TOWARDS A MORE SITUATED IS DESIGN BY PRIORITIZING USE SITUATIONS

Research paper

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Abstract

Understanding user preferences for interactions with information systems (IS) is of particular interest in the field of Management Support Systems (MSS), where strong user preferences must be taken into account. However, managers' IS preferences are underresearched in IS research. Thus, IS are not used very often on the management level. To close this gap, we propose a prioritization of MSS use situations, which generalize distinct classes of "similar" user-group preferences and result in non-functional requirements with respect to MSS. This article provides such a prioritization of MSS use situations from a manager perspective by applying the Analytic Hierarchy Process (AHP). Finally, associated design guidelines for a more situated MSS design are presented: (1) Maintain established MSS features for "alone, stationary" use situations. Then, incorporate "mobile" designs step by step. (2) Build a common MSS core with information at one click, while providing additional analyses on an individual basis. (3) Empower the "alone" MSS use case with a one-pager entry point. (4) To support manager "groupwork," provide them with direct communication and manipulation tools. (5) Run MSS on convertibles with a smartphone as the "satellite" to attract first attention.

Keywords: Human Factor in IS Design; Non-Functional IS Requirements; Management Support Systems (MSS); MSS Use Situations; Analytic Hierarchy Process (AHP).

1 Introduction

Because of the rapid diffusion of powerful information and communication technology (ICT), information systems (IS) increasingly infuse the life of the individual (Fichman et al. 2014). This is also true for managers. IS intended to help managers are known as *Management Support Systems (MSS)*. They have a five-decade tradition (Ackoff 1967; Elam and Leidner 1995; Mintzberg 1972; Rockart and Treacy 1989; Wixom and Watson 2010) and serve as an umbrella term for Management Information Systems (MIS), Decision Support Systems (DSS), Executive Information Systems (EIS), Knowledge Management Systems (KMS), and Business Intelligence (BI) systems (Clark et al. 2007).

The present moment seems favorable for redesigning MSS from a managers' user perspective (Brenner et al. 2014). Firstly, due to technological progress in ICT such as the increasing prevalence of smart devices, managers increasingly operate MSS themselves. Secondly, an individual MSS adaption accommodating different use situation becomes a valid option with recent technology (Schmitz et al. 2016). Thirdly, digital natives are increasingly present in organizations' management and exhibit individual MSS attitudes (Vodanovich et al. 2010). This goes along with higher expectations regarding *managers' user preferences*. If they are neglected, managers will refuse to use MSS (Walsh 2014).

Thus, a "one size fits all" approach is no longer applicable. A new design must broaden its scope beyond pure deployment and include perspectives on the individual use of MSS by managers and how this impacts their work (Marchand and Kettinger 2011). However, an extreme individualization that meets all needs does not make sense from an efficiency perspective (ISO/IEC 2014). Researchers must find a balance between extreme standardization and extreme individualization (Winter 2011). In doing so, Brenner et al. (2014) call for a more *situated MSS design*.

Following research in software engineering, which regards the prioritization of requirements as a crucial step to design a valuable product which is accepted by the users (e.g. Achimugu et al. 2014; Herrmann and Daneva 2008), we propose that a prioritization of distinct MSS use situations from a user perspective is needed to achieve such a balanced and situated MSS design. The *Analytic Hierarchy Process (AHP)* is by far the most widespread technique for prioritization in software engineering (Achimugu et al. 2014). Moreover, the latest wave of digitalization creates a hitherto unknown ubiquity of ICT in companies. IS research, however, has a tradition on focusing on corporate IT departments which leaves a gap of research focusing on decision makers outside IT departments (Legner et al. 2017).

We close this gap by studying the *business perspective of managers* on MSS in different typical situations of corporate use. MSS use situations generalize distinct classes of "similar" user-group preferences (Mayer et al. 2012). They result in requirements with respect to how MSS should provide functions or services (Winter 2011). Taking MSS as our example, the goal of this article is to provide a *rigorous method for a priority ranking of IS use situations.* We consider use situations for both "analyst-" (who primarily work interactively with MSS) and "consumer-type" managers (who primarily consume MSS information). Our research covers two questions:

—According to managers' business perspectives, which are their most important MSS use situations?

—Leveraging these findings, what are initial guidelines for a more situated MSS design?

We follow Design Science Research (DSR) in IS in order to produce more effective IS (Walls et al. 1992). DSR should include both rigor and relevance, e.g. by using established methods which are not widely applied in MSS research (Arnott and Pervan 2008; Power et al. 2011). We do so by applying the AHP, which is not widely applied in DSR in IS, to obtain our priority ranking of distinct MSS use situations. We structure our paper based on the DSR publication schema by Gregor and Hevner (2013). We motivate this article in terms of current challenges in MSS design (*introduction*). Based on the state of the art (*literature review*), we identify existing research gaps. We then apply the AHP to derive a priority ranking of MSS use situations (*method*). This ranking forms the basis of our guidelines for a more situated MSS design (*artifact description*). We then shortly *evaluate* our findings with the help of a prototype. Finally, we summarize our findings and lay out their implications for IS design per se (tied to the needs of individuals), limitations, and avenues for future research (*discussion* and *conclusion*).

2 Literature Review

2.1 Search Strategy

We started our literature review with a *journal search* (vom Brocke et al. 2009) and focused on leading journals from IS and HCI, complemented by marketing journals and by proceedings from ICIS and ECIS. We included IS (marketing) journals with a score of 3 (4) or above in the ABS Academic Journal Guide (Association of Business Schools 2015). HCI journals were taken from the Scimago Journal & Country Rank (SCImago 2015), ranked in Q1.

Our *Boolean search string* combines MSS with use situations (Table 1). For MSS, we included several terms for IS which support managerial decision making (e.g., Clark et al. 2007). We detailed use situations with four keywords and added "user satisfaction" and "success factors" as they interact with MSS use situations (DeLone and McLean 1992). We then examined titles and abstracts of promising publications related to ranking MSS use situations. We found 42 articles. In a backward and forward search, reflecting all references of the researched articles, we found another 38 articles relevant, so that we ended up with *80 relevant articles in total*.

		OR					
AND	**MSS**	Management support systems	Management information systems	decision support systems	Executive information systems	Knowledge management systems	Business intelligence
	Use situations	User requirements	User attitudes	Use cases	Working styles	User satisfaction	Success factors

Table 1. Boolean search string

2.2 Systematization

We structure the 80 articles according to the elements of MSS design theories they deal with. The results of our literature review are shown in Figure 1. MSS design theory consists of three constitutive elements (Walls et al. 1992): (1) In line with findings from Zhang et al. (2009) and Mayer and Mohr (2011), the first element is a *user model*. An MSS user-group analysis segments user-groups and their characteristics that influence how managers use MSS (Mayer et al. 2012). The effects of use describe how managers are affected by the use of MSS (Benbasat and Nault 1990). (2) We define *user requirements* as prerequisites, conditions, or capabilities needed by managers (Abelein et al. 2013). We focus on non-functional requirements. They reflect how well MSS performs its function within its environment and are subdivided into product, organizational, and external requirements (Sommerville 2011). The first reflect MSS behavior. The second are defined by both users' and developers' procedures and policies. The third include all external constraints such as laws or competition. (3) *Design guidelines* are predefined actions for MSS development and go beyond mere requirements (Hoogervorst 2009; Kuechler and Vaishnavi 2008). They contribute to models and methods. Models define concrete MSS, specific (non-functional) MSS features, or combinations of these (Gregor 2006). Methods define a process of designing MSS (March and Smith 1995).

2.3 Gap Analysis

Within the proposed framework, we summarize the literature as follows: *(1) User Model: A model of 18 distinct MSS use situations serves as the foundation for a priority ranking:* With 26 publications, we examined the state of the art of MSS user models as extensive. A wide variety of personal characteristics, ranging from age and education to cognitive style, personality, and culture, have been found to influence MSS use and acceptance (e.g. Arazy et al. 2015; Devaraj et al. 2008; Elam and Leidner 1995; Gray and Olfman 1989; Martinsons and Davison 2007; Reinecke and Bernstein 2013). At the same time, classifications have been developed to reduce individual differences to a reasonable amount of similar working styles (e.g. Gluchowski et al. 2008; Huysmans 1970; Mayer and Stock

2011; Walstrom and Wilson 1997; Witkin et al. 1977). Today, thanks to technological advancements, these differences can be accommodated more appropriately (Dong and Srinivasan 2013). The need for such accommodation is emphasized by findings indicating that current MSS use is rather influenced by the situational engagement of the user than by the mere functional quality of MSS (Peters et al. 2016). In accommodating situational and individual needs, mobile MSS play an increasingly important role (Gebauer et al. 2010; Peters et al. 2016). To find a balance between individualization and standardization, it is crucial to develop a limited set of use situations, each representing a group of similar use scenarios (Winter 2011). Based on Mayer et al. (2012), we consider two working styles: *"Analyst managers"* are tech-savvy, frequent IS users and handle MSS themselves. *"Consumer managers"* only use MSS every now and then (Mayer and Stock 2011). For each working style, we apply their model of *9 "MSS use situations"* which result by multiplying three MSS use cases and three MSS access modes (Figure 2). The three *MSS use cases* distinguish working "alone", in a group ("groupwork"), and giving a "presentation". *MSS access modes* comprise "stationary" and two mobile use contexts: "Mobile-online" (with Internet access) and "mobile-offline."

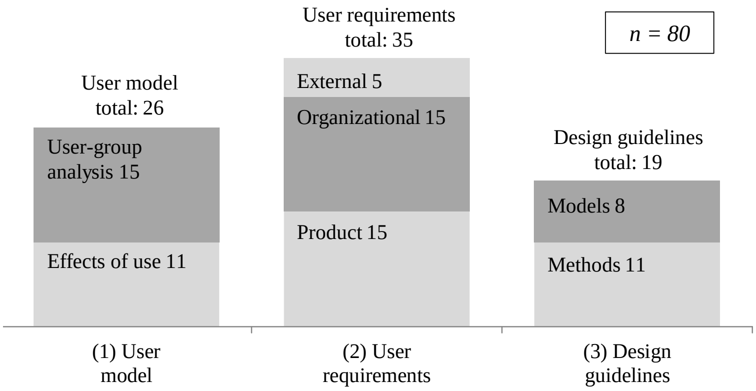

Figure 1. Categories and associated numbers of relevant publications of the literature review.

(2) User Requirements: A manager perspective on situational MSS requirements is missing: Research on MSS requirements encompasses the biggest portion of the reviewed literature. A number of widely recognized models have been developed and refined within this area during the last four decades. They derive MSS requirements by identifying the determinants of the proper design of technology for a certain task (task-technology-fit model, e.g. Gebauer et al. 2010; Goodhue and Thompson 1995; Parkes 2013), technology acceptance by the user (technology acceptance model, Davis 1989), MSS success or failure (IS success model, e.g. DeLone and McLean 1992; Delone and McLean 2003; Pankratz and Basten 2013; Petter and McLean 2009), or a combination of these (e.g. Unified Theory of Acceptance and Use of Technology, Venkatesh et al. 2012; 2003). Until today, their consideration and refinement is an important issue, since the actual use/success of MSS has not been fully understood yet (Tate et al. 2015). As this research evolves, self-service MSS with their specific requirements become more important as an answer to dynamically changing decision environments (Burnay et al. 2014). New determinants, such as *fun and enjoyment*, are considered, and smart devices play an increasing role (Gebauer et al. 2010; Negahban and Chung 2014). Therefore, an update of this research is necessary (Power et al. 2011). Contrastingly and different from the early days of MSS research (Alavi 1982; Elam and Leidner 1995; Henderson et al. 1987; Houdeshel and Watson 1987; Rockart 1979; Vandenbosch and Huff 1997), managers as the research subject could not be identified in recent IS requirements research (Shaikh and Karjaluoto 2015). However, MSS research is of increasing relevance for managers (Arnott and Pervan 2014). Recently, Legner et al. (2017) called for IS research to address research questions from a business view firstly, instead of starting with technological design considerations, which has been the traditional focus of IS research.

(3) Design Guidelines: For a situated and user-centered MSS design, a prioritization of distinct MSS use situations is promising: Regarding the 19 relevant publications covering methods and models for MSS design, early research recognized the need to *analyze use situations* (Crescenzi and Gulden 1983;

Swanson 1982). Recent research confirms the necessity of fulfilling situational MSS needs (Walsh 2014) and emphasizes the need for an updated stream of user-centered MSS research (Brenner et al. 2014). Based on these findings, we propose that a prioritization of distinct MSS use situations will contribute to a more situated MSS design (cf. Sect. 1, Achimugu et al. 2014; Herrmann and Daneva 2008).

3 Method

To obtain a priority ranking of distinct MSS use situations, we follow Karlsson et al. (1998) who propose the Analytic Hierarchy Process (AHP) to be favorable for prioritizing software requirements. The AHP is well-established for multi-criteria decision making (Vaidya and Kumar 2006). It was introduced by Saaty (1977; 1980) and breaks down complex issues hierarchically into simple pairwise comparisons. It yields better results than simple, non-structured ranking techniques, such as simply voting on the alternatives as a whole without distinguishing between different criteria (Easley et al. 2000). Additionally, it models the distances between the different alternatives instead of just giving a rank order (Karlsson et al. 1998). The AHP is originally designed to derive priority rankings for single test persons (Ramanathan and Ganesh 1994). This is suited for our purpose that goes along with a small sample size, since we try to reach busy managers and therefore focus on in-depth insights rather than representative results. We apply the AHP as follows and use a questionnaire which is filled-in during a personal interaction between the researcher and the managers and includes complementary questions about devices for MSS use.

3.1 Applying the Analytic Hierarchy Process in MSS Design

The AHP is applied in three steps: Firstly, the problem is analyzed and structured into a hierarchy, proceeding from the general goal onto criteria and its alternatives (Figure 2). Secondly, at each level of the hierarchy, pairwise comparisons for all elements of a given level are performed to measure the priority of one element compared to another. Saaty (1977) found a scale ranging from 1 (equally important) to 9 (extremely more important) to produce the best results. Thirdly, those numbers are arranged in reciprocal matrices and a final score for each alternative, indicating its relative priority, is calculated using an eigenvalue approach.

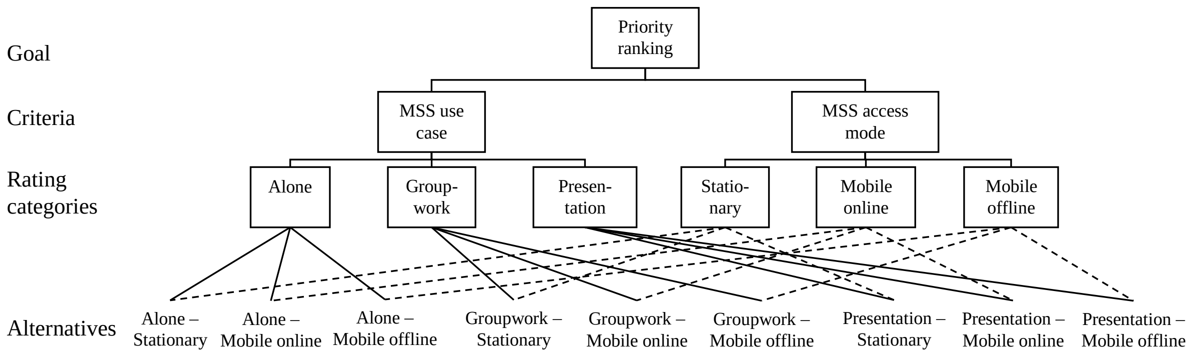

Figure 2. Four level hierarchy of 9 MSS use situations (alternatives).

The AHP is *analytic*, because it structures a complex problem into its hierarchical elements and analyses them independently. It is hierarchic, because it decomposes a large problem into several levels of a distinct hierarchy. Last but not least, it is a process because it follows a step-by-step procedure in a standardized manner (Saaty 1977; 1980). Furthermore, the AHP provides a *consistency ratio* to measure inconsistencies that may occur with expert judgments (Easley et al. 2000). It is intended to ensure consistency for the results as long as the consistency ratio does not exceed 10% (Saaty 1980). According to Achimugu et al. (2014), this makes the AHP a very accurate ranking technique. Moreover, it assures that the AHP as a complex ranking technique was correctly applied by the participants.

As outlined in Sect. 2.3, we classify 9 MSS use situations for each user group. We arrange these use situations within a four-level hierarchy (Figure 2). All alternatives (lowest level) can be derived as a combination of one rating category (third level) for each criterion (second level). Therefore, pairwise comparisons are needed on the criteria and the rating categories level. We ask the managers to judge the importance of the different criteria and rating categories, pairwise on Saaty's (1977) nine-point scale. The score of each MSS use situation (alternatives level) can then be calculated by combining the pairwise comparisons of criteria and rating categories (absolute measurement AHP, Saaty 2008).

To get a better understanding of practical issues, we add a *complementary part* to our questionnaire with the AHP application. It comprises questions on the device selection for each MSS use situation. Moreover, we chose to fill-in the questionnaire one-on-one with the managers rather than handing it out for self-administration. Thus, questions of understanding can be answered directly. Additionally, such a personal interaction provides direct suggestions and feedback (Österle and Otto 2010) and managers who commit to interviews are more interested in research compared to respondents just answering questionnaires. Finally, this provided the opportunity for the managers to give free comments on the topic. Those comments helped to develop more concrete design guidelines (Sect. 4.3).

<table>
<tr><th>N</th><th>Criterion/rating</th><th>Criterion/rating category</th><th>Associated questions</th></tr>
<tr><th colspan="4">I. Criteria: MSS use factors</th></tr>
<tr><td>1</td><td>MSS use case</td><td>MSS access mode</td><td>Considering your everyday work, which MSS use factor is more important for you?
How much more important is the chosen criterion compared to the other?</td></tr>
<tr><th colspan="4">II. Rating categories: 1. MSS use cases</th></tr>
<tr><td>2</td><td>Alone</td><td>Groupwork</td><td rowspan="3">Considering your everyday work, which use case is more important for you?
How much more important is the chosen use case compared to the other?</td></tr>
<tr><td>3</td><td>Alone</td><td>Presentation</td></tr>
<tr><td>4</td><td>Groupwork</td><td>Presentation</td></tr>
<tr><th colspan="4">II. Rating categories: 2. MSS access mode</th></tr>
<tr><td>5</td><td>Stationary</td><td>Mobile online</td><td rowspan="3">Considering your everyday work, which access mode is more important for you?
How much more important is the chosen access mode compared to the other?</td></tr>
<tr><td>6</td><td>Stationary</td><td>Mobile offline</td></tr>
<tr><td>7</td><td>Mobile online</td><td>Mobile offline</td></tr>
</table>

Table 2. AHP questions for 9 MSS use situations

3.2 Data collection

Data were obtained from May to August 2014 in two steps: Firstly, the questionnaire was *pre-tested* for understandability, addressed and missing topics, as well as the time needed to complete the AHP interviews. The AHP part was found to be sufficiently understandable. The complementary part of our questionnaire was suggested by pre-test participants and was accordingly added after the pre-test. Secondly, we conducted the *AHP interview*s with members of a manager group hosted by the Competence Center "Unternehmenssteuerungssysteme" at Darmstadt University of Technology which meet regularly to discuss trends in corporate management and MSS. Managers visiting a corporate management and BI seminar complemented our sample. To assure a comparable context for all interviews, all managers were presented the same prototypical MSS (an earlier version of the prototype presented in Sect. 5) before the interview. They were then asked to rank the use situations as they face them in their day-to-day work assuming that the prototypical MSS could permanently accompany their work.

Table 3 summarizes the managers' characteristics. The sample includes executives (L1) and Level 2 (L2) managers, i.e. business department directors and IT/BI department directors. In order to reach busy managers, the AHP interview was either conducted in a 30 minute face-to-face meeting or a telephone call. We ended with *20 participants* (twelve analyst and eight consumer managers) from 20 different companies, providing diverse findings despite the limited number of participants (Eisenhardt 1989). After a description of the AHP, the questions for the pairwise comparisons were asked. Then, the AHP interview was completed with the questions of the complementary part of the questionnaire.

Position	**No.**	**%**	**Sector**	**No.**	**%**	**Market capitalization [USD bn]**	**No.**	**%**
Executives (L1)	10	50	Industrial	10	50	≤30	11	55
Director business department (L2)	7	35	Financial Services	9	45	30-90	6	30
Director BI department (L2)	3	15	Other Services	1	5	>90	3	15
Total	20		Total	20		Total	20	
Age	**No.**	**%**	**Working style**	**No.**	**%**	**Gender**	**No.**	**%**
≤40	6	30	Analyst	12	60	Female	1	5
40-50	6	30	Consumer	8	40	Male	19	95
>50	8	40						
Total	20		Total	20		Total	20	

Table 3. Sample characteristics

4 Artifact Description

4.1 Results

The pairwise comparisons were analyzed for each interaction per absolute measurement AHP and the final scores were normalized to end up with an overall sum of relative priorities of 100%. A dynamic MS Excel application was used to calculate all scores on each level and the final AHP scores (alternatives level). Correlations were calculated for the score vectors of all participants in order to detect outliers (Riley 1987). The remaining AHP results were aggregated for all managers by calculating *geometric means* of the pairwise comparison scores (Van Den Honert and Lootsma 1997). As results for analyst and consumer managers were similar, the distinction between these groups is only made in the complementary analysis (sect. 4.2).

Panel A: Aggregated priority ranking

53.35% / 46.65%		MSS access mode: Stationary		Mobile online		Mobile offline		Level 3 scores: MSS use case
MSS use case	Alone	1.	17.61%	3.	13.73%	6.	9.52%	49.45%
	Groupwork	2.	15.70%	5.	11.82%	8.	7.61%	37.18%
	Presentation	4.	12.00%	7.	8.12%	9.	3.91%	13.38%
Level 3 scores: MSS access modes			55.76%		33.97%		10.27%	Average Consistency Ratio: 3.97%

Panel B: Individual AHP's results

MSS use situation	Number ranked among top 5	Average Rank
Alone and stationary	14 (82.35%)	2.53
Alone and mobile online	16 (94.12%)	3.35
Alone and mobile offline	7 (41.18%)	5.76
Groupwork and stationary	14 (82.35%)	3.41
Groupwork and mobile online	15 (88.24%)	4.24
Groupwork and mobile offline	3 (17.65%)	6.65
Presentation and stationary	10 (58.82%)	4.94
Presentation and mobile online	6 (35.29%)	5.88
Presentation and mobile offline	0 (00.00%)	8.24

Table 4. Results of the AHP

The resulting *aggregated priority ranking* (Table 4, Panel A) represents the starting point for the analysis of our results. The MSS use situations are ranked in their absolute figures 1-9 and relative priority in percent. Additionally, the isolated scores for the third hierarchy level of the AHP (rating categories level) are given for each MSS use case (row by row) and MSS access mode (column by column). Note that these are not equal to the sums of the inner cells of each row/column as the inner cells represent the final scores of the full hierarchy. The scores of the second hierarchy level of the AHP, the pairwise comparison of MSS use case and MSS access mode, are given in the diagonally divided cell at the top left side. The average consistency ratio is presented at the bottom right side.

Table 4, Panel B reflects the *individual AHP's results.* It shows how often each MSS use situations is ranked in the individual interviewees' top 5, both in absolute and relative (%) numbers, and displays the average rank of all individual AHP rankings for each MSS use situation.

The aggregated priority ranking exposes the MSS use situation "alone, stationary" as most important overall (relative preference of 17.61%). Besides "alone, stationary," the top 3 MSS use situations are "groupwork, stationary" (rank 2, 15.70%) and "alone, mobile online" (rank 3, 13.73%). These top 3 priority ranking covers 47.03% of managers' most important MSS use situations. Following the top 3, "presentation, stationary" and "groupwork, mobile online" rank almost equally on fourth (12.00%) and fifth (11.82%). The remaining four MSS use situations, encompassing all use situations with a "mobile offline" access mode, cover only 29.15% of managers' preferences. Therefore, they are of subordinate importance for a situated MSS design.

Regarding managers' most wanted MSS use cases ranging from "alone, groupwork, to presentation," we calculated the scores of the third hierarchy level of the AHP (rating categories level). Working "alone" covers 49.45% of the MSS use cases priority. This is followed by "groupwork," which is more important than "presentation" covering 37.18% and only 13.38% of the managers' priority, respectively. Considering the scores of the third hierarchy level of the AHP for MSS access modes, stationary MSS access covers 55.76% of the managers' preferences. This number one MSS access mode is followed by "mobile online" with 33.97% of the managers' priority and "mobile offline" with only 10.27%. The pairwise comparison of MSS use cases and MSS access modes revealed that both criteria are of about equal importance (MSS use case covering 46.65% and access mode covering 53.35%).

Considering the individual AHP rankings (Table 4, Panel B) allows a distinction of "groupwork, mobile online" and "presentation, stationary". "Groupwork, mobile online" ranks among the top five MSS use situations as consistently as the top 3 MSS use situations identified in the aggregated priority ranking (88.24% of the top five rankings of all interviewees) while "presentation, stationary" is part of only 58.82% of individual top five rankings. Moreover, while the average rank of "presentation, stationary" (4.94) is close to the neutral point of 5, "groupwork, mobile online" clearly ranks above this neutral point with an average rank of 4.24. Therefore, for a more situated MSS design, we consider "groupwork, mobile online" as an important complement to our top 3 priority ranking.

4.2 Complementary Analysis

To analyze the complementary part of the interview, we pooled the *preferred devices* of all managers together for each MSS use situation, leaving nine distributions of preferred devices, one for each use situation. Table 5, Panel A presents the results of a Wilcoxon rank sum test, pair-wisely testing the device distribution of each MSS use situation against the distribution of every other MSS use situation. Since categorical data is not distributed normally, we choose the Wilcoxon rank sum test as a non-parametric test. However, Student's t-tests yielded the same results without exception.

The results reveal that the preferred devices of the MSS use situations "alone, mobile online" and "alone, mobile offline" significantly differ from all other MSS use situations, while they do not significantly differ from each other and while no other use situation significantly differs from more than three MSS use situations. The preferred device in all MSS use situations is the notebook (not tabulated). While for all other MSS use situations, 78.9% or more of the managers mentioned notebook as their preferred device, for "alone, mobile online" and "alone, mobile offline" 52.6% and 63.2% prefer to use a notebook. In these use situations, smartphones are the next most popular device (31.58% for "alone, mobile online"; 21.05% for "alone, mobile offline"). Analyzing these two use situations for analyst and consumer managers separately, analysts show a greater preference for smartphones (41.67%

for “alone, mobile online”; 33.33% for “alone, mobile offline”) and consumers show a greater preference for tablets (37.5% in both use cases). However, these differences are not significant (p > .85). This can be explained by the fact that notebooks dominate the device distributions for both groups.

Panel A: Results of Wilcoxon rank sum test comparing device distributions in each MSS use situation

	A, ON	A, OF	G, S	G, ON	G, OF	P, S	P, ON	P, OF
A, S	286***	271***	178.5	214.5	193.5	199.5	218.5**	203
A, ON	-	158.5	75***	101***	91***	85***	95***	91.5***
A, OF		-	90***	119**	107***	102***	114***	109.5**
G, S			-	215	195	200.5	218.5	203.5
G, ON				-	163	163.5	180.5	170.5
G, OF					-	183.5	199.5	187
P, S						-	199.5	187
P, ON							-	171

Panel B: Aggregated priority ranking with average final score instead of geometric means of pairwise comparisons

		MSS access mode					
		Stationary		Mobile online		Mobile offline	
MSS use case	Alone	1.	17.52%	2.	15.34%	6.	10.35%
	Groupwork	3.	13.98%	4.	11.81%	8.	6.82%
	Presentation	5.	11.17%	7.	9.00%	9.	4.01%

Panel C: Aggregated priority ranking for analyst managers only

56.51% / 43.49%		MSS access mode						Level 3 scores: MSS use case
		Stationary		Mobile online		Mobile offline		
MSS use case	Alone	1.	17.28%	3.	13.99%	6.	9.30%	49.96%
	Groupwork	2.	15.23%	5.	11.94%	8.	7.25%	35.83%
	Presentation	4.	12.09%	7.	8.80%	9.	4.12%	14.21%
Level 3 scores: MSS access modes		53.27%		35.79%		10.94%		Average Consistency Ratio: 3.02%

Panel D: Aggregated priority ranking for consumer managers only

47.50% / 52.50%		MSS access mode						Level 3 scores: MSS use case
		Stationary		Mobile online		Mobile offline		
MSS use case	Alone	1.	17.96%	3.	13.32%	6.	9.89%	48.26%
	Groupwork	2.	16.45%	4.	11.81%	7.	8.38%	39.63%
	Presentation	5.	11.64%	8.	6.99%	9.	3.56%	12.11%
Level 3 scores: MSS access modes		60.13%		30.76%		9.11%		Average Consistency Ratio: 7.30%

Note: A = alone; G = groupwork; P = presentation; S = stationary; ON = mobile-online; OF = mobile-offline
*** = significant at .01-level; ** = significant at .05-level; * = significant at .1-level

Table 5. Complementary Analyses

The remainder of Table 5 displays alternative aggregations of the AHP results. An alternative to arrive at an aggregated priority ranking to aggregating the individual comparisons by calculating geometric means is to aggregate individual priority rankings by calculating arithmetic means of the individual scores for each alternative (Ramanathan and Ganesh 1994). With this approach, no aggregate scores are determined on the second and third level of the hierarchy. As Panel B of Table 5 shows, this yields qualitatively similar results to the original aggregated priority ranking (Table 4, Panel A). More specifically, the top 3 MSS use situations are the same with the relative priority of the number 1 use situation (17.52% vs. 17.61%) and the aggregated relative priority of the top 3 (46.84% vs. 47.03%) virtually identical. Only “groupwork, mobile online” ranks fourth instead of fifth which reinforces our proposition that “groupwork, mobile online” serves as a complement to the top 3 MSS use situations.

Panel C and Panel D of Table 5 display a separate aggregation (with geometric means of the pairwise comparisons) for only analyst managers and only consumer managers, respectively. Results are consistent with the above-mentioned analyses. While the priority ranking of only analyst managers has the same order as the priority ranking of all managers, the fourth and fifth place and the seventh and eighth place, respectively, are interchanged for only consumer managers. This is driven by the fact that consumers have a greater priority for groupwork than analysts (39.63% vs. 35.83%) and a lesser priority for both MSS access modes overall (47.50% vs. 56.51%) and the two online access modes in particular (taken together: 39.87% vs. 46.73%).

4.3 Design Guidelines

Complementing our results with comments made by the managers during the AHP interviews, we propose five design guidelines (DG) for a more situated MSS design. For each DG, we describe how it relates to our results and the manager comments. We then propose examples of how the design guidelines can be put into practice. These descriptions are based on the experience of the authors who have developed several MSS prototypes in their research. Some design guidelines are applied in a "Corporate Navigator" prototype (Sect. 5) which also provided the MSS-context in the interview (Sect. 3.2). For the development of the DGs, it helped to identify concrete MSS elements which could be redesigned to achieve a situational MSS design according to our results.

Design guideline 1: The AHP reveals "alone, stationary" as the most important MSS use case in all analyses. As managers reveal that "alone, stationary" is still their anchor of situational MSS use, it is crucial for future MSS development to focus on this MSS use situation. A shift to a "mobile-first" and collaboration-focused MSS design could lead to frustration since well-known, appreciated features or interfaces may be replaced by mobile designs. As "alone, mobile online" most consistently ranks among the top 5 of individual AHP rankings, a situational accommodation of mobile use situations must be provided in a second step. The starting point can be as simple as providing an application on mobile devices although it was originally designed for stationary use. As a further avenue of situated MSS design, applications designed for mobile use could be developed and tested to address managers' "alone, mobile online" needs. However, a replacement of established stationary applications must be avoided unless the mobile application is widely accepted. Thus, we propose as a first guideline:

Maintain established MSS features for "alone, stationary" use situations. Then, incorporate "mobile" designs step by step.

Design guideline 2: Although software developments promise easy-to-implement MSS adaptions, our results show that managers concentrate on a limited number of use situations. Their top 3 MSS use situations cover almost half of their priorities. Such a concentration allows focusing on simplicity for the basic, core MSS applications. Thus, we propose a modular MSS design which separates common MSS reporting ("MSS core") from complementary analyses for individual purposes. For simplicity, the MSS core should be accessible at one click and provide information in a very clear and straightforward representation. As one manager stated "IT is not my hobby—keep it simple." It should fit on one page and look the same for all managers. For instance, when starting an MSS application, simple graphics like bar charts present the most important information at a glance. To get additional information or to access complementary analyses, we then recommend an easy-to-use navigation with natural navigation by fingertip, swipe or voice control. These analyses—for example, a value-driver tree analysis or a net sales analysis by product, country, and/or customers—should accommodate the variety of requirements on an individual basis. As one manager reveals: "Our leadership team is diverse. A single MSS solution that suits all of us will no longer work." As a second guideline, we propose:

Build a common MSS core with information at one click, while providing additional analyses on an individual basis.

Design guideline 3: Since working alone is managers' top use case, self-service is another crucial part of MSS design. This was reinforced by a consumer manager: "I regard myself as tech-averse. However, I can no longer cope with my day-to-day work without self-service." Therefore, the access point to the MSS core (DG 2) should encourage self-service. Based on the earlier research of the authors

(Mayer et al. 2014), we suggest combining the easy-to-access MSS core with collaboration (DG 4) and semi-business apps such as on weather or travel. To promote self-service by avoiding access-barriers, we propose a one-page design which presents these apps in separate sections, with the MSS core at the center. To personalize this MSS design in a second step, a manager app store could provide company-wide certified applications. Such an MSS design should transform well-established and valued applications from their traditional "alone, stationary" use to a mobile one. We propose as follows:

Empower the "alone" MSS use case with a one-pager entry point.

Design guideline 4: "Groupwork, mobile online" complements our top 3 MSS use situations, adding a second "groupwork" use situation to the second-ranked "groupwork, stationary". This reinforces the importance of collaboration support as the next step after the MSS core and "alone" use situations are established. Accordingly, one manager commented: "groupwork implies seeing the impact of our agreements in real-time". Therefore, the collaboration section of the one-page MSS entry point (DG 3) should not only provide communication features like e-mailing, but also enable managers to make changes or comments directly within the MSS. These should then be shared with the authors' name and a time stamp to other users to start a chat, for example explaining deviations between planned and as-is data. Therefore, we propose a fourth guideline:

To support manager "groupwork," provide them with direct communication and manipulation tools.

Design guideline 5: In reference to the dominance of notebooks revealed in our complementary analyses, an analyst manager commented: "The desktop PC has already been replaced by a docking station for my notebook. Notebooks and tablets will merge." Microsoft's Surface Pro 4 is an example of this new "2-in-1" device class (convertibles). A consumer manager forecasted: "The smartphone will be the 'satellite' for my future information management." We propose the combination of a smartphone with a convertible as the future of manager MSS devices. Push notifications should be sent to smartphones so that the manager can get a brief idea of new information to decide how to proceed.

Run MSS on convertibles with a smartphone as the "satellite" to attract first attention.

5 Evaluation

According to Gregor and Hevner (2013), the DGs can be evaluated in terms of criteria such as validity, i.e. the DGs fulfill the intended function, utility, i.e. the DGs have value beyond a prototypical implementation, quality, and efficacy. Within our broader research, we developed a prototype (Figure 3) which implements some of the DGs outlined above. We used it for a preliminary evaluation of our DGs with two companies improving their MSS design, a large chemical company (2017 sales: € 64 bn.) and a large automotive supplier (44 bn.). After explaining the DGs and presenting the prototype, we asked the head of management accounting and the head of group reporting of the chemical company, and the head of group BI of the automotive supplier for comments regarding our DGs. Below, we briefly present the prototype and main insights from the evaluation.

The prototype has been developed and refined accompanying our research since Mayer et al. (2012; 2014). We believe that it could give an initial idea of how a transfer of the DGs into practice could look and can provide a basis for future research to evaluate the examined DGs. The basic structure of the prototype (Figure 3, A, B) is in line with DGs 2 and 3. As suggested in DG 3, the *Corporate Overview* (Figure 3, A) is a one-page entry point (DG 3) with the MSS core as two thumbnails in the middle (one to a graphical aggregation of the MSS core and one to the MSS core named *Corporate Dashboard*). Additional individual analysis can be accessed via the analysis bar at the bottom. This design also allows for this bar to be personalized while the MSS core is fixed for all managers and displays the standard (stationary) reporting which is used at the respective company (DG 1 and 2). At one click on the thumbnail, the common MSS core (*Corporate Dashboard*, Figure 3, B, in detail Mayer 2018) can be accessed and displays the most important key performance indicators (KPIs) in a one-page report, structured in different clusters (DG 2). As suggested in DG 2, simple line graphics provide a quick overview over latest developments. Similar to DG 2, one click on the thumbnails in the *Corporate Overview* or the numbers on the *Corporate Dashboard* opens the respective individual analysis the manager configured for the respective cluster. The interface design and the click-navigation follow MSS designs from stationary applications to fulfill DG 1. As they use simple click navigation and display information without scrolling, they can readily be displayed on mobile devices and navigated with fingertips, which follows the second part of DG 1.

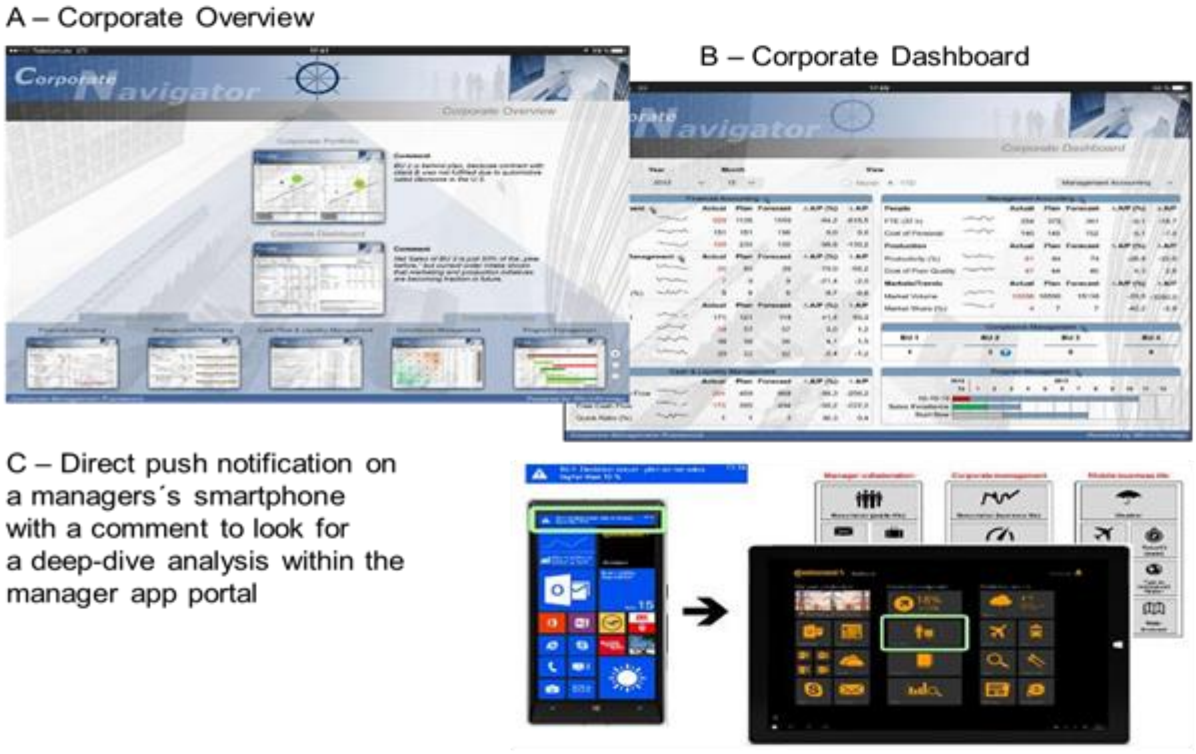

Figure 3. Components of the MSS prototype used in this paper (A, B) and a second prototype by Krönke et al. (2017) applying DG 5 with push notifications on a smart phone (C)

DG 1 received unambiguous support and was evaluated to provide a high utility since such a "down-to-earth" MSS design approach in general is more likely to succeed compared to completely novel approaches that ignore the most important working habits of the user, i.e. the manager. The *second DG* is characterized by a high validity since evaluators agreed that the ease of use that is necessary for MSS success will be ensured by the proposed modular design with the MSS core as its foundation. All evaluators stated that a one-page MSS design with different sections for the MSS core and individual analyses (*DG 3*) will embrace manager MSS self-service in the "alone" use case. However, two evaluators expressed serious doubt about self-service in general. *DG 3* thus provides validity with its potential to support manager self-service. However, its efficacy remains doubtful as some evaluators will not fully utilize the resulting design features in practice. The utility of *DG 4* was confirmed by one evaluator as collaboration was revealed as a major challenge for there IS design in general. The other evaluators, however, expressed doubt about direct manipulation, especially considering security. Hence, the quality of this part of the guideline is questionable since security concerns cannot be fully resolved by the proposed mechanisms. All evaluators agreed that merging device classes have a great potential to outplay more traditional devices even beyond MSS. This confirms the utility of *DG 5*.

A more recent research project supports this initial evaluation. Krönke et al. (2017) developed a manager app portal which relates to the prototype used in the paper on hand. They evaluate this latter prototype and find positive resonance. It adds an application of *DG 5* as follows. The manager app portal runs on a convertible and a smartphone app which attracts first attention through an alert (push notification, Figure 3, C). Such alerts could indicate that important data changed or a new report is now available (Krönke et al. 2017). In the example depicted in Figure 3, C, the push notification alerts the manager to a change of a KPI which has also been directly commented by a colleague *(DG 4)*. In line with DG 4, the colleague used a direct communication feature to place a comment right below the revised KPI. This comment is indicated by an extra icon and opens on a simple click. Again, this design follows well-known stationary applications, but is easily applicable on mobile devices as well *(DG 1)*.

6 Discussion and Conclusion

Following Gregor and Hevner (2013) and Peffers et al. (2007), the results should finally be interpreted in terms of their implications and how they relate back to the objectives and research questions. The first objective was to obtain a rigorous prioritization of IS use situations from a manager perspective, as both a prioritization and manager perspectives were identified as gaps in the literature. Our second objective was to derive initial DGs based on these findings. We collected AHP data from 20 managers and hence provided such a *ranking of distinct MSS use situations* (Tables 4 and 5). We then enhanced our business perspective with comments collected from the managers during the AHP interviews. We used the results to *derive five DGs* which relates back to our second research objective.

Overall, our results indicate that managers focus on a limited number of MSS use situations that are partly accommodated by well-established MSS. Therefore, we argue for an *evolutionary MSS refinement* although powerful new digital technology seems compelling. In line with DGs 1 and 2 and the priority of alone and stationary (put differently: traditional) use, we believe that a revolutionary approach would disregard managers' preferences and could therefore be outplayed by an evolutionary refinement as suggested by our prototype (Sect. 5). Krönke et al. (2017) provide a next step by adding applications to an MSS core which provide familiar services like travel information and communication apps in a more convenient way (DG 3 and 4) and by letting the MSS reach out to smartphones as a "satellite" which attracts managers' attention (DG 5). Although such an evolutionary refinement of MSS might not seem overly appealing, our findings contribute to a focus on managers' day-to-day needs. Thus, research and practice can focus on few key MSS use situations and thereby efficiently achieve a *more situated MSS design* tied to the needs of individuals. As the literature on IS success indicates (Sect. 2), closely following managers' needs promises more and more sustained MSS use.

For *practice*, this can serve as a reference to improve existing MSS designs and to design future MSS from a managers' user perspective. An initial idea of such a situated MSS design is given by our prototype and in Krönke et al. (2017). Big MSS providers such as SAP (2017) or Oracle (2017) still provide "line-centric" analyses which give the user a typical MS Excel feeling. In turn, our DGs and prototype present something new in terms of a fully user-centric – business – design approach combining several visual formats such as portfolios and one pagers instead of a line-item based design. For *research* purposes, our application of the AHP and the resulting priority ranking constitute a starting point for future investigations in MSS design and other IS domains as well.

However, our research is subject to some limitations and thus reveals avenues for future research. As shown in Tables 4 and 5, our aggregated priority rankings have sufficient consistency ratios indicating accurate priority rankings. However, although we introduced the AHP to the interviewees, the individual AHP results suffer from somewhat *poor consistency ratios* with nine individuals above the critical threshold of 10% (not tabulated), which is most likely due to the complexity of the AHP (Achimugu et al. 2014). Future research should ensure even more that managers really understand the AHP thoroughly. This can be supported by *less granular hierarchies*, resulting in a larger number of pairwise comparisons. Furthermore, a *follow-up survey* based on a larger and a more balanced sample of male and female participants could be performed to ensure generalizability of our findings. As our evaluation was only preliminary, a *further evaluation* seems promising. Additionally, the prototype implements the guidelines only on an initial level due to time constraints during the here-presented research. Therefore, a further evaluation will benefit from an *enhanced prototype*. Krönke et al. (2017) provide the next step in this direction. Future research should also cover *developments over time* and yield reliable trends for MSS use situations. Considering the chosen working styles, factors such as *age, gender, education, MSS experience, and culture* were not examined in detail. More in general, we did not consider factors of intrinsic motivation, such as a manager's value system. Such differences may determine differences in decision making and different requirements regarding MSS perception and design.

References

Abelein, U., Sharp, H., and Paech, B. 2013. "Does Involving Users in Software Development Really Influence System Success?," *Software, IEEE* (30:6), pp. 17-23.

Achimugu, P., Selamat, A., Ibrahim, R., and Mahrin, M. N. r. 2014. "A Systematic Literature Review of Software Requirements Prioritization Research," *Information and Software Technology* (56:6), pp. 568-585.

Ackoff, R. L. 1967. "Management Misinformation Systems," *Management Science* (14:4), pp. 147-156.

Alavi, M. 1982. "An Assessment of the Concept of Decision Support Systems as Viewed by Senior-Level Executives," *MIS Quarterly* (6:4), pp. 1-9.

Arazy, O., Nov, O., and Kumar, N. 2015. "Personalityzation: Ui Personalization, Theoretical Grounding in Hci and Design Research," *AIS Transactions on Human-Computer Interaction* (7:2), pp. 43-69.

Arnott, D., and Pervan, G. 2008. "Eight Key Issues for the Decision Support Systems Discipline," *Decision Support Systems* (44:3), pp. 657-672.

Arnott, D., and Pervan, G. 2014. "A Critical Analysis of Decision Support Systems Research Revisited: The Rise of Design Science," *Journal of Information Technology* (29:4), pp. 269-293.

Association of Business Schools. 2015. "Academic Journal Guide 2015." Retrieved 11/22/2016, from https://charteredabs.org/Academic-Journal-Guide/index.html

Benbasat, I., and Nault, B. R. 1990. "An Evaluation of Empirical Research in Managerial Support Systems," *Decision Support Systems* (6:3), pp. 203-226.

Brenner, W., Karagiannis, D., Kolbe, L., Krüger, J., Leifer, L., Lamberti, H.-J., Leimeister, J., Österle, H., Petrie, C., Plattner, H., Schwabe, G., Uebernickel, F., Winter, R., and Zarnekow, R. 2014. "User, Use & Utility Research," *Business & Information Systems Engineering* (6:1), pp. 55-61.

Burnay, C., Gillain, J., Jureta, I. J., and Faulkner, S. 2014. "On the Definition of Self-Service Systems," in *Advances in Conceptual Modeling: Er 2014 Workshops, Enmo, Mobid, Mreba, Qmmq, Secogis, Wism, and Er Demos, Atlanta, Ga, USA, October 27-29, 2014. Proceedings,* M. Indulska and S. Purao (eds.). Cham: Springer International Publishing, pp. 107-116.

Clark, T. D., Jones, M. C., and Armstrong, C. P. 2007. "The Dynamic Structure of Management Support Systems: Theory Development, Research Focus, and Direction," *MIS Quarterly* (31:3), pp. 579-615.

Crescenzi, A. D., and Gulden, G. K. 1983. "Decision Support for Manufacturing Management," *Information & Management* (6:2), pp. 91-95.

Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), pp. 319-340.

DeLone, W. H., and McLean, E. R. 1992. "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research* (3:1), pp. 60-95.

Delone, W. H., and McLean, E. R. 2003. "The Delone and McLean Model of Information Systems Success: A Ten-Year Update," *J. Manage. Inf. Syst.* (19:4), pp. 9-30.

Devaraj, S., Easley, R. F., and Crant, J. M. 2008. "Research Note—How Does Personality Matter? Relating the Five-Factor Model to Technology Acceptance and Use," *Information Systems Research* (19:1), pp. 93-105.

Dong, C.-S. J., and Srinivasan, A. 2013. "Agent-Enabled Service-Oriented Decision Support Systems," *Decision Support Systems* (55:1), pp. 364-373.

Easley, R. F., Valacich, J. S., and Venkataramanan, M. A. 2000. "Capturing Group Preferences in a Multicriteria Decision," *European Journal of Operational Research* (125:1), pp. 73-83.

Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), pp. 532-550.

Elam, J. J., and Leidner, D. G. 1995. "Eis Adoption, Use, and Impact: The Executive Perspective," *Decision Support Systems* (14:2), pp. 89-103.

Fichman, R. G., Dos Santos, B. L., and Zheng, Z. 2014. "Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum," *MIS Quarterly* (38:4), pp. 329-343.

Gebauer, J., Shaw, M. J., and Gribbins, M. L. 2010. "Task-Technology Fit for Mobile Information Systems," *Journal of Information Technology* (25:3), pp. 259-272.

Gluchowski, P., Gabriel, R., and Dittmar, C. 2008. *Management Support Systeme Und Business Intelligence*, (Zweite, vollständig überarbeitete Auflage ed.). Berlin, Heidelberg: Springer.

Goodhue, D. L., and Thompson, R. L. 1995. "Task-Technology Fit and Individual Performance," *MIS Quarterly* (19:2), pp. 213-236.

Gray, P., and Olfman, L. 1989. "The User Interface in Group Decision Support Systems," *Decision Support Systems* (5:2), pp. 119-137.

Gregor, S. 2006. "The Nature of Theory in Information Systems," *MIS Quarterly* (30:3), pp. 611-642.

Gregor, S., and Hevner, A. R. 2013. "Positioning and Presenting Design Science Research for Maximum Impact," *MIS Quarterly* (37:2), pp. 337-355.

Henderson, J. C., Rockart, J. F., and Sifonis, J. G. 1987. "Integrating Management Support Systems into Strategic Information Systems Planning," *J. Manage. Inf. Syst.* (4:1), pp. 5-24.

Herrmann, A., and Daneva, M. 2008. "Requirements Prioritization Based on Benefit and Cost Prediction: An Agenda for Future Research," *2008 16th IEEE International Requirements Engineering Conference*, pp. 125-134.

Hoogervorst, J. 2009. *Enterprise Governance and Enterprise Engineering (the Enterprise Engineering Series)*. Berlin: Springer.

Houdeshel, G., and Watson, H. J. 1987. "The Management Information and Decision Support (Mids) System at Lockheed-Georgia," *MIS Quarterly* (11:1), pp. 127-140.

Huysmans, J. H. B. M. 1970. "The Effectiveness of the Cognitive-Style Constraint in Implementing Operations Research Proposals," *Management Science* (17:1), pp. 92-104.

ISO/IEC. 2014. "ISO/IEC 25000:2014: Systems and Software Engineering -- Systems and Software Quality Requirements and Evaluation (Square) -- Guide to Square." Geneva: International Organization for Standadization, p. 27.

Karlsson, J., Wohlin, C., and Regnell, B. 1998. "An Evaluation of Methods for Prioritizing Software Requirements," *Information and Software Technology* (39:14), pp. 939-947.

Krönke, B., Mayer, J. H., Esswein, M., and Quick, R. 2017. "Manager App Portal at Continental: A Content, Collaboration, and Convenience App Selection That Works," *CONTROLLING – Zeitschrift für erfolgsorientierte Unternehmenssteuerung* (29:5), pp. 36-45.

Kuechler, B., and Vaishnavi, V. 2008. "On Theory Development in Design Science Research: Anatomy of a Research Project," *European Journal of Information Systems* (17:5), pp. 489-504.

Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P., Mädche, A., Urbach, N., and Ahlemann, F. 2017. "Digitalization: Opportunity and Challenge for the Business and Information Systems Engineering Community," *Business & Information Systems Engineering* (59:4), pp. 301-308.

March, S. T., and Smith, G. F. 1995. "Design and Natural Science Research on Information Technology," *Decision Support Systems* (15:4), pp. 251-266.

Marchand, D. A., and Kettinger, W. J. 2011. "Information Orientation (Io): How Effective Information Use Drives Business Performance," *Sistemas* (120), pp. 75-84.

Martinsons, M. G., and Davison, R. M. 2007. "Strategic Decision Making and Support Systems: Comparing American, Japanese and Chinese Management," *Decision Support Systems* (43:1), pp. 284-300.

Mayer, J., Winter, R., and Mohr, T. 2012. "Situational Management Support Systems," *Business & Information Systems Engineering* (4:6), pp. 331-345.

Mayer, J. H. 2018. "Corporate Navigator." Retrieved 04/05/2018, from https://www.youtube.com/watch? v=Uu1fFjQM3vY

Mayer, J. H., Koschtial, C., Hartwig, J., and Röder, A. 2014. "Corporate Navigator App – a New-Generation Management Support System," *Proceedings of the Ninth International Conference on Design Science Research in Information Systems and Technology (DESRIST), Miami, Florida, USA, 2014*), pp. 423-427.

Mayer, J. H., and Mohr, T. 2011. "Accommodating User-Group Characteristics to Improve the Acceptance of Executive Information Systems—State of the Art and User-Interface Components for up Close and Personalized Configuration," *Proceedings of the Americas Conference on Information Systems (AMCIS 2011) - All Submissions. Paper 275,* Detroit, Michigan (USA).

Mayer, J. H., and Stock, D. 2011. "Nutzertypen Für Die Situative Fis-Gestaltung: Ergebnisse einer empirischen Untersuchung," *Proceedings of the 10th International Conference on Wirtschafts-informatik WI 2.011,* pp. 139-149.

Mintzberg, H. 1972. "The Myths of Mis," *California Management Review* (XV:1), pp. 92-97.

Negahban, A., and Chung, C.-H. 2014. "Discovering Determinants of Users Perception of Mobile Device Functionality Fit," *Computers in Human Behavior* (35), pp. 75-84.

Oracle. 2017. "Business Intelligence." Retrieved 04/26/2017, from https://www.oracle.com/solutions/business-analytics/business-intelligence/index.html

Österle, H., and Otto, B. 2010. "Consortium Research," *Business & Information Systems Engineering* (2:5), pp. 283-293.

Pankratz, O., and Basten, D. 2013. "Eliminating Failure by Learning from It–Systematic Review of IS Project Failure," *ICIS 2013 Proceedings*).

Parkes, A. 2013. "The Effect of Task–Individual–Technology Fit on User Attitude and Performance: An Experimental Investigation," *Decision Support Systems* (54:2), pp. 997-1009.

Peffers, K., Tuunanen, T., Rothenberger, M. A., and Chatterjee, S. 2007. "A Design Science Research Methodology for Information Systems Research," *Journal of Management Information Systems* (24:3), pp. 45-77.

Peters, T., Işık, Ö., Tona, O., and Popovič, A. 2016. "How System Quality Influences Mobile BI Use: The Mediating Role of Engagement," *International Journal of Information Management* (36:5), pp. 773-783.

Petter, S., and McLean, E. R. 2009. "A Meta-Analytic Assessment of the Delone and McLean IS Success Model: An Examination of Is Success at the Individual Level," *Information & Management* (46:3), pp. 159-166.

Power, D., Burstein, F., and Sharda, R. 2011. "Reflections on the Past and Future of Decision Support Systems: Perspective of Eleven Pioneers," in *Decision Support*, D. Schuff, D. Paradice, F. Burstein, D.J. Power and R. Sharda (eds.). Springer New York, pp. 25-48.

Ramanathan, R., and Ganesh, L. S. 1994. "Group Preference Aggregation Methods Employed in AHP: An Evaluation and an Intrinsic Process for Deriving Members' Weightages," *European Journal of Operational Research* (79:2), pp. 249-265.

Reinecke, K., and Bernstein, A. 2013. "Knowing What a User Likes: A Design Science Approach to Interfaces That Automatically Adapt to Culture," *MIS Quarterly* (37:2), pp. 427-A411.

Riley, A. C. 1987. "An Analytical Framework for the Evaluation of Inherent Audit Risk." George Washington University.

Rockart, J. F. 1979. "Chief Executives Define Their Own Data Needs," *Harvard Business Review* (57:2), pp. 81-93.

Rockart, J. F., and Treacy, M. E. 1989. "The Ceo Goes on-Line," in *End-User Computing: Concepts, Issues, and Applications,* R.R. Nelson (ed.). New York: John Wiley & Sons, pp. 55-64.

Saaty, T. L. 1977. "A Scaling Method for Priorities in Hierarchical Structures," *Journal of Mathematical Psychology* (15:3), pp. 234-281.

Saaty, T. L. 1980. *The Analytic Hierarchy Process*. New York: McGraw Hill.

Saaty, T. L. 2008. "Decision Making with the Analytic Hierarchy Process," *International Journal of Services Sciences* (1:1), pp. 83-98.

SAP. 2017. "Business Intelligence." Retrieved 04/26/2017, from https://www.sap.com/solution/platform-technology/analytics/business-intelligence-bi.html

Schmitz, K. W., Teng, J. T. C., and Webb, K. J. 2016. "Capturing the Complexity of Malleable IT Use: Adaptive Structuration Theory for Individuals," *MIS Quarterly* (40:3), pp. 663-B619.

SCImago. 2015. "SJR — Scimago Journal & Country Rank." Retrieved 11/22/2016, from http://www.scimagojr.com/journalrank.php?category=1709

Shaikh, A. A., and Karjaluoto, H. 2015. "Making the Most of Information Technology &Amp; Systems Usage: A Literature Review, Framework and Future Research Agenda," *Computers in Human Behavior* (49), pp. 541-566.

Sommerville, I. 2011. *Software Engineering*. Boston: Addison-Wesley.
Swanson, E. B. 1982. "Measuring User Attitudes in MIS Research: A Review," *Omega* (10:2), pp. 157-165.
Tate, M., Evermann, J., and Gable, G. 2015. "An Integrated Framework for Theories of Individual Attitudes toward Technology," *Information & Management* (52:6), pp. 710-727.
Vaidya, O. S., and Kumar, S. 2006. "Analytic Hierarchy Process: An Overview of Applications," *European Journal of Operational Research* (169:1), pp. 1-29.
Van Den Honert, R. C., and Lootsma, F. A. 1997. "Group Preference Aggregation in the Multiplicative Ahp the Model of the Group Decision Process and Pareto Optimality," *European Journal of Operational Research* (96:2), pp. 363-370.
Vandenbosch, B., and Huff, S. L. 1997. "Searching and Scanning: How Executives Obtain Information from Executive Information Systems," *MIS Quarterly* (21:1), pp. 81-107.
Venkatesh, V., L. Thong, J. Y., and Xu, X. 2012. "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Quarterly* (36:1), pp. 157-178.
Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3), pp. 425-478.
Vodanovich, S., Sundaram, D., and Myers, M. 2010. "Digital Natives and Ubiquitous Information Systems," *Information Systems Research* (21:4), pp. 711-723.
vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., and Cleven, A. 2009. "Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process," *Proceedings of the 17th European Conference on Information Systems*, Verona, pp. 2206–2217.
Walls, J. G., Widmeyer, G. R., and El Sawy, O. A. 1992. "Building an Information System Design Theory for Vigilant Eis," *Information Systems Research* (3:1), pp. 36-59.
Walsh, I. 2014. "A Strategic Path to Study It Use through Users' It Culture and It Needs: A Mixed-Method Grounded Theory," *The Journal of Strategic Information Systems* (23:2), pp. 146-173.
Walstrom, K. A., and Wilson, R. L. 1997. "An Examination of Executive Information System (EIS) Users," *Information & Management* (32:2), pp. 75-83.
Winter, R. 2011. "Design of Situational Artefacts—Conceptual Foundations and Their Application to It/Business Alignment," in *Information Systems Development,* J. Pokorny, V. Repa, K. Richta, W. Wojtkowski, H. Linger, C. Barry and M. Lang (eds.). Springer New York, pp. 35-49.
Witkin, H. A., Moore, C. A., Goodenough, D. R., and Cox, P. W. 1977. "Field-Dependent and Field-Independent Cognitive Styles and Their Educational Implications," *Review of Educational Research* (47:1), pp. 1-64.
Wixom, B. H., and Watson, H. J. 2010. "The Bi-Based Organization," *International Journal of Business Intelligence Research* (1:1), pp. 13-28.
Zhang, P., Li, N., Scialdone, M., and Carey, J. 2009. "The Intellectual Advancement of Human-Computer Interaction Research: A Critical Assessment of the Mis Literature (1990-2008)," *AIS Transactions on Human-Computer Interaction* (1:3), pp. 55-107.