level 4	• Considering external trends and functional strategies, a clear understanding of areas in the service business is created, that provides insights as to which specific digital skills are needed and where they have the greatest impact (e.g. Advanced Analytics, Service 4.0, Agility, Digital Business, Digital Marketing). • The digital job profiles and functions that the service company needs for digital transformation and the related digital initiatives in the next 1–2 years are identified (e.g. Data Scientist, Marketing Automation, UI/UE Designer). • Management can pinpoint the risks posed by the lack of or gaps in required critical digital skills, (e.g. delay in digital transformation, cyber security risks). • Required digital skills and skill levels for existing job/function profiles in the service organization are identified and specified in a digital skills matrix. A systematic assessment of existing digital skills and skill gaps is carried out regularly. • A majority of employees see the gap between existing and required digital skills for their current job and future career path.
Level 5	• The digital skills matrix is updated on an ongoing basis to reflect key external trends, service market requirements and changes in strategy. • Required digital job profiles (e.g. digital product manager, UX/CX designer) and digital soft skills (e.g. collaboration, change management, customer centricity, data-driven decision making, …) for the development of innovative/disruptive services / business models take centre stage and are mapped in the digital skills matrix. • Most employees have an individual development plan that targets the existing digital skills gap and development goals for potential future jobs. • Contractual partners/service providers/suppliers are evaluated and selected based on the digital skills framework used in terms of their digital skills, skill levels and experience.

by Alimeter (Solis, 2016) describes digital transformation in six stages. This model claims that "companies typically pursue change from a known, safe approach correlating with business-as-usual practices. Operating within the confines of traditional paradigms without purpose or far-seeing vision eventually challenges the direction, capacity, and agility for thriving in our digital economy" (Solis, 2016). Building on interviews of companies engaging in digital transformation the researchers have found a "series of patterns, components, and processes that form a strong foundation for change" (Solis, 2016). These phases represent a kind of

Tab. 8: Comparing DSTM-Model with other digital maturity models

Model	Domain	# of factors/ dimensions	# of subfactors	# of maturity levels/stages	# of attributes/ characteristics specifying maturity
"Digital Service Transformation Maturity Model" (Teichert, 2019)	Service	8	27	5 (plus default level "zero")	403
"Digital Maturity Model for Telecommunication Service Providers" (Valdez-de-Leon, 2016)	Service	7	–	5 (plus default level "zero")	129
"Value Centric Maturity Model" (Shahiduzzaman et al., 2017)	General	13	–	4	62
"St. Gallen-Model" (Berghaus and Back, 2016)	General	9	–	5	60

blueprint for digital maturity to guide effectively digital transformation efforts and were used as underlaying digital maturity level model to address the organizational perspective of digital transformation. The next model adopted is a specific digital maturity model for service providers acting in the telecommunication industry (Valdez-de-Leon, 2016). It was the only domain specific model for service providers identified in the systematic literature review (Teichert, 2019). In this model "maturity in each dimension is assessed across five levels plus a default level zero reflecting a state of inaction" (Valdez-de-Leon, 2016). Each of the proposed levels in this model builds on the previous one and especially addresses the perspective of digital initiatives for service organizations to drive digital transformation. To reflect the IT perspective of digital transformation the DSTM-Model was complemented with IDC's "Information Digital Transformation Maturity Scape" model (Whalen, 2015). The IDC model especially addresses the perspective of business and IT-alignment with specific business outcomes of digital transformation. Finally, the overall maturity level model adopted and the description for each level and different perspectives (organization, digital initiatives, business & IT alignment, business outcome) are outlined in Tab. 6. Based on this adopted digital maturity level model, all subfactors were specified and described in detail with specific attributes and characteristics for each maturity level to enable a distinct assessment of maturity per subfactor. In addition to the systematic literature review (Teichert, 2019) and the input from the Delphi-study, further literature, reports, concepts, and generic models related to the subfactor topic were reviewed to support the development and definition of attributes for each maturity level. The attributes were created step by step by the author, starting with the description of the first level of maturity (Business-as-Usual) and then formulating the attributes and characteristics of the next higher level. In this way, every maturity level is building on the previous level. Attributes of digital maturity identified in specific literature related to a subfactor were integrated into the maturity level description accordingly. All attributes always were compared and matched with the guiding overall digital maturity level framework (Tab. 6) to ensure alignment. The whole development process was iterative to ensure consistency and differentiation between the maturity levels. Eventually 403 specific items to assess the maturity of all subfactors were created (Tab. 4 and Tab. 5). For example, for the subfactor "Profiles of Digital Competence" within the factor "Digital Competence" the specific attributes per maturity level are illustrated in Tab. 7. Building on these attributes each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of DSTM of the service company.

This detailed description of digital maturity per subfactor and per level provides also good guidance and orientation for stepping up to the next level of digital maturity. Even if

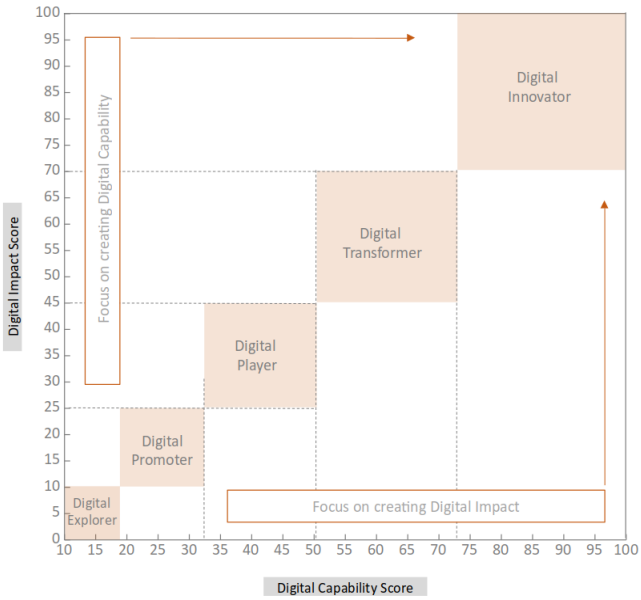

Fig. 3: Digital Transformation Maturity Matrix

actions to improve digital maturity are not fully prescribed in the model, the way attributes are formulated provides already a good informative basis for discussing and deriving possible course of actions from each attribute.

Compared with other examined digital maturity models the presented DSTM-Model comprises the highest number of attributes and characteristics describing digital maturity (Tab. 8). This also is driven by the fact that the 8 factors were broken down into 27 subfactors, which finally were described with 403 specific attributes across 5 maturity levels.

3.3 Digital Service Transformation Maturity Matrix

The DSTM-Model specifies each maturity level for each subfactor and therefore provides an orientation how to move up the maturity scale for each subfactor and what overall a more mature digital service organization and business means. Grouping of factors into Digital Capability and Digital Impact Indicators helps companies to pursue a balance between both dimensions. To achieve the highest level of digital maturity a balance between both indicators is required. Hence, achieving high level of maturity in just one dimension is not enough to achieve an overall high level of digital maturity. In this sense the model spans a matrix consisting of the two dimensions Digital Capability and Digital Impact (Fig. 3).

Within the matrix the different digital maturity areas defined by maturity levels and scoring range are depicted (Tab. 9). The key principle of the DSTM-Model is to always pursue a balance between Digital Capability and Digital Impact. Service companies just focusing on one dimension will not achieve higher level of DSTM. Particularly, if transformation efforts are mainly addressing the digital foundation, which starts with digital technology, and just aim to implement the latest technology trend to become digital, it will not drive digital maturity to a sufficient level. At the same time Digital Impact factors like Digital Culture, Leadership & Organization, Smart Services and Digital Service Business Model are needed to leverage digital technology to react to market demand and changes through improved service offerings. If a service company scores strong on Digital Capability factors and less on Digital Impact factors, the emphasis of actions needs to be placed on developing the weakest subfactors regarding Digital Impact first and vice versa.

Tab. 9: Maturity levels, scoring points assigned and arche-types of digital maturity

Maturity levels	**Level 1** "Testing & Learning"	**Level 2** "Formalized & Enabling"	**Level 3** "Strategic & Integrated"	**Level 4** "Converged & Managed"	**Level 5** "Innovative & Adaptive"
DC, DI-Score Range	0–10	10–25	25–45	45–70	70–100
Archetypes	Digital Explorer	Digital Promoter	Digital Player	Digital Transformer	Digital Innovator

In this way the DSTM-Matrix also supports the prioritization of actions to improve digital maturity. By positioning a service company in the DSTM-Matrix areas to improve digital maturity can be spotted depending on how far the "as-is-position" is off the ideal maturity evolution path and the future "to-be-position" of digital maturity can be envisioned. The ideal evolutionary path is to keep Digital Capability and Digital Impact always in balance. In that context the DSTM-Matrix also is a communication tool to facilitate discussion and understanding of the positioning, identifying potential focus areas and deciding a concrete improvement path and course of action addressing relevant subfactors and attributes.

3.4 DSTM-Assessment Model

The specific description of attributes for each maturity level per subfactor – 403 attributes for the model in total – forms the backbone of the assessment model. To quantify the level of maturity for a subfactor a simple scoring model was adopted. The scale of maturity is ranging from 0 to 100 points, whereby "Level 0" represents zero points, and "Level 5" represents 100 points. Higher maturity levels provide higher incremental points. This should reflect that lower maturity levels can be achieved faster and easier than higher levels of maturity. Therefore, higher levels of maturity are weighted stronger in the scoring model. During an assessment each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of DSTM of the service company. To qualify for a certain maturity level all attributes of this level and all previous levels must be fulfilled. Finally, the assessment scores of all subfactors are used to calculate an overall average Digital Capability (DC) and Digital Impact (DI) Score. Basing on the determined DC- and DI-Score the assessed service company can be positioned in the two-dimensional DSTM-Matrix (Fig. 3). The overall maturity level model and the proposed archetypes of digital maturity form the foundation for classifying service provider companies. The different typologies will be used to characterize companies related to their overall DSTM and to give a labelling and a description regarding their position (as-is position) in the DSTM-Matrix. Based on the defined maturity levels and scale of maturity ranging from 0 to 100 for each archetype a range of assessment scores for DC-Score and DI-Score was defined (Tab. 9).

4 TESTING THE MODEL

In the following the results obtained from testing the designed DSTM-Assessment Model are presented. Seven experts representing five service provider companies (Tab. 10) participating in the expert-panel of the Delphi-study, were testing the model based on a standardized easy-to-use assessment template which was provided per email.

The goal of the test was to proof firstly the understandability of assessment logic and attributes describing digital maturity, secondly the practicability and ease of use of the assessment templates itself, thirdly the evaluation of the assessment and fourthly the depiction in the DSTM-Matrix. The determination and evaluation of scores was facilitated by the

Tab. 10: Companies testing the DSTM-Model

	Company A	Company B	Company C	Company D	Company E
Industry	Elevator and Escalator products & services	High-end domestic appliances and commercial equipment & services	Print and digital document products & services	Automation technologies and services for commercial, industrial, public buildings and infrastructures	Ventilation, heating, air-conditioning, commercial refrigeration equipment & services
Participants	2	1	2	1	1
Roles of Participants	P1: Managing Director, P2: Senior Leader (Mgmt. Board)	P1: Senior Leader (Mgmt. Board)	P1: Managing Director, P2: Customer Service Expert	P1: Business Development Mgr.	P1: Senior Leader (Mgmt. Board)

Tab. 11: Digital Capability Scores per Company and Subfactor (max = 100)

Factors (critical levers)	Subfactor (critical enabler)	Company & Participant Assessment Scores A1	A2	B1	C1	C2	D1	E1	Score per subfactor
Digital Service Strategy	1.1 Digital Transformation Scenario for Service	45	10	25	70	70	100	70	56
	1.2 Market Analysis of Digitalization in Service	25	10	10	45	70	70	70	43
	1.3 Domains of Digitalization in Service	70	70	25	25	70	70	70	57
	1.4 Roadmap for Digitalization	45	10	0	45	45	100	70	45
Digital Competence	2.1 Profiles of Digital Competence	10	10	0	25	25	70	45	26
	2.2 Digital Talents	10	10	10	10	25	100	25	27
	2.3 HR-Development Agenda for Digitalization	10	10	10	10	25	70	45	26
Customer Experience	3.1 Personalization of Service	25	45	25	10	45	100	45	42
	3.2 Simplification of Interactions	25	10	25	0	45	70	25	29
	3.3 Management of Expectations	10	25	10	10	25	25	45	21
Digital Technology	4.1 Application of New Digital Technology	45	25	45	10	45	45	45	37
	4.2 Digital IT Architecture	25	45	25	25	45	100	45	44
	Average Digital Capability Score per Participant	29	23	18	24	45	77	50	
	Average Digital Capability Score per Company	26		18	34		77	50	

Tab. 12: Digital Impact Scores per Company and Subfactor (max = 100)

Factors (critical levers)	Subfactor (critical enabler)	Company & Participant Assessment Scores A1	A2	B1	C1	C2	D1	E1	Score per subfactor
Digital Service Business Model	5.1 Framework of Digital Service Business Model	10	10	10	10	45	100	45	33
	5.2 Service Engineering & Innovation	45	45	25	25	45	70	70	46
	5.3 Digital Service Ecosystem	10	10	10	10	25	25	45	19
Smart Services	6.1 Smart Product	45	25	100	25	45	100	45	55
	6.2 Smart Data	25	45	45	45	45	70	70	49
	6.3 Digital Service Platform	25	45	25	10	25	70	45	35
Digital Leadership and Organization	7.1 Creating the Organizational Frame	25	25	10	25	25	100	45	36
	7.2 Providing Orientation	25	10	25	10	45	100	45	37
	7.3 Managing Change	25	10	10	25	25	100	45	34
	7.4 Digital Savvy	10	10	10	25	25	100	25	29
Digital Culture	8.1 Digital First Mind-Set	45	45	10	10	25	70	25	33
	8.2 Innovation	25	10	10	25	25	70	45	30
	8.3 Agility	25	25	10	25	45	70	25	32
	8.4 Data-Driven Decisions	25	10	25	10	45	70	25	30
	8.5 Collaboration	10	10	10	10	45	70	45	29
	Average Digital Impact Score per Participant	25	22	22	19	36	79	43	
	Average Digital Impact Score per Company	24		22	28		79	43	

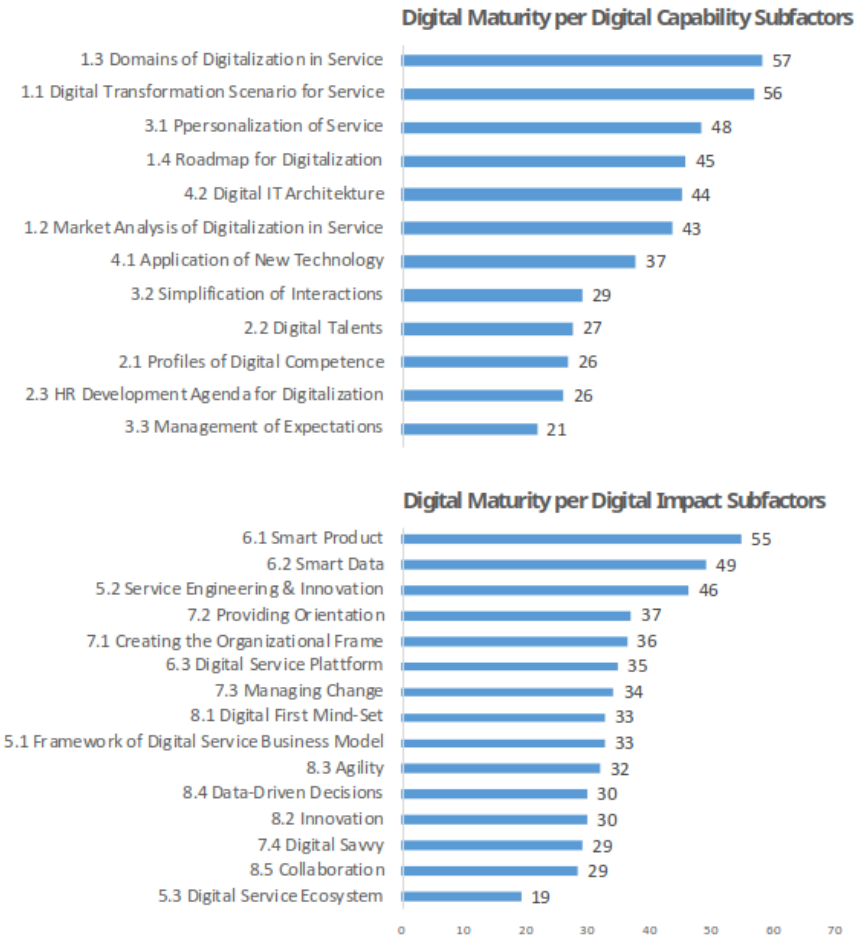

Fig. 4: Ranking of Digital Capability and Impact Subfactors by Digital Maturity Scores (max = 100)

applied assessment templates for each factor and average Digital Capability and Digital Impact scores per factor and finally for each service company could be evaluated quite easily (Tab. 11 and Tab. 12).

Furthermore, the overall scores of subfactors for all the service companies could be evaluated, which gives good insight into the overall maturity status for subfactors of the domain of service and provides guidance for service companies on which subfactors they should focus to drive digital transformation maturity further (Fig. 4).

Regarding Digital Capability it became evident that the subfactors related to "Customer Experience" (3.2 Simplification of Interactions, 3.3 Management of Expectations) and related to Digital Competence (2.1 Profiles of Digital Competence, 2.2 Digital Talents, 2.3 HR-Development Agenda for Digitalization) show lowest level of maturity. Subfactors related to "Digital Strategy" (1.1 Digital Transformation Scenario for Service, 1.3 Domain of Digitalization in Service) reflect highest level of maturity, which clearly underlines that service companies are working on their digital strategy but seem to lack the required digital competencies and talents. The ability to manage customer experience seems also to be underdeveloped, except the ability to personalize services. This clearly indicates that the factors "Customer Experience" and "Digital Competence" need to

Tab. 13: Distribution of Digital Capability and Impact subfactors across maturity levels

Maturity level (score)	Digital capability % of subfactors per maturity level (n = 12 subfactors)	Digital impact % of subfactors per maturity level (n = 15 subfactors)
Digital Innovator (>70)	0%	0%
Digital Transformer (46–70)	25.0% (16.7%)	20.0% (13.3%)
Digital Player (26–45)	66.7% (41.7%)	73.3% (33.3%)
Digital Promoter (11–25)	8.3% (41.7%)	6.7% (53.3%)
Digital Explorer (0–10)	0%	0%

Note: Figures in brackets reflect % distribution without scores of outliers (Company D)

be specifically addressed in the digital strategy of the service companies participating in this assessment.

Regarding Digital Impact most of the subfactors related to "Digital Culture" (8.2 Innovation, 8.3 Agility, 8.4 Data-Driven Decisions, 8.5 Collaboration) show lower levels of maturity. This assessment result clearly indicates that these service companies need a strong focus on "Digital Culture" to drive digital maturity. The subfactor "Digital Savvy", which reflects the digital competence of the leadership team, is also ranking very low. The lowest level of maturity of all Digital Impact subfactors is represented by the subfactor 5.3 Digital Service Ecosystem. The subfactors 6.1 Smart Products, 6.2 Smart Data and 5.2 Service Engineering & Innovation rank highest in this group, what underlines the main starting point of digital transformation in these service companies, namely making the product smart by adding sensors, capturing data in the cloud, analyzing data with algorithms to gain valuable insights and creating new services. Regarding the factor "Digital Service Business Model" it is quite interesting that the subfactor 5.2 Service Engineering & Innovation shows a higher level of maturity, but the other two subfactors which are 5.1 Framework of Digital Service Business Model and 5.3 Digital Service Ecosystem reflect clearly lower levels of maturity. This indicates that these service companies assess their ability to develop and engineer new services relatively high but are not able to translate this ability into developing digital service business models or a digital service ecosystem.

This ranking suggests that on average just a few subfactors are on a Digital Transformer level and most subfactors are still on a "Digital Promoter" or "Digital Player" level (Tab. 13). If you would take out the scores of the outlier service company positioned on Digital Innovator level (Company D) the average scores per subfactor would be even lower and just 16.7% of Digital Capability subfactors and 13.3% of Digital Impact factors would be on Digital Transformer level.

The transfer and depiction of the Digital Capability and Impact scores into the DSTM-Matrix was straight forward and worked out well. The matrix visualized clearly the "as-is" position of each assessed service company and lays a foundation for comparison and developing a path for the desired future state of digital maturity (Fig. 5).

The position of assessed service companies in the DSTM-Matrix depicts that most of the service companies – three out of five – are Digital Promoters or Digital Players. Overall, there is a big spread between the five assessed service companies ranging from Digital Promoter to Digital Innovator. All assessed service companies show a good balance between Digital Capability and Digital Impact factors, although three out of the five service companies close to Digital Player or Digital Transformer level need to improve their Digital Impact factors. Finally, the first test results suggest that most of the assessed service companies still reflect some digital immaturity and not have reached a Digital Transformer level yet. More attention on the factors highlighted above is needed to improve digital transformation maturity further.

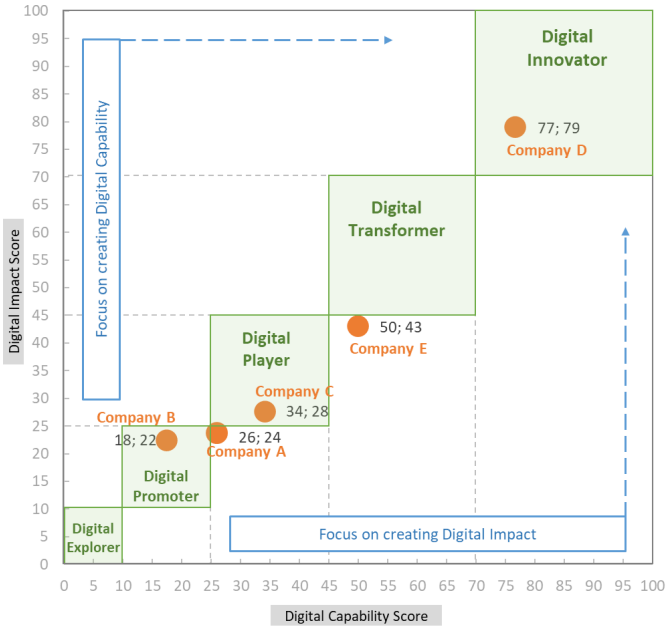

Fig. 5: Service companies positioned in the Digital Service Transformation Maturity Matrix (Source: pilot test)

5 DISCUSSION

5.1 Systematic Literature Review

A systematic literature review (Teichert, 2019) as part of this research took stock of research and contemporary development in the field of digital maturity and has identified 22 different digital maturity models. These models were examined in detail to better understand the contemporary development of digital maturity models and – building on the findings – a comprehensive Digital Service Transformation Maturity Assessment model for the domain of service was developed.

All reviewed digital maturity models are proposing different maturity dimensions, maturity stages and assessment items. Overall, 15 different maturity areas are identified in the included models: Digital Culture, Technology, Operations & Processes, Digital Strategy, Organization, Digital Skills, Innovation, Customer Insight & Experience, Governance, Vision, Digital Ecosystem, Leadership, Compliance & Security, Products & Services and Business Model. Maturity areas of relevance for transformational capabilities of an organization like vision, leadership, digital culture, innovation and governance are playing a more important role in general than in domain-specific contemporary digital maturity models. But to succeed in digital transformation efforts both transformational and digital capabilities are needed in organizations. When comparing the maturity areas addressed in different models, it also becomes evident that nearly all models place strong focus on the technological and process-side of digital transformation. In domain-specific digital maturity models, "technology" is the most addressed maturity area, followed by "digital skills" and "operations & processes". Analysis of maturity areas in general models clearly indicates that "digital culture" is the most addressed maturity area, followed by "technology" and "operations & processes". Hence, the culture aspect plays a significantly more important role in general digital maturity models than in domain-specific models. Other "soft" dimensions, more attached to transformational capabilities like leadership, vision, and

innovation culture are also more addressed in general than in domain-specific models. In addition, most of the contemporary digital maturity models – general and domain-specific – neglect and hardly reflect the capability to develop new and disruptive business models as an indicator for digital maturity. Just very few models address the aspect of the developing a new business model and to which extent digital is taken into consideration for it. This underlines that most companies rather focus on the exploitation of digital technology than on the exploration of digital innovation and development of new digital products and business models to generate new digital revenues. Another interesting finding is that maturity dimension "customer insight & experience" as characteristic of digital maturity plays a minor role in domain-specific models. General models also tend to show more external orientation and therefore take customer experience as criteria for digital maturity much stronger into account than domain-specific models.

A special light was shed in the analysis on the cultural aspect of digital transformation. Overall, more than half of the examined digital maturity models include "culture" as a maturity dimension. Especially general digital maturity models developed by practitioner (e.g. consultants) address "culture" as a critical enabler for digital transformation, because culture can be one of the barriers, which is often underestimated and usually not recognized by companies in the context of digital transformation. Especially attributes of a digital culture need to be well presented in a service-specific digital maturity model. When taking a closer look to the most frequently addressed cultural attributes in the examined digital maturity models, attributes like "collaboration", "agility & flexibility" and "organizational learning" could be found. The ability of an organization to change and continuously reinvent itself ("change ability"), along with "failure tolerance" and "risk tolerance" were identified as additional critical attributes of a digital culture. "Ideating new digitalized working methods", "open communication" and "customer centricity" were also addressed quite frequently in the culture dimension of the examined models. This is in line with a research study (Buvat et al., 2017), which was conducted to establish a definition of "digital culture".

Basing on the examined digital maturity models in this dissertation it can be argued that general digital maturity models more comprehensively address transformational capabilities, and the domain-specific models more strongly address digital-technological capabilities in the assessment of digital maturity of a company. There were some general models identified (Westerman and McAfee, 2012; Shahiduzzaman et al., 2017; Berghaus and Back, 2016), which already distinguish between two main areas encompassing digital assets, like digital capabilities, digital infrastructure and investments, and transformation enabler, like vision culture, leadership, governance, innovation or agility. These models cluster their dimensions into these main areas, which underlines the importance of the managerial and soft aspect of digital transformation efforts. They also propose a very comprehensive description of digital maturity and were used as guiding models in this dissertation. Following key findings of the systematic literature review are addressed by the developed Digital Service Transformation Maturity Model (DSTM) for service provider organizations:

- There is a lack of digital maturity models reflecting domains other than manufacturing, taking the context and challenges of other industries into account (e.g. service in technical industries). Major part of existing models addresses the domain of manufacturing (Industry 4.0). More specific and granular assessment approaches are required to give companies effective guidance towards digital maturity in different contexts.
- Inconsistency of dimensions, maturity levels and characteristics describing digital maturity across all existing digital maturity models. Underlaying definition of digital maturity demonstrate a significant heterogeneity in content and methodology.
- Most of the models provide an incomplete picture of digital maturity. Either transformational management capabilities (e.g.

vision, leadership, governance, innovation, agility) or an organization's digital foundation (e.g. technology, digital skills, organization, strategy, customer experience…) are not addressed sufficiently and systematically.

- Most of the examined digital maturity models are descriptive in their nature, just assessing the level of digital maturity, and do not give guidance and a clear roadmap how to achieve higher level of maturity (prescriptive).
- Cultural attributes enhancing digital transformation are not represented systematically in existing models. A consistent definition of "digital culture" has to be established.
- The aspect of digital business model is hardly addressed in any models.

5.2 Digital Service Transformation Maturity Model (DSTM)

Building on these findings a comprehensive Digital Service Transformation Maturity Model was developed by applying a development framework which was used for the development of other maturity models in other domains (de Bruin et al., 2005). By adopting the Delphi-Method 16 experts reflecting 10 different companies and two Universities of Applied Sciences were involved in the design of the model. The goal was to establish a very granular model consisting of factors, subfactors and five maturity levels including a default level zero which reflect business-as-usual and a state of inactivity trying to keep the status-quo and believing that it remains the solution to digital relevance. By breaking down the factors into subfactors a better granularity and guidance in striving for a desired future maturity state is provided. The subfactors were derived from clusters of themes generated by the experts. Finally, 8 factors and 27 subfactors were identified to describe digital transformation maturity for service provider organizations. When comparing the DSTM-Model with other relevant digital maturity models (Tab. 7) it becomes evident that the scope of the DSTM-Model is broader and the level of granularity significantly higher. None of the other models is using an additional layer of subfactors. In line with the guiding models (Westerman and McAfee, 2012; Shahiduzzaman et al., 2017; Berghaus and Back, 2016) a balance between digital capabilities and digital impact factors was pursued to ensure that digital maturity in the DSTM-Model is understood as a holistic concept addressing the managerial and soft aspect of digital transformation efforts, which is even more important in the service industry. The proposed model clearly addresses the identified lack of digital maturity models for the domain of service and the dissertation is enriching literature related to the topic of digital maturity models.

5.3 DSTM Assessment Model & Matrix

To make Digital Service Transformation Maturity assessable for each subfactor several specific attributes per maturity level were generated. Compared to other digital maturity models it is a very comprehensive model (Tab. 8). Eventually 403 specific attributes to assess the maturity of the subfactors were created in a way that each maturity level is building on the previous level. Building on these attributes each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of Digital Transformation Maturity of the service company. This detailed description of digital maturity per subfactor and per level provides also good guidance and orientation for moving to the next level of digital maturity. Even if actions to improve digital maturity are not fully prescribed in the model, the way attributes are formulated provides already a good informative basis for deriving possible actions from each attribute.

To visualize the assessment results of a service company (as-is-position) a two-dimensional Digital Transformation Maturity Matrix with a Digital Capability and Digital Impact Score was established. Within the matrix the different digital maturity areas are depicted. The key principle of the DSTM-Model is to always pursue a balance between Digital Capability

and Digital Impact factors. Service companies just focusing on one dimension will not achieve higher level of Digital Transformation Maturity. Particularly, if transformation efforts are mainly addressing the digital foundation, which starts with digital technology, and just aim to implement the latest technology trend to become "digital", it will not drive digital maturity to a sufficient level. At the same time Digital Impact factors like Digital Culture, Leadership & Organization, Smart Services and Digital Service Business Model are needed to leverage digital technology to respond to customer demand and changes in the environment through improved product and service offerings. By positioning a service company in the DSTM-Matrix areas to improve digital maturity can be spotted depending on how far the as-is-position is off the ideal maturity evolution path. If a service company scores strong on Digital Capability factors and less on Digital Impact factors, the emphasis of actions needs to be placed on developing the weakest subfactors regarding Digital Impact first and vice versa. In this way the DSTM-Matrix also supports the prioritization of actions to improve digital maturity. Overall, the designed DSTM-Matrix fulfils several important functions supporting the development and deployment of digital transformation efforts of a service company:

- Visualization-function: helping to visualize the as-is-position of the service company's digital transformation maturity in a two-dimensional continuum basing on Digital Capability and Impact Scores.
- Benchmarking-function: comparing the as-is-position with regards to maturity-zones in the matrix labelled with clear arche-types (Digital Resister, Digital Explorer, Digital Promoter, Digital Player, Digital Transformer, Digital Innovator). This maturity-zones reflect a position of balance between Digital Capability and Digital Impact factors.
- Alignment-function: supporting the discussion of results and review of detailed subfactor assessment to create common understanding of current state. Basing on the common understanding of current state the desired future state of digital transformation maturity can be developed.
- Roadmap-function: helping to decide the to-be-position of digital transformation maturity and to develop a path along the different maturity-zones. Underlaying subfactors and its specific attributes will help to develop a certain course of action fueling the transformation effort of a service company.
- Simulation-function: supporting to assess the impact of actions addressing different subfactors and make the progress visible. In this way the focus areas with biggest impact can be identified, prioritized and an effective course of action can be decided.

The DSTM-Matrix with its functions can effectively support the development process of the digital service strategy for a service provider company.

5.4 Test of the DSTM-Assessment Model

Finally, the designed DSTM-Assessment Model was tested by 7 experts participating in the expert panel of the Delphi-Study representing five service companies. The goal of the test was to proof firstly the understandability of assessment logic and attributes describing digital maturity, secondly the practicability and ease of use of the assessment templates itself, thirdly the evaluation of the assessment and fourthly the depiction in the DSTM-Matrix. Beyond that a first analysis and interpretation basing on the results was conducted. Basing on the feedback of experts the DSTM-Model is understandable, practicable and can be used in an easy way with the template provided for the test. Also, experts indicated that the assessment gives a clear picture of the as-is-situation and shows what could be possible regarding a potential desired state for different factors. This gives evidence that the attributes describing digital transformation maturity were clearly understandable for the assessors. At the same time some limitations and areas for improvement were pointed out. Especially it was highlighted that not all aspects can be assessed by one person, what proposes that

an interdisciplinary group of employees should be involved into the assessment. Beside interdisciplinarity it was mentioned that employees participating in the assessment should represent different levels of hierarchy, because perception of digital maturity might differ between various levels of hierarchy in a sense that employees from higher levels of hierarchy tend to assess digital maturity more optimistic than employees on lower levels. Regarding understandability one limitation was indicated. Although the assessment tool is clearly understandable for people who were involved in the development of the DSTM-Model like the experts testing it, it might be difficult for people not involved in the development and not being expert in the topic. In that context also the use of abbreviations should be reduced to a minimum because it could be misleading if assessors do not understand the concepts behind and are not familiar with it.

The determination and evaluation of scores was facilitated by the applied assessment templates for each factor and average Digital Capability and Impact Scores per factor and finally for each service company could be evaluated quite easily. Furthermore, the overall scores of subfactors for all the service companies could be evaluated, which gives good insight into the overall maturity-status for subfactors of the domain of service and provides overall guidance for service companies on which subfactors they should focus to drive digital transformation maturity further. The transfer and depiction of the Digital Capability and Impact Scores into the DSTM-Matrix is straight forward and worked out well. The Matrix visualized clearly the as-is-position of each assessed service company and lays a foundation for comparison and developing a path for the desired future state of digital transformation maturity.

The first results indicated that the subfactors related to Digital Capability Factors "Customer Experience" and "Digital Competence" show lowest levels of maturity in all assessed service provider companies. On the opposite the subfactors related to "Digital Service Strategy" reflect highest level of maturity compared to all other Digital Capability subfactors. This underlines that service companies feel quite comfortable with their digital service strategy. At the same time results also reveal that there is a lack of digital competence and talents in the service organization, which could be a roadblock for the development and execution of a digital service strategy. The ability to manage and design customer experience systematically also seems to be underdeveloped within the assessed service companies. Consequently, the factors "Digital Competence" and "Customer Experience" need to be addressed in the digital service strategy of service companies assessed in the test. Regarding Digital Impact Factors most of the subfactors related to "Digital Culture" indicate the lowest levels of maturity compared to all other subfactors. This is kind of alerting because research clearly shows that culture is the roadblock number one for digital transformation efforts. Creating a digital culture requires strong leadership and digital competence among the leaders and managers of an organization. However, the subfactor "Digital Savvy" also ranks very low compared to other subfactors. This clearly illustrates an overall risk for the assessed service companies in pursuing their transformation efforts successfully. Another finding in the test results is that out of the three subfactors related to "Digital Service Business Model" the subfactor "Framework of Digital Service Business Model" and "Digital Service Ecosystem" reflect quite low maturity levels compared to the third subfactor which is "Service Engineering & Innovation". This gives some evidence that service companies feel quite comfortable in developing and innovating their services but lacking a common framework for digital service business models they are not able to translate this ability into a new digital service ecosystem. To drive maturity of the factor "Digital Service Business Model" is a key requirement for becoming a Digital Innovator. The ranking of all the subfactors basing on their assessment scores suggests that Digital Capability and Digital Impact factors of assessed service companies are immature and assessed service companies have still to take some effort to become a Digital Transformer or Digital Innovator. Especially "Digital Culture",

"Digital Competence", "Customer Experience" and "Digital Service Business Model" are the clear areas of attention to positively impact Digital Service Transformation Maturity.

The position of assessed service companies in the DSTM-Matrix depicts that most of the service companies – three out of five – are Digital Promoters or Digital Players. Overall, there is a big spread between the five assessed service companies ranging from Digital Promoter to Digital Innovator. Overall, all assessed service companies show a good balance between Digital Capability and Digital Impact factors, although three out of the five service companies close to Digital Player or Digital Transformer level need to improve their Digital Impact factors. Finally, the first test results suggests that most of the assessed service companies still reflect some digital immaturity and not have reached a Digital Transformer level yet. More attention on the factors highlighted above is needed to improve digital transformation maturity further.

5.5 Practical Implication, Limitation and Recommendation

The practical implication of the developed DSTM-Model for service provider companies is that it gives a full picture of digital transformation, because it is a multidimensional maturity model which offers a better approach in approximating the digital transformation status than a one-dimensional model. Beyond a systematic and granular assessment of the status of digital transformation it also provides guidance on how to improve digital transformation maturity by making the areas of attention transparent. The systematic literature review identified just one digital maturity model in the domain of service. The DSTM-Model therefore offers an additional approach to management or other stakeholders for assessing digital maturity of a service company and supports internal strategy discussions to derive specific strategic initiatives like the initiation of company-wide digital projects and programs. Furthermore, the model enables systematic benchmarking and comparison related to digital transformation maturity between service companies.

The focus of the presented research work was placed on identifying the critical factors describing digital maturity, which provide insight how digital transformation success can be improved rather than just being measured.

The limitation of the model is that it is not fully prescriptive. The specific attributes used to describe digital transformation maturity give indeed some indication and idea of tangible measures, but they are not fully predefined. Furthermore, the model practicability and understandability just were tested by service companies participating in the Delphi-Study. They have special insight into the model, what will not be the case for other companies conducting an assessment.

As a next step it is recommended to apply the model in the companies, which were involved in the development of the model as a first step. In a second step it should be applied within service-provider entities that are independent of the model development. To establish generalizability of the DSTM-Model a higher volume of model applications is required (e.g. via web-interface). The evolution of the model will occur as the domain knowledge and model understanding broadens and deepens. This is required to ensure the continued relevance of the model. A further recommendation for future research is to investigate the link between digital maturity and transformation success and final business success. In this way the effectiveness of digital maturity models for the service industry can be proven.

6 CONCLUSION

This research work presented here is intended to complement the contemporary research and to close an identified gap related to digital maturity models in the domain of service. As a result, a domain-specific and holistic assessment model for the digital maturity of

service provider companies in a B2B-related context was developed. In comparison to other digital maturity models the model presented includes and specifies in more detail than other models the soft and managerial aspect of digital transformation, which can potentially be a critical hurdle for the transformation.

It serves a scientific and a practical purpose. The scientific purpose aims at addressing a white spot in the contemporary research related to digital maturity models for the domain of service in a B2B-related context. The developed model enables to collect data regarding the state of evolution of service provider companies related to digital maturity across different industries and will help researchers to further investigate and better understand potential interrelations between factors and digital transformation success for the domain of service in a B2B-related context, what further contributes to the digital maturity body of knowledge. The practical purpose of this research aims to gain systematic insights for management where a service provider company stands with regards to digital transformation, to identify digital maturity gaps and to develop a course of action for the relevant areas. Therefore, it provides a substantiated model for practitioners to apply within service provider companies to determine a solid reference point for further strategic initiatives to move effectively to the next level of digital maturity.

The presented DSTM-Model is not intended to fully prescribe the best and most easy route to the desired future state of digital maturity. Basing on its granularity and specific attributes describing current and potential target levels of digital maturity it indicates areas of attention, which might positively affect the effectiveness of digital transformation efforts, and therefore provides some guidance on how to move forward. As digital maturity is more a moving target than a static concept, the DSTM-Model needs to be continuously adapted to reflect new emerging technologies and new customer and market requirements.

Finally, the assessment model was tested successfully by five service companies. Practicability and understandability of the assessment model was confirmed. Basing on first comparisons related to the positioning of the companies in the DSTM-Matrix a clear variance related to digital transformation maturity became evident. Overall, the results suggest that just a few service provider companies reflect high levels of digital maturity and can be seen as Digital Transformers or Digital Innovators. A big portion of them still is on lower levels of digital maturity and are rated as Digital Promoter or Digital Player. They need to clearly define and drive their transformation efforts further to improve their level of digital transformation maturity.

A limitation of the research might be that the model just was tested by a small sample of service companies and experts participating in the development of the model and not by other service provider companies independent from the model development, what might not give a full picture regarding generalisability of the model. In addition, the relationship between the proposed factors and digital transformation success of service provider companies is not proven yet and needs further attention. Basing on the mentioned limitations and potential shortcomings following recommendations for future research are proposed:

- Identifying and linking best practices to successfully drive digital transformation maturity to each of the maturity levels per subfactor. This could be organized in a kind of knowledge-management database, in which service provider companies using the DSTM-tool provide input. In this way the DSTM-Model over time will become a more prescriptive model.
- Review and adoption of the content describing digital transformation maturity (factors, subfactors, specific attributes) to ensure a dynamic view of digital maturity reflecting new emerging trends and technologies and customer and market requirements.
- To establish generalisability of the digital maturity model successfully a high application and data collection volume is required (e.g. assessment via web-interface). The model will evolve as the domain-knowledge and model understanding broadens and

deepens. This phase is important to assure the relevance of the model over time and needs ongoing attention in future.

- Better understanding the relationship between the proposed factors, digital transformation success and business success.

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