Management Support Systems on Different Devices—A Business Perspective Accommodating Managers' Growing Range of Use Situations

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Abstract

As manager's human-computer interface, end-user devices greatly determine the acceptance of management support systems (MSS). Accommodating managers' growing range of MSS use situations, this article proposes a model for selecting such devices from their business perspective. Based on a literature review, we derive a research model that incorporates three MSS use factors and a taxonomy for MSS devices. We validate this model with findings from an expert focus group and, by applying it in different industries, we demonstrate utility. Looking forward, we propose threefold: (1) Tablets are catching on among consumer managers. (2) For analyst managers, in turn, tablet functionalities matter more than tablets as a dedicated device. (3) Instead of providing "the more, the better" technical features for single devices, MSS design must focus on an "IS design for use" accommodating managers' increasingly different use situations.

1. Introduction

Starting with Ackoff 1967 [1], among others, managers and their information systems (IS) have been a constant topic of interest to researchers over the last five decades. Since decision support systems [2] evolved from a specific concept that originated as a complement to management information systems and overlapped in the late 1980s with executive information systems [3], we refer to our object of study as *management support systems* (MSS, [4, 5]).

Mobility is currently one of the most visible trends in IS, as companies are even looking to bring their internal processes into a post-PC era [6]. *Mobile MSS* promise managers new freedom to access, generate, and disseminate information. However, they are subject to limiting factors such as smaller screens, electronic rather than tactile keyboards, reduced processing power, and location-dependent connectivity [7]. And, they must be accessible to managers while being distracted by noise and disruptions.

According to ISO 9241-110 [8], MSS are a combination of software and hardware components. User interfaces "[…] are what users see and work with to use a product" ([9], p. 1). They are a combination of different software components that conform to a model composed according to a standard ([10]). *End-user devices* (hereafter referred simply to as devices), in turn, are the physical elements handled by users [11].

We focus on devices for managers to access MSS for two reasons. First, as companies become more dispersed, managers spend more time "on the road" and are exposed to complementing their set of devices beyond the PC [12]. Second, in the general IS consumer market, mobile devices are often used for fun and enjoyment activities like gaming, browsing the web, or watching movies. As a result, guidelines for selecting devices to access, generate, and disseminate business data are underrepresented [13].

This article proposes a *model for selecting devices in a MSS context* from a managers' perspective. By embracing their growing range of working styles, MSS use cases, and MSS access modes, it enables a more personalized MSS use. We answer two research questions:

- What are managers' most important use factors when accessing MSS?
- Covering their preferences, what is a proper MSS device selection?

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In doing so, we follow the rising tenets of design science research (DSR) in human-computer interaction (HCI, [14, 15]). After revisiting the foundations of our research questions (Sect. 2) and based on a literature review (Sect. 3), we lay out our research model (Sect. 4). Using findings from an expert focus group, we validate our model (Sect. 5). By applying the model in different industries, we demonstrate utility and derive implications from manager interviews for adjusting our final arguments (Sect. 6). We conclude with a summary and avenues of future research (Sect. 7).

2. User Preferences in MSS Research and Design Theories

The higher managers are positioned within an organization, the more idiosyncratic they often become—and the more challenging it is to design IS support for them. As a result, *IS use factors* are gaining importance [16]. Especially digital natives along with digital immigrants, who learned to engage with IS and developed into IS users over the years, more naturally accept MSS, but also have higher expectations about how they should accommodate their individual preferences [17].

Thus, it becomes especially important to better understand *user preferences* in the MSS domain [18]. They describe differences in the ways human beings prefer to use IS and this has been a topic of HCI research since the 1970s. The *theory of cognitive fit* states that decision making is efficient and effective when a problem is presented in line with an individual's approach to problem-solving [19]. Also well-known is the theory of task-technology fit (TTF, [20]), a user-evaluation construct for IS success which describes the degree to which system characteristics accommodate user tasks. More recently, Gebauer et al. [21] extend the TTF theory to mobile IS. Andersson and Henningsson [22] point out additional aspects such as different smart devices with different screen sizes to be addressed by the interface designs.

Such models aid understanding of IS fit in terms of what factors should be included in an IS model, while ignoring both how these factors interact with one another [10] and that they do not directly provide advice on the design of (innovative) artefacts [23]. More importantly, in the light of new-generation managers' idiosyncrasies, a one-size-fits-all concept of device selection for a "typical" manager just deploying "plan, build, run" is no longer sufficient [24]. In contrast, an MSS design that would meet individual IS use characteristics of all potential managers is untenable from an efficiency perspective. By adapting situational method engineering [25], adaptive reference modeling [26], design for artifact mutability [27], or configuration of standard software [28], *IS design for use* provides a way to achieve such a balance by segmenting different classes of user-group preferences [10]) and then find a rigorous procedure to select the "right" devices to achieve a balance between individualization and standardization. We define *MSS use situations* as distinct classes of managers' user-group preferences.

3. State of the Art

According to Walls et al. [29], a bottom-up model is best suited for innovative artifact design. It derives its hypothesized design from a state of the art, develops principles that meet the requirements examined, justifies the model in brainstorming with experts, and once the IS has been deployed, tracks its utility with case-to-case reasoning.

Starting with this procedure, we use the findings from a literature review in two ways to incorporate three use factors representing managers' preferences for MSS design and a taxonomy of devices.

3.1. Multidimensional MSS Design Framework

We suggest that incorporating user-group preferences into device selection needs multi-disciplinary literature review [30]. The following citations extend our prior work [10, 30, 31], adding new references for selecting MSS devices (Phase D, Fig. 1).

Leveraging research on human-computer interaction (HCI, [32]), we begin our literature systematization with defining a *user model* (Fig. 1). We continue with enterprise engineering (EE, [33]), which separates the MSS interface design process into the *black-box model* which describes the managers' user perspective on MSS and the *white-box model* which considers constraints from an IS engineering perspective. Then, we use requirements engineering (RE) to detail the functional requirements. Specifying the *situated selection of MSS devices*, we distinguish between a generic solution level, which covers domains of MSS design, and a solution instance level [34]. To be applied in practice, generic solutions must be instantiated for situated MSS functionalities (*implemented MSS variants 1-n*). Fig. 1 summarizes the structure of our literature research.

In line with Webster and Watson [35], we focused on leading IS research outlets and selected ten most relevant journals based on the catalog provided by the London School of Economics [36] for our literature review.[1] We expanded our list with proceedings from

[1] This catalog incorporates not only mainstream IS journals, but also social studies. We chose the five top journals from each set, namely: Management Information Systems Quarterly, Information Systems Research, Information and Management, Journal of Management In-

Table 1. Search string of the keyword search.

			OR						
AND	IS focus		management support system	management information system	decision support system	executive information system	data ware-house	business intelligence	decision making
	OR	user focus	Use	style	pattern	adoption		acceptance	
		device	desktop PC	laptop	notebook	tablet		smartphone	

ICIS and ECIS, publications from five journals of systems and software engineering, four computer sciences journals, and six HCI journals.[2]

Using EBSCOhost, Science Direct, and Pro Quest, our keyword search (Table 1) of titles and abstracts resulted in 469 hits, of which we found 24 to be relevant in terms of problem statement, research methods and findings. A final backward search led to a total of *49 relevant publications*.

Fig. 1 shows relevant work identified at the generic solution level.[3] Publications from the journals with the highest impact factors are highlighted and described below. Our complementary research string (Table 1, third row) focusing on devices for managers came up with another 11 articles (Fig. 1).

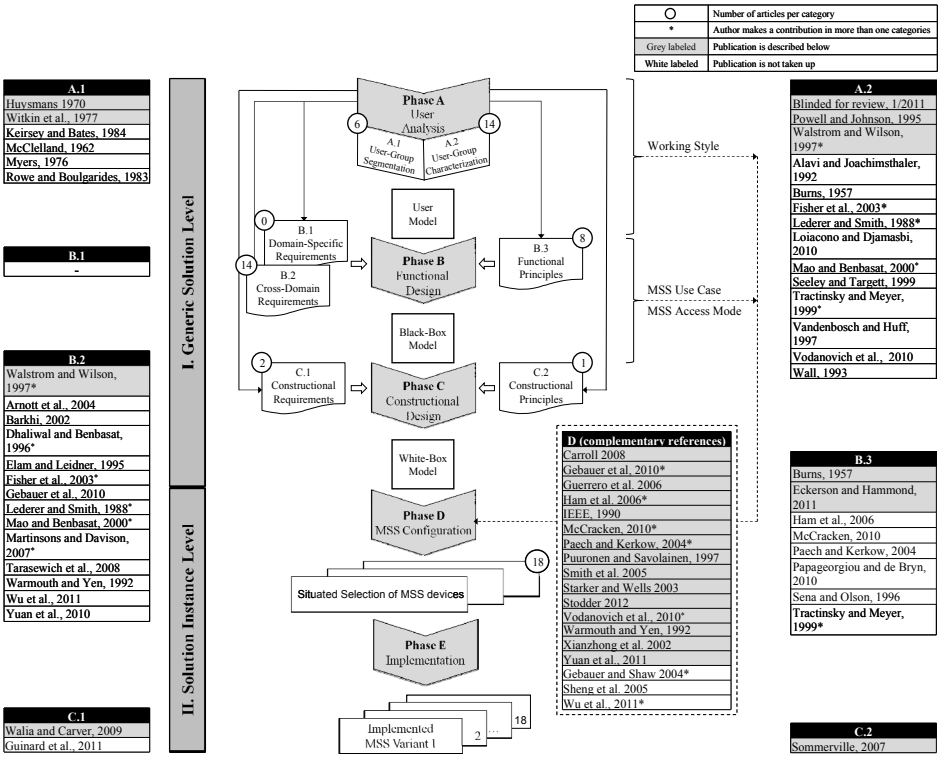

Fig. 1. Publications examining user-group characteristics in MSS design. Expanded illustration based on Mayer [10] and Mayer et al. [30, 31].

3.2. Managers' Most Important Use Factors When Accessing MSS

Phase A "User Model:" A first group of publications deals with individual cognitive styles and covers techniques for user-group segmentation (A.1). One of the most widespread techniques is Huysmans' [38] distinction between the analytical and the heuristic style. In a study of managers from companies listed in the FT "Europe 500" Mayer and Stock [39] updated these findings and reported two basic working styles among managers and their different MSS usage (Fig. 1): *Analyst managers* seek causal relationships, prefer quantitative data, and pay attention to detail. They might use standard reporting as an IS entry point, but want to be able to switch to an interactive, deep-dive mode, rather than simply information presentation. *Consumer managers*, in turn, pay less attention to detail and rely most often on content in a predefined order.

A second group of publications covers user-group characterization (A.2). These studies either apply the techniques employed in the group above and differen-

formation Systems, and Decision Support Systems as well as European Journal of Information Systems, Information and Organization, Information Systems Journal, Journal of Organizational and End User Computing, and Journal of Information Systems.

[2] Based on journal rankings of [37], for system and software engineering, we found IEEE Transactions on Software Engineering, ACM Transactions on Systems Engineering and Methodologies, Journal of Systems and Software, IEEE Software, and Information and Software Technology. For computer sciences, we selected ACM Transactions on Computer Systems, IEEE Transactions on Computers, Journal of Computer and System Sciences, Journal of Information Technology. For HCI, we found International Journal of Human-Computer Studies/Man-machine Studies, Human-Computer Interaction, International Journal of Human-Computer Interaction, and ACM Transactions on Human Computer-Interaction.

[3] Studies may appear more than once if they relate to more than one component of the framework.

tiate characteristics that have an impact on MSS (e.g., women vs. men, [40]) or utilize an explorative procedure to identify user groups of managers and their "typical" MSS usage. The second approach is evident in Walstrom and Wilson [41] who divide managers into three types: converts, pacesetters, and analyzers.

Working style as a first dimension of our research model. As a number of authors provide methods to differentiate individual cognitive styles (A.1), and even more consider characterizations of user groups (A.2) and their MSS usage, we propose to consider the influence of user-group preferences in our model and take the most basic differentiation (Fig. 1): *Analyst and consumer managers* [39].

Phase B "Black-Box Model:" MSS literature provides several methods for determining information needs as a starting point for domain-specific requirements (B.1). However, none of these proposals consider user-group preferences and MSS design. Several publications examine the implications of user-group preferences on cross-domain (functional) requirements (B.2). Walstrom and Wilson [41] find that converts use MSS to access predefined reports, sources outside the company and company news. Burns [42] derive functional principles for MSS design (B.3) distinguishing between the interpretation and communication of information.

Phase C "White-Box Model:" In terms of constructional requirements (C.1), Walia and Carver [43] classify errors that occur during the requirements phase and develop a taxonomy consisting of people, documentation, and process errors. Turning to constructional principles (C.2), it is primarily software engineering that deals with IS architecture approaches [44].

MSS use cases as a second dimension of our research model. To take account of the working situations in which managers use MSS, we follow Walstrom and Wilson [41] by acknowledging that MSS users are not only in a receiving, but also in a communicating and presenting role. Consequently, the different MSS use cases are another dimension that has impact on the device preferences for our model.

MSS access modes as a third dimension of our research model. Since managers' MSS access influences their IS usage to a great extent, we incorporate their MSS access mode into our model as well.

3.3. Situated Selection of MSS Devices

Phase D "MSS Configuration:" Most publications focus on layouts for desktop PCs. Yuan et al. [45] examine the fit between work and IS along mobility, location dependency, and time criticality. Gebauer et al. [21] classify mobile use contexts in terms of the level of distraction, connection quality, and mobility, and state requirements for these situations.

Today, various device classes exist. Besides desktop PCs (Fig. 2, F), notebooks (C) integrate most of the typical components of a desktop PC into a single unit, but they are for mobile use. Interactive whiteboards (G) are large interactive displays mounted on a wall. Users can interact with their finger or a stylus. Recently, products have entered the market that blur the boundaries of former device classes. We include new tablet PCs such as Lenovo X 230t, ThinkPad Helix or Mac Book Air in the notebook device class (C) because, although their screens are smaller (e.g., 12.1 inch), they still have the key features of a full-size PC. Furthermore, bearing in mind the rise of captive devices, the Apple's iPad 4, MS surface, Amazons Kindle Fire or Samsung's Galaxy Tab 3 combine a letter-sized screen (up to 10 inch, high resolution) and easy handling to claim an own device class between notebooks and smartphones. Such tablets (D) are controlled by gesture via a touchscreen rather than a pen. As tablets and smartphones are evolving into *phablets* (e.g. Samsung Galaxy Note II, Google's Nexus 10), the only distinctive feature of this device class is its "in-between" size. Thus, we classify them still as (big) smartphones. Exposing voice control as a supplementary control philosophy, another trend is wearable devices like Google Glass or new smart watches like Samsung Galaxy Gear. As smart watches do not operate in a stand-alone mode without a corresponding device, we classify them as complementing devices in the smartphone cluster. Glasses are portable and focus on control philosophy by gesture, they may define in future a new device glass besides smartphones.

Within the market for smartphones (B), 63% of business customers use devices such as RIM's Black Berry, Apple's iPhone 5, Google's Nexus 4 or Windows 8 phone by Nokia or Microsoft.

Taxonomy of MSS Devices. Since tablets show that screen size and functionality are no longer necessarily decisive characteristics, we follow Paech and Kerkow [46] by proposing aspects of usability as the core distinguishing features of mobile devices (Fig. 2): *Portability* defines the ease of transferring an IS from one environment to another and distinguishes whether devices are stationary or portable [47]. Paech and Ker-

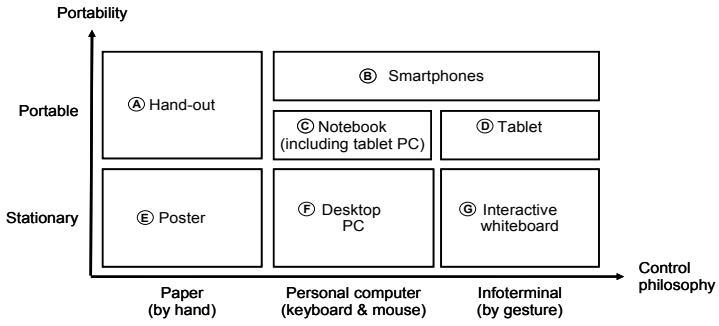

Fig. 2. Taxonomy of devices.

kow [46] propose distinguishing between stationary and portable devices. The *control philosophy* is important in terms of how users create and access information [48]. Although not a digital device, paper (A and E) is still an important medium for MSS, because it can be easily shared during a conversation.

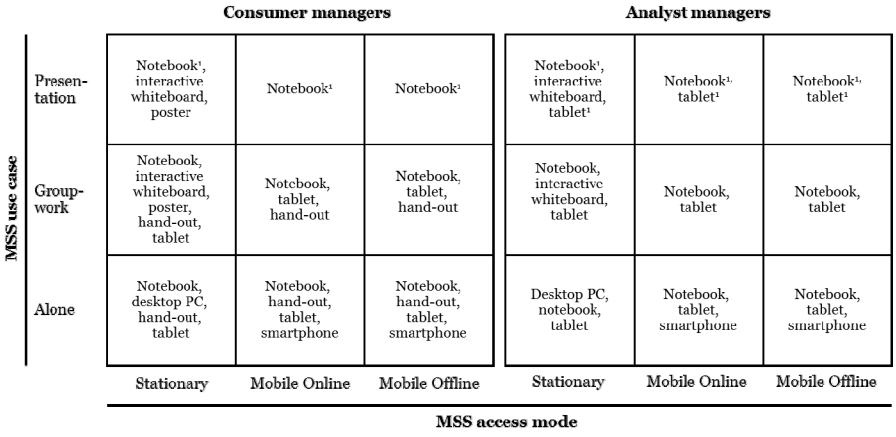

Fig. 3. Model for selecting devices by MSS use situation based on our literature review.

4. Research Model

Besides Ham et al.'s [49] framework for applicability and their suggestion that smartphones can be used to diagnose utility problems, no researchers considered managers' use situations in combination with their MSS usage on different devices. Following the findings from our literature review, we choose the *working style* as our first dimension for the model set-up and differentiate between *analyst and consumer managers*.

Regarding the *MSS use case*, for the sake of simplicity, we propose to distinguish between three "typical" items [50]: *alone* (e.g., desk research in the office), *groupwork* (one-to-few: e.g. manager with colleagues), and *presentation* (one-to-many: e.g., in a board meeting).

Regarding the *MSS access case*, accessing information while managers are *stationary*, e.g., at their own desks with a fixed cable, W-LAN or UMTS connection, is easy. When managers are mobile, MSS access can take two forms. If they are traveling, but still have little connection, these managers are *mobile online*, sometimes with disruptions. They are *mobile offline* when they are e.g. in planes, high-security buildings, or cars where no online connection is available [51]. Fig. 3

Table 2. Mode and median responses from hypotheses testing.

No	Hypotheses	Explanation [Reference]	Mode/ Median
1	The type of reporting standard or detailed reporting is relevant for device selection.	Analyst managers seek causal relationship and pay attension for details [39]. Depending on several factors (screen size, processing power, memory), the details reported vary [54].	disagree/ disagree
2	MSS use cases are relevant for selecting a device.	Tablet PCs can be used for presentations at customer's location [13, 22]. Device selection is distinguishing between activities such as interpretation and communication of information [43]. MSS can be specified by "alone," "group work," and presentation mode [51].	disagree/ disagree
3	MSS access mode is relevant for selecting a device.	The more mobile an employee is, the more likely he will prefer a mobile device [32]. There are mobile online and mobile offline versions of MSS access mode [51].	agree/ agree
4	The "when" is not relevant for determining a device.	In general, mobile devices allow the user to fill dead spots effectively when s/he is under time pressure, but "when" is irrelevant [55].	agree/ agree
5	The capability of smartphones are sufficient for consuming standard reports (e.g., basic information and analyses as a PDF, not for detailed reporting with attachments).	Smartphones provide users with sufficient storage and processing capacity to consume information. In turn, slicing, dicing, and drill downs are constrained on this device [32, 54].	agree/ agree
6	A keyboard control is favorable if frequent inputs are necessary (e.g., setting parameters, typing a longer text).	Tactile keyboards are better suited for data-intensive inputs [13, 56].	agree/ agree
7	During presentations, interactive whiteboards are favorable when navigating through reports, KPIs or comments.	Executives' perceptions and problems will drive whiteboards in future [52]. Key benefits of interactive whiteboards are interactivity, effectiveness, versatility, and multimedia presentation [53].	agree/ agree
8	In general, screen size determines the level of comfort in analyzing information.	User are not only receiving informations, but are also in a communicating and presenting role [42]. Depending on the screen size, the density of information represented is constrained [55].	agree/ agree
9	In a mobile working context, the set-up time (e.g., booting a notebook) is important.	Time criticality of information drive IS fit [46]. Depending on the working context, effortless and speedy communication is crucial for device selection [53].	strongly agree/agree
10	In a mobile working context, the weight of a device determines whether it is used or not.	**Size as well as weight strongly influence the portability of a mobile device [13].**	agree/ agree
11	In a mobile working context, the size of a device determines whether it is used or not.		agree/ agree
12	At the desk, an external monitor for mobile devices is favorable.	IS selection depends on location IS is used [46]. What to display depends on the screen size [56].	strongly agree/ strongly agree
13	In a mobile working context, paper versions are often preferred over digital reports.	Stationary vs mobile use sitations will determine the kind of report [50]. Managers tend to refuse IS and therefore prefer paper-based reports in a mobile context [32, 56].	disagree/ undecided

shows our model in terms of managers' working styles, MSS use case, and MSS access mode.

Table 2 lists the underlying hypotheses with their references, which we formulated by analytical argumentation from literature. For example, when mobile, consumer managers will use hand-outs, because they can pass their edits to their secretaries, whereas analyst managers want digital devices to change their documents immediately [51]. Interactive whiteboards support collaborative work in the presentation- and groupwork-use-cases because they immediately document the meeting results and save them for further rework [52].

Table 3. Sample characteristics.

Position	No.	%	Sector	No.	%
Group managers (L1)	4	17	Industrial	13	56
Director accounting (L2)	10	44	Financial services	5	22
Director business intelligence (L2)	3	13	Other services	5	22
Divisional managers (L2)	6	26	Total	23	100
Total	23	100			
Working style			**MSS use case**		
Analyst manager	14	61	Alone	6	26
Consumer manager	9	39	Groupwork	14	61
Total	23	100	Presentation	3	13
			Total	23	100
MSS access mode (most often)			**Market capitalization [USD bn]**		
Stationary	4	17	<30	6	26
Mobile online	11	48	30-60	5	22
Mobile offline	8	35	90-120	11	48
Total	23	100	> 120	1	4
			Total	23	100

5. Model Validation

5.1. Workshop with Expert Focus Group

Using findings from an expert focus group, we validate our hypotheses. This research format provides direct feedback in a personal atmosphere [57]. Our focus group consisted of 23 participants from 17 different companies (Table 3). The managers belong to a working group (level L1 and L2) who have been meeting three times a year since 2006 to discuss trends in MSS [58]. The focus group encompasses group managers, directors of accounting or business intelligence (BI), and divisional managers.

Data were obtained in a 3.5-hour moderated *workshop*. The workshop began with an introduction by two facilitators (30 min). Participants were given 60 minutes to try out the "look and feel" of the following devices:[4] Apple iPhone 5 (smartphone); Lenovo X230t (notebook); Apple iPad 2 (tablet); SMARTboard (interactive whiteboard). For the next 30 minutes, MSS content was provided in the form of an MSS implementation covering several device-specific report designs, the Corporate Navigator [59]. Finally, participants had 90 minutes to fill out a questionnaire (Table 2).

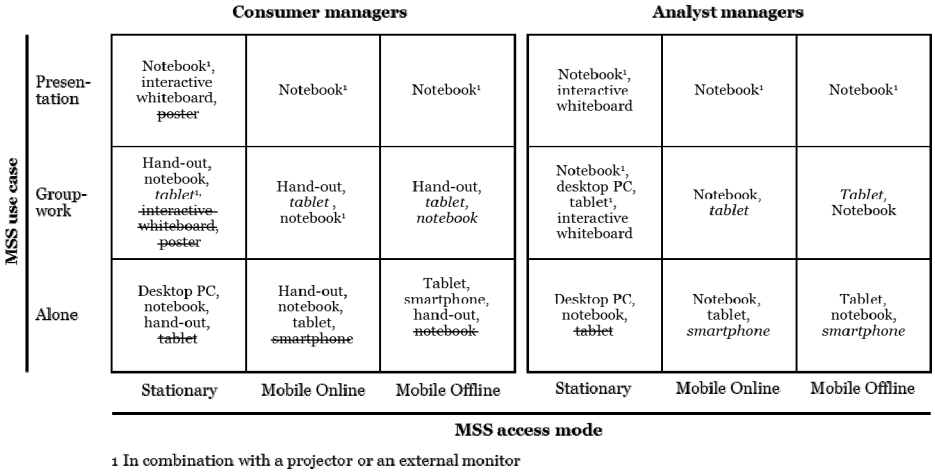

Fig. 4. Refined model for selecting devices by MSS use situations.

To provide triangulation, the questionnaire was designed to test our model in two ways. The first part, which took 45 minutes, consisted of a five-point Likert scale marking numbers from one-to-five regarding whether a participant agrees or disagrees with each of our statements: (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree, and (5) strongly agree. The mode (most frequent) and median (middle) for the responses are listed in Table 2.

Furthermore, the questionnaire consisted of multiple-choice questions in the second part. Respondents were first asked to indicate their working style and then pick the preferred device for a given context. We used 3x3 matrices (Fig. 4) to structure the questions and propose devices for each cell. In this 45-minute section

[4] A serious issue is the influence of group dynamics on each individual's perspective. We avoided this by having participants answer the questionnaire at their own desks after the demo.

of the workshop, for example, we asked the participants how they would like to analyze standard reports at their desk or present information in a working meeting. Aggregating the responses leads to a refined version of our proposed model (Fig. 4). New elements in each of the cells are marked in italics. We cross out devices managers said they would not use in that use situation. The order of devices corresponds to the frequency they appear in the responses.

5.2. Results

Fig. 4 revealed five results which we verified with the findings of the hypotheses tests as follows:

Managers solely use their notebooks for presentations: For both consumer and analyst managers, notebooks remain the first choice in any presentation context (first line, Fig. 4). Although they acknowledge the advantages of interactive whiteboards (hypothesis 2, 7), only six respondents considered them to be favorable, e.g., for board meetings. Both, a tablet for presentation mode only or smartphones with beamer functionality integrated are currently not in their mind.

Managers select their devices independent from the extent to which they use MSS: Whether managers are analysts or consumers, they stick with their device whether they use the MSS once a week or every day. Consumer and analyst managers have identical device preferences of a notebook in a presentation mode (see finding above). For group work (second line, Fig. 4), mobile online and offline analysis, consumer managers prefer *paper-based reports* over a digital device (second and third column, Fig. 4), in turn, analyst managers like a more *interactive* MSS device (fifth and sixth column, Fig. 4). We assume that the different attitudes are due to the fact that paper is still the most trustable documentation format for consumer managers "not changing overnight" by technical issues. However, since paper-based consumption plays a more and more subordinate role even for consumer managers, hypothesis 13 that paper-based reports are often preferred over digital reports was rejected (Table 2).

Smartphones are not the future "all-in-one" device: Smartphones have limited potential as the sole device for managers. Even in a mobile context (second and third, fifth and sixth column, Fig. 4), smartphones rank below tablets. This is in line with hypotheses 9, since tablets are as readily available as a smartphones (Table 2), but have a larger screen (hypothesis 8).

Digital reports on "always online" tablets become a reasonable alternative to print-outs. Paper-based solutions are losing significance, in line with our rejection of hypothesis 13 (Table 2). Handouts still achieve a high ranking for consumer managers in the group work context. However, tablets, which consumer managers already ranked higher for mobile offline analysis on their own, will continue to gain acceptance and additional functionality (e.g., in terms of ad-hoc connectivity, always online, and to share documents). Analyst managers argue that the shift from paper-based reports to digital documents becomes more important as the growing amount of paper makes management, storage, and linking these documents too complex.

Tablets will outperform smartphones: Tablets are revealed to be a fast-growing class for MSS devices even from managers' business perspective. As marked in Fig. 4 in italics, managers consider tablets to be appropriate new devices for group work and analysis (first and second line, Fig. 4). Consumer managers think that tablets can be useful when conducting group work or analyzing in mobile online and offline use situations, and the tablet is their preferred choice for reading documents.

6. Demonstrate

6.1. Manager Interviews

To demonstrate utility, we applied our model from October 2011 to January 2013 at three companies supporting their manager device selection. The companies are members of the University of St.Gallen Competence Center "Corporate Management Systems" [58] and were chosen by chance: a leading chemical company (2012 sales: USD 65.5 bn.; 2011 employees: 105, 000), a large automotive supplier (32 bn.; 150,000) and a BI consultancy (0.45 bn.; 200). The results of four personal interviews are summarized below. No managers interviewed here were part of the focus group.

Manager A: He is an energetic multicountry division CEO of the chemicals company and travels weekly. He is an analyst manager with affinity to IS and he uses the MSS in all use situations. Equipped with a notebook and a smartphone, when he is mobile, he was rather dissatisfied. Based on our model, which indicates that even analyst managers do not consider a notebook to be the most suitable solution in a mobile context, we proposed an additional tablet. Manager A is now more satisfied, especially because he now can use his *tablet as an advanced PDF reader, an electronic typewriter for more complex emailing especially with attached office documents, and for simple ad-hoc analysis "on the fly"* when being mobile.

Manager B: One of the first digital natives at the C level in Europe, he is the CFO of an automotive supplier. Since 2006, he has used the MSS to an equal extent for his own analyses and in working meetings, accessing information predominantly from his office (80 percent) and in a mobile context (20 percent). He is

equipped with a desktop PC in the office, a smartphone for mobile communication including e-mailing, a notebook, and—since 2010—a tablet. Although he is outfitted in line with our model for his analytic profile, he claimed that having three devices is one too much. An alternative could be the *next-generation tablets* such as Microsoft surface with a *full operating (windows) system and a complete office package on board*. Combined with a docking station in the office and at home they may replace managers' desktop PC and notebook.

Manager C: He is the senior HR director of the automotive supplier. He does not like IS at all, as his tasks—in his words—most often require face-to-face meetings on three different continents. To handle these tasks, he needs an easy-to-use mobile online and offline device to combine quantitative data, e.g., plant outputs, and qualitative data about the local management to prepare group work or presentations. He is equipped with a desktop PC in the office and an ordinary mobile phone without e-mailing capability. His secretary provides analyses and e-mails as paper-based hard copies. In general, he is rather satisfied with his equipment. Our model suggested that he does not need a bulky notebook, but instead a *tablet* when he is on the road. He currently started to use this new device, especially *reading daily news* when he is mobile.

Manager D: He is the CEO of the BI consultancy. He is dissatisfied with his desktop PC and smartphone as he believes that "a one-pager on a modern device" would be sufficient for him. He stated that smartphones are too small to visualize more than three or four KPIs, and that the MSS he accesses does not support reports for these devices due to missing flash report format. This finding is in line with our model, as *smartphones have limited potential as the sole device for mana*ger. The CEO might benefit from a tablet, which provide him with the comfort of a bigger screen.

6.2. Implications

Suited to different MSS use situations, our findings show that tablets do not just fit to requirements of the consumer market, but constitute a new capability for IS designers to improve even manager IS acceptance. Our expert focus group asked for them in several use situations (Fig. 4) and the manager interviews (Sect. 6.1) specified these findings in three respects:

For consumer managers, tablets constitute a new class of devices: Tablets reduce paper-based reporting for consumer managers (e.g., manager C) when they are mobile. Thus, they are catching on among consumer managers, not just for the general consumer market. We propose providing these managers with an "*e-book reporting"* in the form of PDF files delivered on demand to their e-mailbox so that they can launch analyses using page-to-page navigation instead of the flexible navigation analyst managers prefer. Links should allow consumers to navigate to predefined analyses in a "read more" modus on the tablet.

For analyst managers, tablet functionalities matter more than tablets as a dedicated device: For analyst managers (e.g., manager B) it is inconvenient to handle three (smartphone, notebook, and tablet) or even four devices (assuming a desktop PC in the office as well). More precisely: if notebooks remain the preferred device for analyst managers (right hand side, Fig. 4), they should be enhanced with *tablet functionalities*, such as the support for direct comments with a digitizer or especially fingertip. Furthermore, analyst managers' preference for a tactile keyboard is another argument against replacing their notebooks with tablets. Thus, a key difference to the general consumer device market is that analyst managers consider incorporating useful tablet functionalities into MSS design to be more important than having tablets as an additional device.

MSS design must focus on configuration mechanisms accommodating managers' MSS use situations instead of providing "the more, the better" technical features for single devices.

As mobile devices become more multifunctional, they are more flexible in terms of technical features, especially the boundaries between device classes are blurring. However, our model of MSS use factors gives the device selection a rigor structure, while the findings (Sect. 5.2) provide general pattern for this issue. In doing so, our model transformed MSS user acceptance-related preferences from their business perspective into a concrete proposal for device selection (Fig. 4).

The manager interviews then showed that, instead of providing the technical features of single manager devices "the more, the better", to improve their acceptance, MSS design must stronger focus on an IS design for use (Sect. 2). In doing so, we laid out that configuration mechanisms can help accommodating managers' increasingly different MSS use situations which we defined as distinct classes of manager user-group preferences regarding their working style, MSS use cases, MSS access modes (Fig. 4).

7. Summary and Avenues of Future Research

This paper addresses the non-functional aspect of MSS design. In doing so, we proposed a model for selecting devices in a MSS context from a managers' perspective accommodating their growing range of MSS use cases. We determined the latter by different working styles, MSS use cases, and MSS access modes. The proposed model shows that it is possible to

provide MSS device selection with a rigorous structure and to generalize basic pattern for this issue.

More concrete, our findings show a key difference to the general consumer market: Incorporating useful tablet functionalities in MSS devices matters more to analyst managers than having tablets as additional devices. However, tablets as a device are catching on among consumer managers. Furthermore we approved our plea for IS design for use.

In future, we aim at transforming our findings into more MSS design guidelines. In doing so, our research agenda include designing a better top-down communication supported by MSS, keyword storytelling, editing office attachments within e-mails, and convenient predefined links to upstream enterprise resource planning (ERP) systems "at a click." Thus, a follow-up paper should not only examine the interdependencies between the MSS user-interface design and device selection which we have not addressed in this article.

An avenue for future research is even to examine software components for mobile MSS use. Mobile IS is not just about screen-scraped notebook. Furthermore, the impact of MSS use factors such as gender, age, self-efficacy, and past device experience which all constituted that our working style construct needs to be examined in detail. Finally, the implications of the growing number of mobile devices and the role of alternative operations systems should be analyzed to improve IS architectures and policies that support governance, efficient application development, security and maintenance in a more heterogeneous IS world.

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