

Evaluating a Forward-Looking Maturity Model for Enterprise Performance Management



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Abstract Enterprise performance management (EPM) helps in executing a company’s strategy. As current benchmarking approaches against the so-called “first quartile” are backward-looking and, thus, fail to capture the disruptive nature of digital technologies, a new zero-quartile benchmarking compares companies against the expected (collectively deemed best possible) state. However, its relevance was not yet demonstrated. Therefore, the objective of this article is to evaluate this new zero-quartile benchmarking approach with the help of a case study at a global supplier of natural ingredients and nutrition solutions which currently improves their EPM by leveraging digital technologies. We subsume our findings towards digital EPM as follows: (1) From playground to pitch: It is not easy to implement a digital enterprise platform. However, it should be a company’s future single source of truth. (2) Powering up a company’s crystal ball: Leveraging predictive analytics, companies should rethink their budgeting and forecasting. (3) Setting the scene: Companies should continue harmonizing their ERP while automating their standard reporting and analysis using finance bots.

Keywords Digital transformation · Enterprise performance management (EPM) · Maturity model (MM) · Benchmarking · Digital technologies: automation, analytics, digital enterprise platform · Survey · Rasch Algorithm · Design science research (DSR) in information systems (IS)

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1 Introduction

The onset of the COVID-19 global pandemic is highlighting the importance of digital technologies. The basic understanding is that organizations with a higher level of digital maturity are more flexible and can better cope with challenging situations like the present one [1].

Improving their digital maturity, companies can resort to *benchmarking* as a continuous process of identifying highest standards of excellence for products, services, and processes [2]. However, current benchmarking approaches against the so-called “first quartile”—defined as the top 25% target state of top performing companies [3]—are backward-looking and fail to capture the disruptive nature of digital technologies such as automation, analytics, and digital enterprise platforms [4].

Addressing this shortcoming, a new *zero-quartile benchmarking* compares companies against the *expected* (collectively deemed best possible) state of benchmarking objects [5]. Accordingly, the zero quartile marks a target state which is a step ahead of (existing) best practices of top performing companies today.

Comparing digitalization efforts between companies’ departments shows that the *finance function*—once a frontrunner for digitalization—is falling behind. This could be attributed to a lack of guidance from academia. Taking enterprise performance management (EPM) as a case example, Esswein et al. [5] constructed a zero-quartile-benchmarking towards a future EPM leveraging digital technologies. Their *maturity model (MM)*—defined as a conceptual model incorporating a sequence of discrete maturity levels and representing an anticipated, desired, or typical path of evolution [6]—serves not only as a self-assessment for companies to evaluate their as-is situation, but also to derive design guidelines for reaching the next to-be level.

Emphasizing a staged research process with iterative “build” and “evaluate” activities Peffers et al. [7], *evaluating* artefacts is a key element of design science research, (DSR) in information systems (IS, [8]). Some researchers such as Straub and Ang [9] appraise an object of interest along the two basic dimensions, that is rigor and relevance. Other authors apply a series of more detailed criteria such as completeness, efficiency, consistency, and robustness [10].

As the EPM MM by Mayer et al. [11] is based on a comprehensive literature review and a survey among 203 participants, it should be rigorous. However, its *relevance* was not yet demonstrated. Therefore, the objective of this article is to *evaluate this (new) zero-quartile benchmarking MM towards digital EPM at a global supplier of natural ingredients and nutrition solutions*. We raise two research questions:

- Does the proposed model fulfill what it is meant to do (validity)?
- Is it useful beyond the environment in which it was initially developed (utility)?

To create things that serve human purposes [12], ultimately to build a better world [13], we follow DSR in IS [14, 15], for which the publication schema by Gregor and Hevner [16] gave us directions. We motivate this article on the basis of current

challenges associated with a new benchmarking towards digital EPM (*introduction*). Based on the state of the art, we highlight research gaps (*literature review*). Addressing these gaps, we substantiate an evaluation framework and apply it in a case study (*method*). Then, we present our *results*. Comparing them with prior work and examining how they relate back to the article's objective and research questions, we end with a summary, the limitations of our work, and avenues for future research (*discussion and conclusion*).

2 Literature Review

Following Webster and Watson [17], we commenced our literature review with a (1) *journal search* focusing on leading IS research and accounting journals, complemented by proceedings from major IS conferences.^{1,2,3} In line with Mayer et al. [11], we also considered papers from MIS Quarterly Executive and the Harvard Business Review. For our (2) *database search*, we used ScienceDirect, EBSCO host, Springer Link, AIS eLibrary, and Google Scholar. Assessing the publications through their titles, abstracts, and keywords, we performed an iterative (3) *keyword search*.

As a result, we complemented the 69 publications examined by Mayer et al. [11] with another six publications. They focus on evaluation activities contributing to our staged research process (Sect. 1). Finally, we conducted a (4) *backward and forward search*. Including references from all relevant publications, we identified another three publications such as Alturki et al. [21] and ended up with 78 *publications* in total (Fig. 1).

The **gap analysis** was structured in three clusters (Fig. 1): (1) The *benchmarking object* encompasses the two key EPM process activities “planning, budgeting, and forecasting” as well as “reporting and analysis”. “Others” subsume articles that do not focus on a specific EPM process activity. (2) The cluster “*peer-group partner*” refers to what the benchmarking object is compared to [22]. (3) Last, but not least, we differentiated between research methods, addressing the way in which researchers collect and understand data [23]. Quantitative research includes

¹Based on the AIS senior scholars' basket of leading IS Journals [18]: European Journal of Information Systems; Information Systems Research; Information Systems Journal; Journal of the Association for Information Systems; Journal of Information Technology; Journal of Management Information Systems; Journal of Strategic Information Systems; MIS Quarterly.

²In order to focus on leading accounting journals, we used the Scimago Journal Ranking [19]. We selected the subject area “Business, Management, and Accounting” and, herein, the subject category “accounting.” The resulting top 50 journal ranking includes outlets such as Accounting Review, Journal of Accounting Research, and the Journal of Finance.

³We followed the AIS' list of leading IS conferences [20]: Americas Conference on Information Systems; European Conference on Information Systems; International Conference on Information Systems; Pacific and Asia Conference on Information Systems.

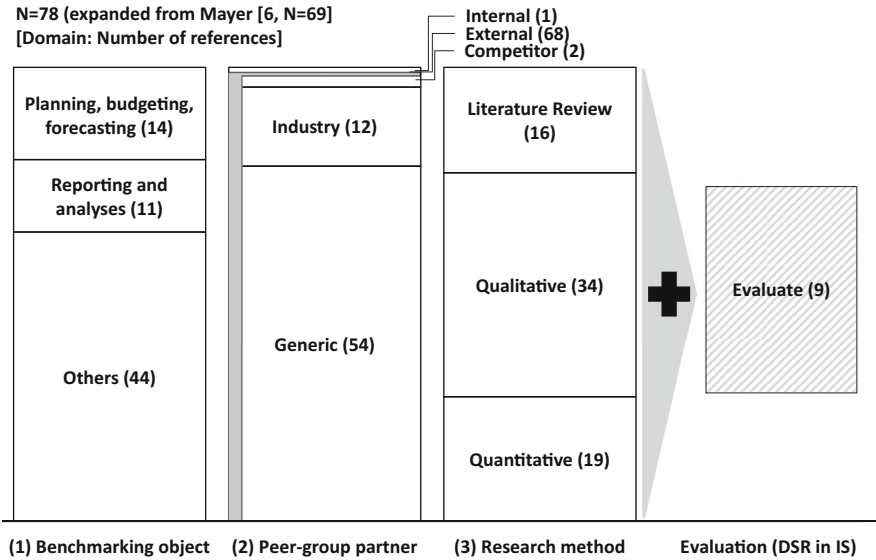


Fig. 1 Overview of relevant publications including the results from Mayer et al. [11]

empirical studies such as surveys, (laboratory) experiments, and archival studies. In turn, qualitative research covers case studies, focus group observations, interviews, document and text analyses, as well as researchers’ impressions and reactions. Literature reviews are a third category, because they summarize both quantitative and qualitative research outcomes. Finally, we complemented the work of Mayer et al. [11] with nine articles focusing on (4) *evaluation activities*.

(1) Benchmarking object: We differ three digital technologies, namely automation, analytics, and digital enterprise platform. The latter serves as a single source of truth of a company’s data. Efficiencies can be realized by automation, when transferring data between IS [24]. Companies will become more effective when applying (predictive) analytics on big data as a “modern” crystal ball [25]. However, summarizing our observations, neither of these articles offered design guidelines on how to improve EPM processes by leveraging digital technologies. Furthermore, as most of the articles incorporate only past data, we follow Mayer et al. [11] in suggesting a more *forward-looking EPM MM based on the zero-quartile definition* (Sect. 1).

(2) Peer-group partner: Internal benchmarking compares different sites or employees’ skills within a company [26]. 68 articles referred to external benchmarking. 54 out of these 78 articles incorporate *generic benchmarking* across industries [2]. Ensuring sufficient data for their novel benchmarking, Mayer et al. [11] and Esswein et al. [5] applied a *generic benchmarking across industries*.

(3) Research method: A majority of 34 researchers such as Hess et al. [27], Pinto [28], and Sjödin et al. [29] opted for case studies. Kane et al. [30] and Plaschke et al. [31] chose a survey as their research method. Articles from practitioners most often describe the impact of digital technologies on the Finance function [32, 33]. However,

they often lack a rigorous foundation [34], lack validation [35], or fail to provide guidelines on how to reach a next level of maturity. In this context, the *Rasch algorithm* is a well-established method. Leem et al. [36] surveyed managers from 312 companies and came up with a MM based on the analytical hierarchy process. Mayer et al. [11] applied the Rasch algorithm for design guidelines in order to align reporting, planning, and consolidation from functional, organizational, and IT perspectives.

Determining how well they perform against a predefined set of metrics there are different approaches how to **evaluate** artefacts [37]: (a) A basic differentiation is rigor and relevance [10]. While *rigor* covers the scientific adequacy of a research project, *relevance* addresses its applicability in practice. (b) Gregor and Hevner [16] propose more evaluation criteria, in particular validity, utility, quality, and efficacy. Whereas the latter refers to the value the artifact brings to the field, a *valid* artifact works and does what it is meant to do. *Utility* criteria assess whether the achievement of goals has value outside the development environment. (c) Prat et al. [11] recommend a larger series of criteria such as goal (efficacy, validity, and generality), environment, structure, activity, and evolution. They clarify efficacy to be the degree to which the artifact produces its desired effect, subordinating quality under utility as the quality of the artifact in practical use. (d) Other authors developed *evaluation frameworks*. Examples are Sonnenberg and vom Brocke [38] who proposed to differentiate between when, what, and how to evaluate. The “when” question covers the two alternatives of an *ex-ante evaluation*, which is the evaluation of an uninstantiated artifact, while an *ex-post evaluation* is after instantiation. This distinction is similar to the differentiation of a formative evaluation, which takes place during artifact creation and forms the artifact, while a summative evaluation summarizes the artefact and evaluates for given criteria after the fact. The “what” question distinguishes product artefacts like *tools, diagrams, and software* from process artifacts like *methods and procedures*. Finally, the “how” question refers to methods used for evaluation. Venable et al. [39] proposed a *framework for evaluation in Design Science (FEDS)* that takes the two differentiators of “when” and “what” along with other factors and requirements to provide evaluation methods such as case studies or surveys for a naturalistic ex-post evaluation or a mathematical or logical proof for an artificial ex-post evaluation.

Combining the findings from these four approaches, we propose a naturalistic, summative ex-post evaluation by triangulating three sources of data [21, 40]: Receiving basic information about the reference company, we propose to start with *desk research*. To evaluate the reference company regarding their digitalization status (as the outcome of the proposed MM) and especially if the MM does what it is meant to do (RQ 1), we propose *expert interviews*. Finally, we propose to discuss the results from the manager perspective and do that with another interview to check if the proposed MM is useful beyond the environment in which it was initially developed (RQ 2).

3 Method

Applying our findings from Sect. 2, we evaluated the MM from Mayer et al. [11] at a global *supplier of natural ingredients and nutrition solutions* (1.7 bn EUR sales; 7000 employees, [41]). Guided by our research questions, we focused on *validity* and *utility*.

We started with *desk research* in the accounting department of the reference company and focused on the EPM processes and their status of applying digital technologies. After six weeks we had gained a comprehensive overview of EPM process activities and got to know the most important processes and IS experts to, finally, select the following five experts: the team lead of Sales Controlling; the Head of Financial Services; the team lead of IT Business Solutions; the Head of Supply Chain Controlling; the Head of Group Controlling.

Based on the questionnaire from the survey by Mayer et al. [11], we continued with five *expert interviews* of about 60 min per interview. In doing so, we explained the six EPM processes with their activities, the three digital technologies automation, analytics, and digital enterprise platform (Sect. 2), and filled out the questionnaire according to their answers. Then, we averaged the individual results and, with reference to RQ 1, we positioned the reference company within the maturity model for each of the EPM processes (in detail, Sect. 4).

In order to evaluate not only the company, but even the MM itself (RQ 2), we discussed the results with the Head of Group Controlling, Supply Chain Controlling, and Financial Services. These interviews lasted about 60 min. We laid out the maturity of the reference company and then discussed design guidelines from Mayer et al. [11] towards the next steps within the MM. We concluded the interviews with their feedback regarding the ease of use of the MM as well as asking about other areas of implementation within the reference company and across their industry.

4 Results

4.1 Evaluating the Company (Validity)

Our reference company can be considered as a “*digital beginner*” (category I) in terms of **strategic business planning**. While they have a digital enterprise platform set up, they do not use it for strategic business planning. Since regional strategy plans are created manually in MS Excel by the regional heads and then evaluated by the group management, this can be classified as a manual process. Analytics is used to judge market potential, but data is often manually derived from external data sources. Automation is not realized at any scale. However, the reference company is currently updating their data sources to implement a peer-customer basis in their digital enterprise platform, that is a cloud for customer data (C4C) by SAP. However, these developments have not been fully integrated, yet. Therefore, there is

room for a single source of truth target and enabling analytics on big data. This is in line with Mayer et al. [11] as they propose to implement a digital enterprise platform allowing managers to back their experience with data from market analytics and social media listening. The Head of Group Controlling agreed with this design guideline, seeing a digital enterprise platform implementation as an important step. He added that such a platform should be used to quantify qualitative goals like “exploit full market potential,” great people, great workplace” (employee wellbeing), and help to form “guard rails” for processes like increase in market potential or employee retention rate. These guard rails should incorporate performance indicator thresholds that can then be used to control these processes.

With respect to **budgeting**, our reference company is a *digital student* (II). The budget is obtained in a bottom-up approach derived from both last year’s performance and the forecasts until the end of the current year. It is uploaded as MS Excel data to the digital enterprise platform and checked against group management’s top-down strategy. Multiple systems are used simultaneously. Analytics are sometimes used—for example to forecast the market potential and adjust the regions’ budgets accordingly. No automation is in place. In order to advance their maturity level, the reference company should benefit from the use of their digital enterprise platform and incorporate predictive analytics for a more accurate budgeting. The Head of Group Controlling laid out a shift in the budgeting process towards a rolling forecast model. Both the budgeting and forecasting process have to be built on the same basis. The budget will serve as the performance goal whereas the forecast indicates deviations. Predictive analytics is therefore an essential component of the 2025 budgeting process. He argued that the budget will be a mix of the predicted outcome and the guide rails provided by strategic business planning.

Forecasting is on the same level as budgeting, judging from a technical standpoint, as the consolidation units’ forecasts are still based on managers’ experience and then aggregated by the company headquarter. There are both a digital enterprise platform and analytics for all sales order data, but no automation in the forecast creation, yet. However, the reference company is already working on an automated forecast solution. Based on that, the reference company is ranked on maturity level II “*digital student*” progressing towards level III. As they will be rolling out a forecasting solution for automatic forecast creation, tapping into their rich analytics, they are on track to level IV and V. The design guidelines of Mayer et al. [11] propose to ground forecasts on predictive analytics and advise managers to shift their attention to irregularities and sudden changes to adjust developments which cannot be foreseen by the model such as the current corona virus, which is aligned with the reference company’s efforts.

Regarding the fourth process activity, **standard reporting and analysis**, we evaluate the reference company as a *digital driver* (level IV). Reports are most often generated on a daily basis and provided via dashboards with drill-down capabilities incorporating several filters. Mayer et al. [11] proposed that more standard reports should be automated and that reports should be available for “self-service” reporting. It was evident that the reference company already accomplished this design guideline and can focus their work on implementing this

technology in other sectors and activities. The Head of Group Controlling saw further development potential in standard reporting in the combination of data with causation. He mentioned tying the automated reports together with notifications to, finally, inform stakeholders of what needs attention and with necessary transactions to solve the issue.

Ad-hoc analyses can be found in a similar state, although often less automated than standard reporting and analysis. Ad-hoc analyses are often accomplished by managers utilizing dashboards in a “self-service fashion.” However, since they do not utilize predictive analytics yet and ad-hoc analyses are sometimes stitched together using multiple dashboards, the reference company is situated as a digital practitioner (maturity level III). Here, the design guideline by Mayer et al. [11] proposes that managers should start working with data themselves, “. . .analyzing in a self-service fashion.” This is already accomplished by the reference company, but there is potential in connecting multiple dashboards to intelligently create views on specific situations much like a person would create a top management presentation combining different data sources.

Since ad-hoc analyses at the reference company are mainly defined by ordering an analysis from employees when dashboards are not sufficient, the question arises, where to draw the line between deep-diving into an automated reporting dashboard or an ad-hoc analysis. Especially when daily reports start automatically reporting underlying issues and offering transactions for solving the problem in the future, like indicated by the Head of Group Controlling, this differentiation will be increasingly difficult to make.

Finally, **business decision support**, was evaluated to be on the level of a digital practitioner (maturity level III) as the reference company already has a modern infrastructure including analytics which is just not weaved into other processes yet. The digital enterprise platform is used for accessing automatically imported customer market data as well as for dashboards. Looking forward, similar actions as for ad-hoc analyses can be recommend. With increasing levels of digitalization, the reference company wants to merge ad-hoc analyses, business decision support and the daily reporting dashboards into one system supplying employees with relevant information. The sixth design guideline by Mayer et al. [11] establishing a digital enterprise platform for business decision support to enable views in different granularities from a top-down to the line-item level was already accomplished by the reference company.

According to the Head of Group Controlling, ad-hoc analyses and business decision support are only necessary when the standard reporting is not sufficiently automated. He said that the design guidelines recommending the development of the digital enterprise platform supported by analytics to enable managers to work with data themselves as the next development step provide good advice, but at the same time he perceives these processes as a sign of insufficient control through technology itself. Today, these processes still exist and, in the future, they will be a part of the combined process. But as technology will improve, he predicted daily reporting, ad-hoc analyses, and business decision support to merge into one when the decision and correction process become part of an automated reporting.

4.2 *Evaluating the Model (Utility)*

After applying the maturity model at our reference company, we evaluated the *utility* of both the MM and design guidelines from Mayer et al. [11], (RQ 2). For the latter, we focused on the proposed critical paths from one to the next higher level.

During the questionnaire-based interviews, we observed that managers of different departments sometimes evaluated the company's maturity quite differently. The most striking difference was the use of a digital enterprise platform for forecasting. This can be attributed to different degrees of technology implementation and its use in different areas like Supply Chain Controlling and Financial Services. The Head of Group Controlling added that, firstly, age and technology understanding might play a role. The young team lead of Sales Controlling was regularly disappointed by the lower level of automation. She and her supply chain colleague were often manually enhancing reports and forecasts, while the more positive results came from IT and accounting, which already have many automated dashboards live.

Regarding utility, we focused on the structure of the model regarding (I) the choice of technologies and (II) the six processes. The Head of Group Controlling laid out that a model should not only measure the level of technology implementation, but also the level of control. For that, a careful selection of technology is important. He found our selection quite fitting, covering the important areas of data aggregation (digital enterprise platform), interpretation (analytics), and process automation (automation). As for the six EPM process activities, he agreed with the differentiation, but foresaw a shift towards merging processes in future. More specifically, automated reports are supposed to merge with ad-hoc analyses and business decision support. In addition to their usual function, they will enable solutions such as business decision support. This can be accomplished by not only reporting on anomalies, but also offering the necessary transactions to accomplish the strategy.

The Head of Group Controlling evaluated the MM as a useful tool for benchmarking. He proposed the model to be used as a metric when a new company is to be bought and its digital fitness needs to be evaluated. When asked, if he preferred the traditional "first quartile" benchmarking, he answered that he is in favor of the forward-looking zero-quartile approach. He was convinced that the model could also be applied to other processes like order-to-cash and purchase-to-pay. Nevertheless, frequent updates would be necessary as the pace of digitization is high and new technologies will emerge.

To start future discussions beyond our reference company, we subsume our findings in three categories. **(1) From playground to pitch:** The feedback regarding the MM was good throughout all evaluation steps. The critical path and the design guidelines from Mayer et al. [11] provide a useful EPM development. For example, when it came to the first process activity "strategic business planning," the managers from the reference company laid out that they currently do not have a digital enterprise platform integrating data within one single source of truth. Furthermore, they agreed with the associated first design guideline that a digital enterprise platform should be the new *single source of truth* allowing managers to back their

experience with internal and external data. However, two interviewees expected more guidance on how to proceed in detail, for instance, how to select the “right” data and the appropriate mix of internal and external data. Another issue that was mentioned by the Head of Financial Services is that there was no differentiation between rule-based and cognitive-based automation.

(2) Powering up a company’s crystal ball: In future, *machine-based forecasts* will complement the management judgement within the company and, thus, will help to better navigate in a volatile world. This is in line with the second and third design guideline driving predictive analytics by Mayer et al. [11]. Looking forward, so the Head of Financial Services, the so-called W-budgeting with its first estimations from the business units will be replaced by a “V-budgeting.” He argued that this new kind of budgeting and forecasting should start with machine-based estimates for the next year, derived from their group strategy and leveraging latest internal and external data. Then, these guidelines should be discussed with the business units, aligned, and, finally, fixed. This will be relevant for all functions and business units alike, our interviewees agreed. However, only digital masters have such a machine-based budgeting already in place.

(3) Setting the scene: With a focus on the reporting and analysis processes, the Head of Financial Services and the Head of Group Controlling stated that experiencing digital technologies in a “trial and error” mode was accepted in the years of global economic prosperity. Today, even digital technologies had to pay off. Nonetheless, this should not be understood too literally. As an example, they highlighted that *software robots* relieve Finance personnel from repetitive tasks when transferring data between different IS. Furthermore, they improve data accuracy and speed, but rarely result in full-time equivalent (FTE) savings. Accordingly, they proposed to consider *effectiveness* equal to efficiency when measuring digital technology success. Only when assessing digital technologies and their benefits and drawbacks comprehensively will a company be able to advance to higher levels of digital maturity.

5 Discussion and Conclusion

Evaluating a MM which should lead *towards future EPM* leveraging digital technologies, we answered two RQs about the model’s validity and utility. The MM is based on a new zero-quartile benchmarking and focuses on three digital focus technologies, that is automation, analytics, and the digital enterprise platform.

We answered RQ 1 about validity with the help of five expert interviews and gave answers to RQ 2 about utility by three complementing manager interviews. The *validity* of the model by Mayer et al. [11] should be higher than Imgrund et al. [42] as we applied a triangulation approach to evaluate it (Sect. 3). Furthermore, multiple participants within the reference company increased the validity of our results. In other words: Personal biases as discussed in Sect. 4.2 were mitigated by the number of interviews. In comparison to Berger et al. [43] and Eremina et al. [44], the model

by Mayer et al. [11] provides better *utility* incorporating three waves towards digitalization beyond the EPM processes.

For practice, our findings should help companies to better understand the forward-looking MM by Mayer et al. [11], finally, evolve better towards digital EPM. The input by our interviewees provides insights into how managers engage with the omnipresent topic of digitalization and where they see challenges and opportunities.

For research purposes, our method mix constitutes a rigorous starting point for future evaluation activities. Our approach is more comprehensive than Alturki et al. [21] and Venable et al. [45] as we focus on the application of evaluation in greater detail applying a naturalistic approach not only on the evaluated artifact (MM) but at the same time on the topic of evaluation itself.

Our article reveals *avenues for future research*: As we have seen different perspectives of maturity within the same reference company, the validity can be increased by a *larger sample sizes of interviews*. Thus, the impact of our evaluation results should be tracked in *other companies*. They should evaluate if our findings are relevant and could be converted into concrete actions.

Besides digital technologies, even EPM processes will change over time. Thus, we recommend to *continuously update* our results. This is also true for the *questionnaire of the survey* from Mayer et al. [11] as more and more building blocks like processes, digital technologies, the method per se, and the outcomes of the MM may change. Furthermore, there could be more unpredictable developments in the future such as the current COVID-19 pandemic which may shift the key topics of corporate management towards treasury. In other words, the zero-quartile benchmarking from Mayer et al. [11] and even our findings should be tested in *other domains of a company*.

Last, but not least, companies should suggest a *continuous benchmarking* of their “as is” status in order to track digital progress over time. Our findings on hand may help in doing so.

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