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Towards Maturity Models as Methods to Manage IT for Business Value – A Resource-based View Foundation

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ABSTRACT

For more than three decades business value of IT attracts attention in Information Systems Research (ISR) and practice. Despite the fact, that corporate management considers enterprise IT increasingly as a strategic factor, the question on how to manage IT effectively for business value remains widely unsolved. With the goal to support this management task we suggest maturity models (MMs) as a new method. We found MMs in the resource-based view in order to provide maturity models with a theoretical basis in general and to lay out the feasibility of MMs as methods to manage IT resources for business value in particular. To accomplish these goals, we conduct an in-depth analysis using an argumentative-deductive research approach. We contribute to the knowledge base by adopting a well-proven approach, transferring it to a new application domain, and grounding it in theory. Taking an example from corporate management research we illustrate our findings schematically.

Keywords

IT Business Value, Resource-based View (RBV), Management Methods, Maturity Models, Theoretical Foundation

INTRODUCTION

Since Robert Solow's observation and his remark "you can see the computer age everywhere but in the productivity statistics" (Solow 1987), a large number of studies investigating the impact of IT on organizational performance has been published. The demonstration or even quantification of the business value which is supposed to be provided by the enterprise IT is a rather complex task. Nowadays, the riddle concerning this so-called productivity paradox is undoubtedly resolved (Kohli and Grover, 2008). Scientists as well as practitioners are aware of the fact *investments in IT* do not necessarily result in business value but, however, IT has the *ability* to deliver value to the business. Moreover, IT can serve as one or even as the main *source for an organization's competitive advantage* (Melville, Kraemer, and Gurbaxani, 2004). Recognizing this issues, Brynjolfsson and Hitt (1998) state that "[…] today, the critical question IT managers are facing is not 'Does IT pay off?' but 'How can we best use computers?'"

The *resource-based view (RBV)* (Barney 1991), which is used especially within the research domain of strategic management, has the ability to empower researchers in shedding light on this critical question. Crook et al. (2008) emphasize that in strategic management the RBV "has emerged as a key perspective guiding inquiry into the determinants of organizational performance." In this regard the RBV implies that organizations' resources drive the generation of business value via the creation of a competitive advantage (Ireland, Hitt, and Sirmon, 2003). The RBV allows for identifying resources that are presumably able to deliver value to the business and are the necessary prerequisites to establish a competitive or even a sustainable competitive advantage (Melville et al. 2004). When applying the RBV in ISR, the RBV has the capacity to explain why a certain enterprise IT is able to outperform a comparable one and which particular IT resources are in charge of doing so (Wade and Hulland 2004). In order to support management in using their resources effectively and/or efficiently using the RBV, methodical support is required (Sirmon, Hitt, and Ireland 2007).

Against this background, we propose *maturity models (MMs)* as useful methods. Fundamentally, MMs consist of multiple archetypal levels that jointly represent the evolution path of a certain domain (Fraser, Moultrie, and Gregory, 2002; Rosemann and de Bruin, 2005). They can be interpreted as reference models and used as methods[1] for designing and using enterprise IT effectively and efficiently (Becker et al. 2009). The basic idea of MMs is based on the stages of growth theory (Nolan 1973). Assuming a strong link between the maturity level of a particular business capability and the effectiveness of

[1] A more detailed discussion on the issue whether maturity models are models or methods can be found in (Mettler and Rohner 2009).

IT enabling that capability, MMs help to understand how the business value gained from enterprise IT proceeds along the determined evolution path.

The *objective* of this article is to introduce MMs as methods for managing IT resources for business value. Using the RBV we ground MMs in theory while showing how MMs in combination with the RBV can be applied in order to determine the course of action to manage IT resource for business value. In so doing, we contribute to the knowledge base (Hevner, March, Park and Ram 2004) first by providing a theoretical foundation of MMs based on the RBV according to (Poeppelbuss, Nihaves, Simons and Becker, 2011), and second by shedding light on MMs as methods to manage resources for IT business value.

As we adhere to the design science research approach (Hevner et al. 2004), the remainder is structured as follows: First, we introduce the RBV and its application in IT business value research in IS. Afterwards, we describe MMs and their components. By integrating the elements of the RBV with MM components we provide the theoretical foundation for MMs and accomplish the 'build' phase suggested in Peffers, Tuunanen, Rithenberger, and Chatterjee (2008). The 'demonstrate' phase is carried out using an example from corporate management domain to illustrate schematically the application of MMs to manage IT for business value. Subsequently we make concluding remarks and shortly summarize our finding while providing future avenues for research.

THE RESOURCE-BASED VIEW AS FRAMEWORK FOR IT BUSINESS VALUE RESEARCH

Elaborated by Barney (1991), the RBV theorizes that every company consists of an individual bundle of resources. The postulate of resource individuality, determining the uniqueness of every organization's resource combination, accounts for a probable *competitive advantage* or moreover for a *sustainable competitive advantage*. According to Barney, the RBV comprehends two key propositions: First, resources are *heterogeneous*. Second, resources are *immobile*. A set of four attributes *valuable* (V), *rare* (R), *inimitable* (I), and *non-substitutable* (N) – abbreviated VRIN – characterizes every resource. The peculiarities of these attributes determine the likelihood whether a resource is able to establish a competitive advantage or even a sustainable competitive advantage.

Since the first RBV's application in ISR (Clemons and Row 1991; Mata, Fuerst, and Barney 1995), the RBV has attracted enormous popularity. According to Melville et al. (2004) the RBV provides the researcher with a "robust framework for analyzing whether and how IT may be associated with competitive advantage." The core elements of this theory are IT resources divided into *IT capabilities* (e.g. project management, programming, etc.) and (in-)tangible *IT assets* (e.g. hardware, software, etc.). IT assets are an input or output in a transformation process which is represented by IT capabilities (Wade and Hulland 2004).

On the one hand the RBV is used as a *theoretical framework*. Herein, the goal of applying the RBV is to derive testable hypotheses explaining which IT resources might generate business value (e.g. Baharadwaj 2000). Empirical research based on theoretical RBV driven elaborations reveals insights into how IT capabilities, for instance IT/business alignment, technological, managerial skills, or IT assets such as investments in IT, IT infrastructure, or IT knowledge impact the organization's competitive advantage (Liang You, and Liu, 2010; Patas, Bartenschlager, and Goeken, 2012a). On the other hand, the RBV is applied as a *conceptual framework* utilizing the RBV as a means to identify resources which might significantly impact an organization's performance (e.g. Feeny and Willcocks 1998; Mata et al. 1995). However, these conceptualized IT resources are often derived solely by argument and the peculiarities of resource attributes are thereby only occasionally considered and hardly justified (Patas et al. 2012a).

In literature two general concepts of IT business value are mainly associated with the RBV. These are competitive advantage (e.g., Barney 1991; Wade and Hulland 2004; Bhatt and Grover 2005) and firm performance (e.g. Bharadwaj 2000; Liang et al. 2010). In order to clarify the distinction, Kohli and Grover (2008) emphasize: "IT-based value is not the same as IT-based competitive advantage." In fact, IT business value refers amongst others to competitive advantage, productivity, cost reduction, etc. Melville et al. (2004) point out that IT business value is commonly defined as *organizational performance* and divided into *efficiency* and *effectiveness*. Whereas efficiency refers to easy to measure key performance indicators (KPIs), for instance cost reduction or productivity, effectiveness implies a differential value, the competitive advantage, which is a rather hard to measure concept (Bhatt and Grover 2005; Kohli and Grover 2008; Melville et al. 2005). De facto, it is used as an umbrella term. In this respect, using RBV implies a differential value.

Figure 1 illustrates the relation of the RBV key propositions, the resource attributes VRIN, and the business value as (sustainable) competitive advantage. A high peculiarity of the attributes valuable and rare can lead to a competitive advantage. In accordance with Wade and Hulland (2004), a sustainable competitive advantage calls for high inimitability and high non-substitutability of IT resources. Accordingly, whether IT resources are likely to generate business value or not depends on the interrelationship of inimitability and rarity as well as of non-substitutability and value. The more a resource can be easily imitated, the less it becomes rare. Analogously, a resource's value decreases as more perfect substitutes appear on the factor market.[2]

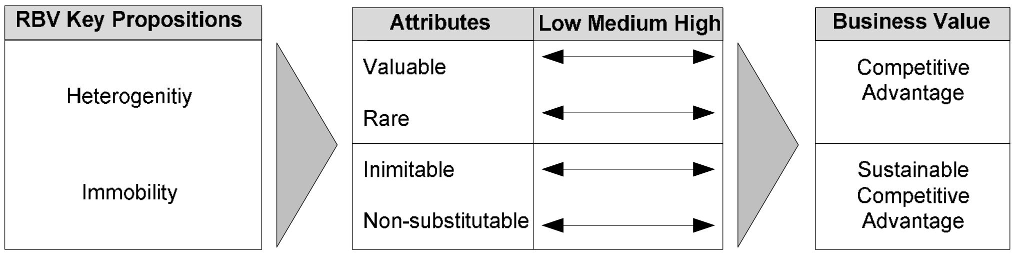

Figure 1. The Resource-based View and its Core Elements.

However, currently the RBV does not provide knowledge about the way how to manage IT resources for business value (Sirmon et al. 2007). Concerning the operationalization of the RBV, we will suggest and describe in the following section MMs as feasible methods to cope with this challenge.

MATURITY MODELS, CONSTITUENT COMPONENTS, AND THEIR ARRANGAMENT

MMs have gained reasonable attention during the last years. Becker et al. (2010) report that more than 1,000 articles over a period of 15 years refer to MMs, and (Mettler and Rohner, 2009) found more than 100 different MMs from domains as, for example, software engineering, project management, or business process management, etc. MMs represent "… an anticipated, desired, or typical evolution path," in which reaching the next maturity level implies the improvement of the capabilities under consideration (Becker et al. 2009, 2010). When MMs are applied to measure how effectively and efficiently IT is designed and used, *maturity* can be interpreted as "a measure to evaluate the capabilities of an organization" (Rosemann and de Bruin, 2005). Fraser et al. (2002) lift the terms maturity and performance on the same level. In so doing, they discuss empirical studies showing positive relations between the Capability Maturity Model (CMM) and improvements in software quality.

Typically, MMs consist of an arrangement of the following *constituent components* (Fraser et al., 2002): A certain number of levels, a concise descriptor for each maturity level pointing to the content, a generic description of the content of each level, several dimensions, and a set of elements or activities for every level as well as their descriptions. The MM application domain has also to be defined (e.g. Fraser et al. 2002; Pöppelbuss and Röglinger, 2011). Pointing to Steenbergen, Bos, Brinkkemper, Weerd, and Bekkers (2010) we add to the MM components list so called focus areas which help to group the elements or activities of a dimension throughout the entire designated evolution path (Figure 2).

Moreover, MMs can be classified descriptive, prescriptive, or comparative, i.e. depending on their application they help to evaluate a capabilities' status quo, provide advices for feasible capability development paths, or compare similar organizational capabilities throughout different subsidiaries, organizations, industries, etc. (Röglinger and Kamprath 2011). MMs are also categorized by the kind of evolution path they are describing. The evolution path concept is distinguished between *evolutionary approaches* that constitute a continuous evolution of capabilities and *stage approaches* that define clear-cut maturity levels (Fraser et al. 2002). Accordingly, the evolutionary approach does not oblige the provision of every element for every focus area within a dimension in order to evaluate the maturity level of a dimension entirely. Therefore MMs based on the evolutionary approach implicate different focus areas within a certain dimension that can be located on different maturity levels resulting in a maturity assessment of the particular dimension in-between two levels (illustrated in Figure 2 by gray shaded focus areas evaluated on different maturity levels). In contrast, the stage approach requires the evaluation of dimensions entirely. Here, the maturity level of a dimension depends on the worst evaluated focus area.

[2] Regarding the interrelation of the resource attributes and their impact on the differential concept of IT business value, a more detailed analysis can be found in (Wade and Hulland 2004).

			Generic description of maturity level	Generic description of maturity level	Generic description of maturity level	Generic description of maturity level	Generic description of maturity level
		Focus Area	Level 1 Descriptor	Level 2 Descriptor	Level 3 Descriptor	Level ... Descriptor	Level n Descriptor
Domain	Dimension 1	1	Element 1.1	Element 2.1	...	...	Element n.1
		...	Element ...	Element ...	...	...	...
		n	Element 1.n	Element 2.n	...	...	Element n.n
	Dimension ...	1	Element 1.1	...	...	...	...
		...	Element ...	…	…	...	...
		n	Element 1.n	...	...	...	...
	Dimension n	1	Element 1.1	...	...	...	...
		...	Element ...	...	...	...	...
		n	Element 1.n	...	...	...	...

Figure 2. Overview of Constituent Components of Maturity Models and their Arrangement

In the following section we focus explicitly on prescriptive MMs based on a stage approach because they are able to provide the user with "…emphasis on the domain relationships to business performance and indicate[s] how to approach maturity improvement in order to positively affect business value i.e. enable[s] the development of a road-map for improvement" (de Bruin, Rosemann, Freeze, and Kulkarni 2005). Following the argumentation by de Bruin et al. (2005) we propose MMs as a method for managing IT resources for business value. In the following section we therefore argumentatively analyze how MMs can be applied to serve this purpose.

THEORETICAL FOUNDATION OF MATURITY MODELS FOR MANAGING RESOURCES FOR BUSINESS VALUE

Adhering to the design science research paradigm (Hevner et al. 2004) we aim at developing IT artifacts not just to solve a single problem but rather a class of problems. To do so, the design of an IT artifact should be grounded in well-established theories (Gregor 2009). In addition, applying theories, while designing an IT artifact supports a rigorous scientific research process (Gehlert, Schermann, Pohl, and Krcmar, 2009; Hevner et al. 2004).

This course of action makes the artifact design more transparent and traceable. Simultaneously, it allows explicating the artifact's solving power while transferring an IT artifact into a new application domain. Thus, using the RBV we ground MMs in theory in order to analyze MMs if they might be useful methods to manage IT resources for business value. Since only prescriptive MMs are considered as feasible, we follow the MM design principles (DP) for prescriptive MMs (Pöppelbuß and Röglinger 2011). In order to satisfy our research goal we adjust these DP to our needs (Table 1).

	No.	Design Principle	Description
Design principles	1	Improvement measures for each maturity level.	Prescriptive statements require improvement measures to be included for every maturity level, dimension, and focus area.
	2	Decision calculus for selecting improvement measures.	Prescriptive statements require a decision calculus to select appropriate measures. In business context, such a decision calculus is determined by organizational performance.
	3	Target group-oriented decision methodology.	Prescriptive statements require a target group-oriented decision methodology to decide upon the available to-be implemented alternatives under consideration of improvement measures.

Table 1. Adjusted Design Principles for Prescriptive Maturity Models adopted from (Pöppelbuß and Röglinger, 2011)

The idea of grounding MMs in theory is based upon *matching* RBV elements with MM components. We match the RBV elements depicted in Figure 1 with the constituent components of generic MMs and illustrated in Figure 2 in the prior sections. Thereafter the most basic elements of the RBV are IT resources further divided into IT assets and IT capabilities. As priory described, an IT asset represents an input transformed into an output using IT capabilities. For instance, management reporting capabilities require a data warehouse to store historical data that provides the user with higher data extraction performance than extracting the required data from transaction processing systems directly. In that particular case, the hardware basis for the data warehouse could be termed tangible IT asset and the database management system (DBMS) for instance might be termed intangible IT asset.

In line with this argumentation a capability represents the transformation process that utilizes the listed IT assets. Thus, it is important to emphasize that capabilities must not necessarily be classified into IT capabilities because pure business-related capabilities might also use IT assets (Melville et al. 2004). For example, in the narrow sense reporting capabilities are usually not regarded as IT capabilities but they could be classified as organizational, business, or even more specific as administrative capabilities.

Summing up, we match the MM components 'elements and activities' with IT assets (either tangible or intangible) and 'dimension' with capabilities (either IT capabilities or non-IT capabilities). This matching is not only accomplished on a syntactical level but also based on our argumentation on a semantic level. In our explanation the MM component 'focus areas' expresses classes of IT assets, for example software, hardware, people, skills. They allow us to represent more easily the determined maturity evolution path of a certain IT assets class. Thus, we fall back on Steenbergen et al. (2010) and rename this MM component into IT asset class. We leave the other two MM components 'generic description of maturity level' and 'level descriptor' unchanged because they did not change their purpose. The adjusted and in the RBV grounded MM components are presented in Figure 3.

			Generic description of maturity level	Generic description of maturity level	Generic description of maturity level	Generic description of maturity level	Generic description of maturity level
		IT asset class	Level 1 Descriptor	Level 2 Descriptor	Level 3 Descriptor	Level ... Descriptor	Level n Descriptor
Domain	(IT) Capability 1	1	IT Asset 1.1	IT Asset 2.1	...	...	IT Asset n.1
		...	IT Asset ...	IT Asset ...	...	...	...
		n	IT Asset 1.n	IT Asset 2.n	...	...	IT Asset n.n
	(IT) Capability ...	1	IT Asset 1.1	...	...	...	...
		...	IT Asset ...	…	…	...	...
		n	IT Asset 1.n	...	...	...	...
	(IT) Capability n	1	IT Asset 1.1	...	...	...	...
		...	IT Asset ...	...	...	...	...
		n	IT Asset 1.n	...	...	...	...

IT Business Value

Figure 3. Integration of Maturity Model Components and Resource-based View Elements.

Referring to DP1 listed in Table 1, prescriptive MMs require *improvement measures*. We use the resource attributes VRIN for this purpose at which their peculiarities are evaluated as low, medium, or high. According to the adjusted first DP these measures have to be implemented at every maturity level for every dimension and their respective focus areas, hence, for every IT asset. The peculiarities of every particular resource attribute allow tracing the evolution path of every asset class.

DP2 asks for a *decision calculus*. In our case, the decision calculus is business value of IT bounded by the RBV; hence, it is the (sustainable) competitive advantage. It relies on the improvement measures VRIN and can be measured by perceptual measures, for example suggested in (Bhatt and Grover 2005).

DP3 instructs to implement a *target group-oriented decision methodology*. In order to support the design of MMs, (Lahrmann, Marx, Mettler, Winter, and Wortmann, 2011) proposed the Rasch algorithm. The algorithm provides the MM designer with the ability to rank IT assets at the respective maturity level depending on the difficulty of the IT assets and the ability of the organization. Another easier to handle method for matching IT assets with maturity levels would be a n-level Likert scale depending on the given number of maturity levels or the Delphi technique as suggested in (de Bruin and Rosemann 2007).

SCHEMATIC ILLUSTRATION OF MATURITY MODELS FOR MANAGING IT RESOUCES FOR BUSINESS VALUE

Business value of IT is grounded in the fact that IT is an important factor to leverage valuable, rare, inimitable, and non-substitutable organizational capabilities (Kohli and Grover, 2008). Hence, IT is often an enabler providing manifold opportunities to leverage organizational capabilities impacting business value (Melville et al., 2004). In this section we illustrate the proposed methodical approach schematically. Basically, we try to lay out the idea behind this approach. We use an example from corporate management research adopted from (Patas, Mayer, Goeken, and Wippel 2012b). We chose this particular example because the article discusses the business value of IT in conjunction with a prescriptive MM designed under consideration of empirical data. Originally, the underlying MM was designed by (Lahrmann et al. 2011) using the Rasch algorithm and complies with the DP for prescriptive MMs (Pöppelbuß and Röglinger 2011). Patas et al. (2012b) have extended this MM applying multi case study research in the global chemical sector. For every maturity level they surveyed instances for the six IT asset classes as follows (Patas et al. 2012a): Technological assets, technological quality assets, IT external relationship assets, human assets, knowledge assets, and (IT related) business assets.

Our approach grounds on the assumption that advancing within a MM correlates with the evolution of the maturity of an (IT) capability (Becker et al., 2009). Predictive MMs help to increase the business value contribution by advising which instances of IT resources have to be deployed to reach the next maturity level. In Figure 4 we illustrate for the dimension reporting capability – as it proceeds through the maturity levels – how business value from IT resources can be exploited. We only show the development of IT business value exemplary for the class *technological assets* in order to keep complexity of this example low. It shows which IT assets have to be deployed at every maturity level.

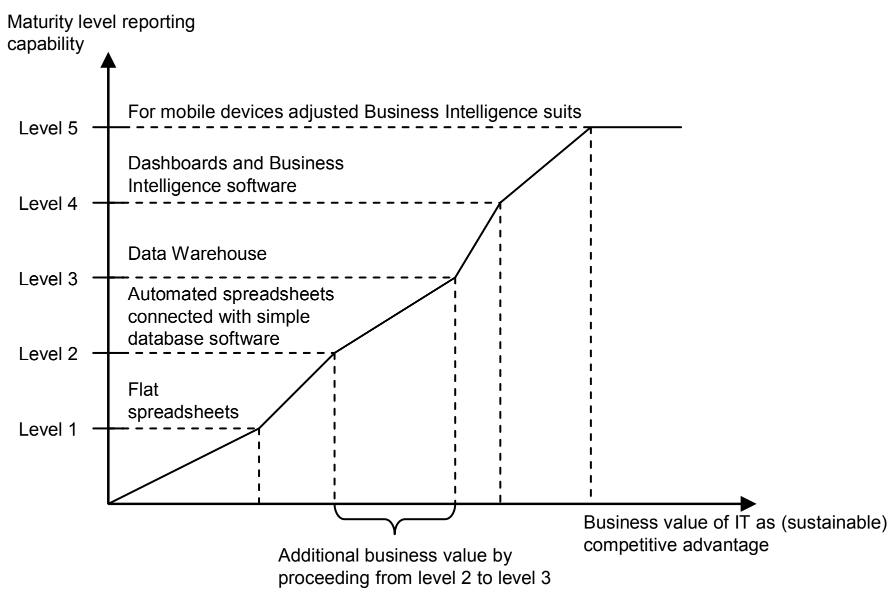

Figure 4. IT Business Value Creation by Leveraging Reporting Capabilities through IT Technological Assets.

Basic reporting capabilities on *level 1* are predominantly based on office tools and in particular on flat spreadsheets. In consequence, reporting is error-prone and very time-consuming because required data has to be collected manually. Within the reports every single change in reporting requirements entails "hard-coded" adjustments on the implemented logic, for instance within Visual Basic for Applications (VBA). Necessary data has to be manually inserted and typing errors are common. IT business value in terms of a competitive advantage cannot be expected at this maturity level because these technological assets are widely spread in practice and can be termed as standards not satisfying any of the given resource attributes. Although these tools account for office automation and can speed up paper work, poorly trained and insufficiently skilled employees can cause even a competitive disadvantages, if they destroy reporting logic while making adjustments.

Lifting reporting capabilities to maturity *level 2* requires the implementation of fully automated spreadsheets that utilize databases to store relevant data for reporting. Such a ‘self-made’ software supported reporting accelerates the creation of reports and adds reliability to the reported data because typing errors are reduced as data flows automatically from databases. Although, the attributes value, rarity, non-substitutability remain low and inimitability stays high, productivity rises (efficiency part of IT business value concept). However, a competitive advantage still cannot be expected but IT business value in terms of efficiency is provided.

To extend reporting capabilities in order to reach *level 3*, data warehouse should be deployed. Through data extraction, transformation, and loading, data can be stored in a proper form ready for further analysis. Because data is cleansed, reporting reliability is further increased and has the ability to lead therefore to more precise management decisions. Additionally, the business value manifests itself as managerial accountants have more time left to accomplish more complex and valuable tasks. The attribute value can be assessed as high, but the other ones remain at the same level as before because data warehouses are more or less commodity. Thus, a competitive advantage still cannot be created.

Level 4 reporting capabilities are considered highly advanced if Business Intelligence (BI) suits are implemented. Using BI suits, data can be easily analyzed and enormously extended data analyses capabilities can be provided by data mining functionalities. Highly reliable reports including numerous overviews can be created only with a few mouse clicks and dashboards intuitively visualize data summarizing the most important KPIs. In this case, value can be rated as high, rarity as medium, non-substitutability as medium up to high and inimitability as medium. At least it is likely that these tools can provide a temporary competitive advantage. One of the best known examples herein is the case of Wall Mart which was able to outperform their competitors by intensively using BI suits.

Reporting capabilities leveraged to maturity *level 5* could enable the establishment of even a sustainable competitive advantage by allowing ubiquitous ad-hoc management decisions and empowering management to immediately react on occurring events. Basically, all features described for maturity level 4 are also valid at this level. But in contrast to level 4, these features are made available anytime and everywhere. Therefore, the highest business value can be expected by using mobile devices for corporate reporting to support ad-hoc managerial decisions.

SUMMARY, CONCLUDING REMARKS, AND FUTURE AVENUES OF RESEARCH

In this article we introduced MMs as methods to manage IT resources for business value. We have primary focused on the differential IT business value, i.e. a (sustainable) competitive advantage. Using an example from corporate management domain, we showed how the methodical approach on hand works in order to manage IT resources for business value.

We are aware of the fact that MMs cannot be considered as a precise method for managing the resources for IT business value at the current development status. This is due to the issue that IT business value in terms of a (sustainable) competitive advantage is a rather hard to measure concept which is tough to capture with easy calculable objective measures. Therefore, we tried to describe how the differential value can be approximated. By grounding MMs in the RBV, the resource attributes can be used to evaluate the value contribution to firm performance of every single IT assets within the IT assets classes along the maturation path. Thus, at the current development status we treat MMs rather as pragmatic methods and to a lesser extend as measurement methods. However, MMs allow managing IT resources for business value in terms of showing which IT assets for the improvement and extension of (IT) capabilities are required on every maturity level. Although prescriptive MMs reveal how to reach out for the next maturity level, it could be reasonable for a certain capability or an IT asset class to remain at the current level. For example, economic issues as high IT expenditures could distract from investing in IT assets which are required on the next maturity level (Röglinger and Kamprath, 2011). Another issue is the selection of a suitable MM from the plethora of MMs found, for example, in Pöppelbuß et al. (2011). Not every MM addresses the right application domain and some of them are too complex. The one used in this paper might be oversized for small or mid-sized companies. However, a recent one should be preferably to comprehend modern IT assets, because attractive ones from former days might turn into commodity a few years ahead (Kano, Seraku, Takahashi, and Tsuji 1984).

Nevertheless, with our presented methodical approach we tried to contribute to both research and practice. The contribution to ISR is to provide grounding for MMs in theory using RBV. Practitioners benefit from our findings as we have explained why and how MMs can be applied to manage IT resource for business value and they are provided with a new easy to use management method.

Future research avenues lead to the demonstration of the applicability of the presented methodical approach using case study research and developing guidelines on how to improve within a MM. Moreover, the proposed method needs to be evaluated against competing methods in the domain of IT business value research. Finally, to turn the method from a pragmatic method into a precise measurement and managing method, the development and deployment of a measurement model is required.

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