How Different Types of IS Assets Account for Synergy-Enabled Value in Multi-Unit Firms: Mapping of Critical Success Factors and Key Performance Indicators

Full paper

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Abstract

Rooted in a longstanding tradition, research and practice strives to determine how to derive business value from IT investments. This applies particularly to the neglected research area of multi-unit firms, where there is still a high potential to enhance IT synergies. Our study addresses important research gaps in IT business value research. First, we investigate how different of types of IS assets, i.e., infrastructural, transactional, and strategic IS, account for cross-unit synergies to create business value. Second, we map critical success factors and key performance indicators of this value creation process in order to open the "grey box" in IT business value research. An explorative multiple-case study methodology with five case sites is applied. Our results reveal that these different types of IS assets account for a different degree of cost and value synergies, support diverse critical success factors, and require distinct measurement approaches in the form of KPIs.

Keywords

IT business value, cross-unit synergies, critical success factors, key performance indicators, case study.

Introduction

Driven by the potential advantages of IT, organizations continue to invest in them heavily. As a result, average IT spending continues to increase. At the same time, IT value–related issues have been regarded as one of the top 10 most important IT management concerns (Kappelman et al. 2014). Therefore, the challenge of how to create, capture, and measure the business value of information technology (IT) investments is an ongoing issue for practice, IS research in general, and accounting information systems research in particular (Vaassen and Hunton 2009). This is especially relevant and challenging for multi-unit firms, where legally independent entities are owned and managed by an administrative and financial center. On the one hand, different business units strive for autonomy to leverage IS for their individual business needs (Tanriverdi 2006). On the other hand, this results in wasteful redundancies, as deploying joint IT resources can enhance beneficial synergies in terms of knowledge sharing (Saraf et al. 2012), cost saving (Tanriverdi 2006), and superior value (Cho and Shaw 2009).

Much effort has been made in IT business value research; the productivity paradox seems to be resolved (Kohli and Grover 2008). Researchers argue that under certain conditions, IT does lead to business value, such as process improvements, financial benefits, and customer satisfaction (Kohli and Grover 2008; Masli et al. 2011; Melville et al. 2004). However, our understanding of how IT leads to value remains incomplete, especially regarding multi-unit firms. First, most studies investigate IT investments at a very generic and aggregate level (Aral and Weill 2007). However, the usefulness of specific types of IS assets may differ across different business objectives as well as environmental and organizational settings (Schryen 2013). Only a few studies disaggregate IS assets into more detail (e.g., Aral and Weill 2007;

Chang and Shaw 2009) and, to the best of our knowledge, no study has examined how different types of IS assets lead to business value in multi-unit firms. Second, research highlights the importance of synergies when accounting for the link between different IS assets and business value (Aral and Weill 2007; Cho and Shaw 2009). This is especially relevant for multi-unit firms (e.g., Cho and Shaw 2009; Saraf et al. 2012; Tanriverdi and Uysal 2011).

Based on these research gaps, we aim to investigate how different types of IS assets are leveraged for value creation in the context of cross-unit synergies. Furthermore, we need an appropriate method to examine how different types of IS assets account for business value achievements. Schryen (2013) proposes the use of critical success factors (CSFs) and key performance indicators (KPIs) as its operationalization to map different types of IS assets and performance effects under the consideration of synergies. However, research on CSF and KPIs in the context of IT business value research is almost nonexistent. For example, Hamel et al. (2012) develop a balanced scorecard including KPIs for multi-unit firms but do not account for different types of synergies and IS assets. Therefore, we address the following two research questions proposed by Schryen (2013) in the special context of multi-unit firms: (1) How do different types of IS assets account for synergies between business units to create business value? (2) How can CSFs and KPIs be mapped in this value creation process?

Because this research field remains nearly unexplored, we conducted an explorative and theory-building multiple-case study. Building upon theoretical foundations in IT business value research and cross-unit synergies, we investigated how multi-unit firms use different types of IS assets to support CSFs, which KPIs they use to measure these CSFs, and which types of synergies occur. Our analysis of five cases including seven interviews resulted in a proposed research model, which provides first insights into this research problem and highlights promising directions for further research.

The paper is organized as follows. First, we explain the theoretical foundations and adapt the research framework of Schryen (2013). Next, we describe the multiple-case methodology of our study. We then analyze the results, including a within- and cross-case analysis. Following this, we discuss the results by proposing a research model, giving directions for future research, and discussing the limitations. Furthermore, we present the theoretical and practical contributions of our study.

Theoretical Foundations

According to Smangs (2006), a multi-unit firm consists of legally independent entities that are owned and managed by an administrative and financial center. However, the degree of control can vary among different firms and their subunits. While in some cases the subsidiaries are fully managed by a central entity, in other cases the central entity only determines the overall strategy, with financial and administrative control rather limited and decentralized. In this instance, the subunits remain largely autonomous and maintain full operational control. The central entity then has a solely coordinating role for governing interactions between the independent units of an organization (Hamel et al. 2012).

IT business value research investigates the impact of IT on organizational performance (Melville et al. 2004). In this study, we adopt the proposed research framework by Schryen (2013) to structure our research. He proposes investigating how different types of IS assets account for synergies and how CSFs and KPIs can be mapped in this process, which matches the research questions (RQs) of our study. In the following, the individual concepts of the framework will be introduced.

To capture types of IS assets we refer to the characterization of Aral and Weill (2007) and consider infrastructural, transactional, and strategic assets for our analysis. However, we explicitely exclude informational IS assets, as informational functions of IS play a key role in cross-unit synergies in general (Saraf et al. 2007; Tanriverdi 2006). *Infrastructural IS assets* provide the basis for both technical and human IT services, such as servers, databases, and help desks. As a result, infrastuctural investments in IS lay the foundation for greater market value and profit as well as lower costs. *Transactional IS assets* are designed for the automation of repetitive transaction processing functions, including, for example, order processing, point-of-sale processing, or billing statement production. Investments in such transactional IS assets are associated with cost reductions and higher profitability. *Strategic IS assets* enable the repositioning of an organization by supporting the entry into new markets or the development of new products or services. Hence, investments in strategic IS assets are typically closely linked to changing business processes and product innovations, leading to competive advantage.

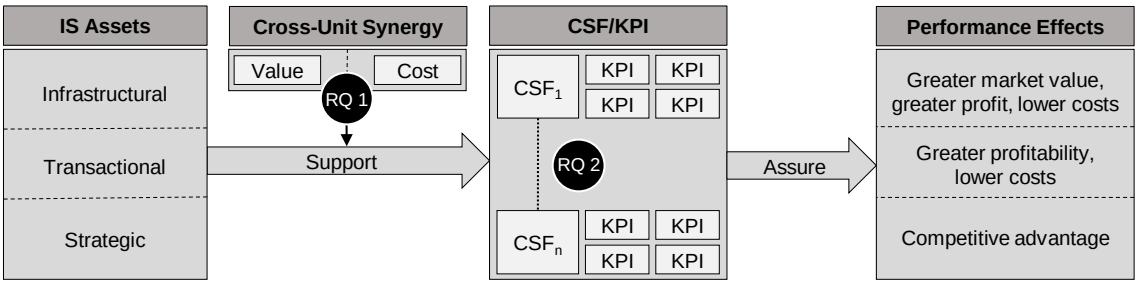

Figure 1. CSFs and KPIs in the Value Creation Process; Adapted from Schryen (2013).

The strategic management literature classifies two types of synergies that can occur between business units (Tanriverdi and Venkatraman 2005; Tanriverdi 2006): (1) Business units create sub-additive cost synergies (or economies of scope) when the joint costs of certain product factors are less than the sum of their individual costs. (2) Super-additive value synergies are created if the joint value of business units is greater than their individual values. According to Cho and Shaw (2009), IT can enhance these synergies in multi-unit firms; While sub-additive cost synergies can be enabled through the use of common IT resources among business units, super-additive value synergies are enhanced through IT in two ways. First, additional value can be created if the value of IS resources of one business unit is influenced by the other business units, but not vice versa. For example, the value of IS assets can depend on the use of a common IT infrastructure. Second, additional value can be interpendent among business units, such as when integrated systems enable the multiple use of data.

CSFs refer to "the limited number of areas in which results, if they are satisfactory, will ensure successful competetitive performance for the organization" (Rockart 1979, p. 85). Traditionally, CSFs are used in IS planning to develop an IS asset portfolio and to evaluate the costs and benefits of IS investments (Peffers et al. 2003). Schryen (2013) suggests that CSFs can be used in a broader field of application in IS research, i.e., analyzing how different types of IS assets account for synergies in the value creation process. KPIs can be seen as operationalization and measures of CSFs (Chaffey and White 2010). In the context of IS assets, KPIs measure the effectiveness and efficiency of IT in strategic key areas (Buchta et al. 2007) – here, accomplishing CSFs.

Particular IS assets support a CSF that assures the achievement of business objectives (Schryen 2013). For example, to improve order fulfilment, "ship to target" is a CSF that is supported by a logistics tracking and a customer order management system. Synergies between these two systems, such as cost reductions through the use of a common IT infrastructure, strengthen this relationship. The effect of these IS assets on business value is mediated through IT capabilities and complementary organizational capabilities.

In this study, we investigate how different types of IS assets support CSFs in the context of cross-unit IT synergies, using the classification of IS assets by Aral and Weill (2007) presented above. Furthermore, we adopt sub-additive cost synergies and super-added value synergies as types of synergies (Tanriverdi and Venkatraman 2005; Tanriverdi 2006) in the context of multi-unit firms (Cho and Shaw 2009). To investigate CSFs, KPIs, and synergies in the context of different types of IS assets more deeply, we exclude capabilities from analysis and leave this area for future research.

Research Design

Since there is no explanation of how specific types of IS assets account for cross-unit synergies or how CSFs and KPIs can be mapped on the value creation process (Schryen 2013), an inductive, theory-building case study approach (Eisenhardt 1989) was selected. The case study method has been recognized as being well suited for understanding the interactions between IT-related issues and organizational contexts (Darke et al. 1998) and has been successfully used in IS research (e.g., Chatfield and Yetton 2000). Furthermore, this method is suitable for studying a current phenomenon deeply and in a timely manner. In addition, case study research provides rich data that might offer novel insights regarding the relations and can be an effective tool for analyzing complex constructs (Yin 2009). However, case study research has often been criticized for a lack of rigor. Therefore, we follow the steps suggested by Dubé and Paré (2003) and explicitly address validity and reliability concerns, which are summarized in Table 1.

Stage	Activities	Description
1. Designing the case study	Prior theorizing	Case studies are based on a predefined model
	Unit of analysis	Multi-unit firms
	Sampling strategy	Diverse case sampling strategy
	Case study protocol	Overview of project Interview guideline
2. Conducting the case study	Data-collection methods	Qualitative semi-structured interviews, internal documents, desk research
	Data triangulation	Multiple sources if information were consolidated and results were compared to increase validity
	Theoretical saturation	Theoretical saturation was reached after seven interviews
3. Analyzing the case study	Early steps in data analysis	Coding of raw data, structuring
	Case analysis	Explanation building
4. Writing up the case study report	Case study reports	Report were written according to a standardized guideline

Table 1. Steps in Case Study Research.

Theory-building case study research does not develop a priori hypotheses. Instead, novel propositions are emerge inductively through the process of field investigation. However, following Eisenhardt (1989), an a priori specification of constructs allows for the shaping of an initial research design and enables a more accurate measurement of constructs. If these constructs can be regarded as relevant when the research progresses, one has a stronger theoretical grounding for the emergent theory (Eisenhardt 1989). Therefore, our interview guideline is based on a predefined model of IT business value in Figure 1, including the type of IS assets, cross-unit synergies, as well as CSFs and relating KPIs. We chose large-scale, multi-unit firms as the unit of analysis to ensure a certain degree of IT maturity and conducted multiple cases studies to enhance robustness and generalizability (Eisenhardt and Graebner 2007). Following a diverse case-sampling strategy, we identified multi-unit firms according to their anticipated characteristics in order to obtain a high level of variance along our relevant constructs. This includes a wide range of centralized and decentralized organization forms. To obtain an in-depth understanding of the research problem, we used semi-structured interviews as the central instrument for data collection. Moreover, we flowed the suggestion of Yin (2009) to also analyze secondary data – such as freely available information and internal documents, e.g., KPI lists – to triangulate our findings. In total, seven interviews covering five different organizations were conducted. Table 2 provides an overview of all case sites.

Characteristics	Organization				
	Case A	Case B	Case C	Case D	Case E
Industry	Forestry	Electronics	Construction	Automotive	Media
Number of major subunits	4	3	5	3	4
Revenue (bn €)	> 10	> 10	< 10	> 10	> 10
Number of employees	< 100,000	> 100,000	< 100,000	> 100,000	> 100,000
Interviewees	Division CIO, Group CIO	Group service CIO	Group CIO	IT governance officer, ITSM strategist	IT governance officer

Table 2. Summary of Case Sites.

All interviews were recorded. Each interview lasted about one hour. The coding procedure followed the deductive content analysis method (Mayring 2007). Two graduate researchers were involved in the case analysis in order to reduce the risk of subjective judgments. Inconsistencies in coding were discussed until a common understanding was reached.

Results of Case Studies

In this section, we present results from both the within-case and cross-case analyses. First, we analyzed the data provided for each case site. For each type of IS asset, i.e., infrastructural, transactional, and strategic, we analyzed the degree of synergies between business units as well as CSFs and KPIs as their operationalization. Synergies were identified according to the definitions of Cho and Shaw (2009) and

classified into super-additive value and sub-additive cost synergies. We were able to identify all types of IS assets in each case study with one exception: The company in Case C was reported to have not adopted

Case Study D: Delta Group	
The Delta Group is one of the largest automotive suppliers in the world and is divided into three major divisions. Each business unit operates in different business areas and has different financial resources available. Two units at the group level – "corporate infrastructure" and "corporate functions" – and a group CIO were established for centralized IT needs. Furthermore, each division enstated a division CIO who manages a decentralized IT department for the individual needs of each division.	
Infrastructural IS Assets	
IS Assets	Infrastructure, such as networks, servers, and terminals, is provided in the form of IT services. This is further supported by service management and reporting IS (e.g., HP asset/service manager, SAP BP, dashboard functions).
Synergies between Units	Infrastructural IS assets are fully centralized in the Delta Group. They are provided by the corporate infrastructure, and the ITIL framework is used to manage these IT services. Hence, the divisions use common IS resources and services, leading to high sub-additive cost synergies. Super-additive value synergies were not observed in this case.
CSFs and KPIs	*Reduce IT costs*: The interviewees characterized the business group as a financially driven network with the reduction of IT costs as an important strategic goal for the whole business group. KPIs: Typical cost indicators in relation to competitors and between divisions exist, for example, *IT costs per employee*, *IT costs turnover*, *IT costs per user*, and *costs per IT service*. *High operational IT performance*: A high reliability of the IT infrastructure is crucial in many areas, such as production lines. KPIs: *Time to respond of systems*, *response ratio*, etc. *High quality of IT services*: Due to the service orientation of the corporate IT infrastructure, an effective and efficient performance of IT services is essential to the Delta Group. In addition, users should perceive the quality of IT services. KPIs: ITIL KPIs (e.g., *number of incidents* and *incident resolution time*) and *user satisfaction score* (measured by surveying employees). *IT agility*: Due to environmental dynamism, the infrastructure should be agile and must be downsized in case of sales declines. KPIs: *Ratio of operative and transformative IT costs*, *Agility Index* (percentage of the IT budget that can be reduced within 12 months without compromising essential services)
Transactional IS Assets	
IS Assets	Transactional IS assets mainly encompass numerous SAP applications as well as business intelligence and supply chain management applications that are provided by a third party.
Synergies between Units	Both sub-additive cost and super-additive value synergies between the divisions are high. All divisions use the same IS resources from a third-party provider, leading to high synergy-enabled cost reductions. As the divisions use standardized applications and interfaces for transactional purposes, IS assets can be highly integrated between business units, leading to a higher output of business processes through, for example, multiple use of information.
CSFs and KPIs	*Improve efficiency of business processes:* Transaction costs of administrative processes (e.g., invoicing) can be reduced by automation through IS, thus contributing to the overall efficiency of business processes for each division. Furthermore, through the multiple use of information across all divisions, the output of business processes is increased. KPIs: *Increased user productivity*, *value per user*, *increased output of business processes through IS*, etc.
Strategic IS Assets	
IS Assets	IS in products and user-driven IS services (e.g., integrated transport systems and highly automated drive) and in business processes (e.g., highly automated CAD systems, eCommerce, and EDI).
Synergies between Units	Due to a high heterogeneity in the business fields of each division, management of strategic IS assets is highly decentralized. Normally, each business unit purchases or develops its own IS to avoid having to coordinate and to speed up time to market. An expert stated, "We intend to have shadow IT in each business unit." Hence, both cost and value synergies are at a low level.
CSFs and KPIs	*Fast product innovation:* Product innovations through IS (e.g., networked cars) are crucial for the Delta Group as it operates in a highly competitive environment. KPIs: The role of strategic IS for supporting product innovation is discussed individually. KPIs such as *increased sales through new products* serve as suggestions but are not really installed. *Align IS with business:* As the Delta Group has business units with different business models and areas, it is important that IS satisfy the individual needs of the business units to create value. The interviewees characterized IS as entirely business driven. KPIs: No KPIs used. *Support business processes:* Crucial processes such as automated supply chain processes are not possible without IS support. KPIs: The division CIO and the process owner discuss support of business processes for each project individually without using standard KPIs.

Table 3. Example Within-Case Analysis of Case Study D.

any strategic IS asset, as their IT infusion is very low and IS assets are only used for operational purposes. An example description of Case D can be found in Table 3.

After we conducted the within-case analysis, we aggregated the data and compared them across all cases. Table 4 depicts the results from the cross-case analysis. Similar CSFs were aggregated; for example, "streamline business processes," "reduce business process costs," and "automate business processes" were summarized to "optimize business process efficiency." The naming and classification of CSFs relied on previous IS studies that developed CSFs (Van Grembergen and Saull 2001; Hamel et al. 2012; Kesten et al. 2007; Rockart 1979). For each CSF, we assigned the extent of KPI use according to the statements of the experts and internal documents in three categories: "no KPIs are used," "some KPIs are used," and "extensive use of KPIs." All KPIs identified for each CSF are provided in the Appendix. It should be noted that some CSFs may be relevant for all firms, but we only considered the most important factors critical for the success of the individual firm. In addition, CSFs from one type of IS asset are also relevant for other types of IS assets. For example, the costs of strategic IS assets must also be monitored and controlled. However, these factors are not critical for the success of these IS assets.

	Case A	**Case B**	**Case C**	**Case D**	**Case E**
Infrastructural IS Assets					
CSFs	Efficient use of IT resources (2), high operational IT performance (2), high quality of IT services (2)	Efficient use of IT resources (2), high operational IT performance (2), high quality of IT services (2), IT agility (2)	Efficient use of IT resources (2), high operational IT performance (2), high quality of IT services (2)	Efficient use of IT resources (2), high operational IT performance (2), high quality of IT services (2), IT agility (2)	Efficient use of IT resources (2), high operational IT performance (2), high quality of IT services (2)
C-synergy	High	High	Mid	High	Mid
V-synergy	/	/	/	/	/
Transactional IS Assets					
CSFs	Optimize business process efficiency (2)	Optimize business process efficiency (1)	Optimize business process efficiency (1)	Optimize business process efficiency (1)	Optimize business process efficiency (1)
C-synergy	Mid	High	Low	High	Mid
V-synergy	High	Mid	Low	High	Low
Strategic IS Assets					
CSFs	Align IS with business (0), improve customer satisfaction (1), enable/ support business processes (0), manage external relationships (0)	Align IS with business (1), improve customer satisfaction (1), enable/ support business processes (0), manage external relationships (0)	/	More product innovation (1), align IS with business (0), enable/support business processes (0)	More product innovation (1), improve customer satisfaction (1), manage external relationships (1)
C-synergy	High	High	/	Low	Low
V-synergy	Mid	High	/	Low	Low

C-Synergy = Sub-additive cost synergy, V-synergy = Super-additive value synergy.
(2) = Extensive use of KPIs, (1) = Some KPIs are used, (0) = No KPIs are used.

Table 4. Summary of Case Sites.

Discussion and Conclusion

It is beyond the scope of this paper to describe each CSF and KPI entirely. Instead, we will discuss similarities and differences among the cases, identify patterns, and theorize how different types of IS assets account for cross-unit synergies and how CSFs and KPIs can be mapped in this process. The theoretical linkages are summarized in Figure 2.

Infrastructural IS assets have a high potential for sub-additive cost synergies – in three cases we observed a high level of this synergy type and in two cases a medium level. This can be explained by the ease of IT infrastructures to be configured to meet the specific needs of each business unit and to be dynamically allocated through remote access (Tanriverdi 2006). Therefore, multi-unit firms must support the efficient use of IS resources and ensure operational excellence in a technical and service-oriented way through infrastructural IS assets, which are amplified by sub-additive cost synergies. Furthermore, in two out of three cases with a high sub-additive cost synergy, we identified IT agility as a CSF. Hence, a high level of cost-enabled synergy supports not only the efficient use of IT resources but also their dynamic allocation due to environmental concerns. The reason that we did not observe this CSF in Case A might lie in the fact that the wood industry in Germany has a very low level of IT diffusion (Trang et al. 2014). In addition, we did not find super-additive value synergies enhanced through infrastructural IS assets. This might be because IT infrastructure does not have any strategic and competitive value, as this type of resource is widely available on the market and can easily be duplicated by competitors (Bhatt and Grover 2005). This seems to apply for more complex IT infrastructure in the context of multi-unit firms as well.

Across all cases, we found that the achievement of business process efficiency is the only critical success factor achieved through transactional IS assets. In this context, transactional IS assets seem to not differ from single-unit analysis (Aral and Weill 2007). However, we found that both sub-additive cost synergies and super-additive value synergies amplify the support of business process efficiency through transactional IS assets. The former type of synergy was observed through the reuse of technical components and applications across different business units. Moreover, cross-unit synergies are even possible without compromising the autonomy of business units necessary to satisfy their business needs. For example, in Case A, each business unit has financial autonomy regarding investments in transactional IS assets. However, the central IT unit manages and coordinates synergies through, for example, regular IT strategy meetings and the exchange of IT employees. Super-additive value synergies were observed through the multiple use of information derived from transactional IS. For example, in Case B the business units share customer segments. Information about customers, which is collected through transactional IS assets, is shared across all business units and thus enhances super-additive value.

We observed sub-additive cost and super-additive value synergies through strategic IS assets at different levels. However, there seems to be a tradeoff. For example, in Case A, division CIOs have regular meetings to discuss the overall business group IT strategy and to specify technical standards for all IS assets. This leads to high sub-additive cost synergies by reusing technical components and also to a medium degree of super-additive value synergy through knowledge transfer between IT projects in different business units. Similar effects were observed in Case B. However, being flexible and fast regarding IS-enabled product innovations is not critical for success in these cases. In contrast, in Cases D and E, individual business units need to react fast to environmental changes, such as upcoming rival products. For example, an expert in Case E stated, "We are evaluated by our customers based on how fast we can react to their needs. […] When we provide such IS centrally to create synergies, it takes about three to six months. That doesn't make sense. Therefore, we want to react extremely flexibly to customer needs and this is where competitive advantage is defined. […] If you talk to the heads about IT services and how they can enable new business opportunities, we are very 'granular' in each business." As described in Table 3, the same applies to Case D. Hence, although synergies might amplify the relationship between strategic IS assets and the achievements of CSFs, such as supporting business processes and achieving IT alignment, they might also dampen certain CSFs, such as developing more product innovations. Future research is necessary to investigate how multi-unit firms can handle both synergies and flexibility ambidextrously.

The use of KPIs decreases from infrastructural over transactional to strategic IS assets. In all cases, we observed an extensive use of KPIs regarding sub-additive cost synergies of infrastructural IS assets. All business groups investigated use highly formalized and quantitative KPIs in this context. To consider the synergies through infrastructural IS assets, KPIs are aggregated into different levels and used to measure, for example, the development of IT costs in different business units. Furthermore, as infrastructural IS assets are provided by central or outsourced service centers, the quality of IS services is operationalized by various KPIs considering business unit needs. Regarding the optimization of business process efficiency through transactional IS assets, only a few KPIs were used across all case studies – mostly for highly standardized processes across all business units, such as invoicing. For more business-oriented processes, the quantification of synergy-enabled performance effects is more challenging. For example, an expert in Case D stated, "We integrated a production planning system in one of our tire plants. Afterwards, we

found out that the output was raised by 4% and felt great. However, logistics then said that they changed the product portfolio and that enhanced the efficiency, not our IT system." We observed such problems across all cases. Although research states that value of IS first affects – and thus can be best measured at – the process level (Ray et al. 2005), capturing cross-unit synergies seems to be challenging in this context, requiring new methods and KPIs. Regarding synergies of strategic IS assets, we found little to no KPI use across all cases. Although managers should quantify costs and benefits in reasonable situations (Gunasekaran et al. 2006), strategic IS assets mostly lead to intangible benefits (Irani and Love 2002). Hence, it is challenging and often not useful for firms to quantify such effects and use rather qualitative approaches (Irani and Love 2000). This especially holds true for cross-unit synergies, where interdependencies of costs and benefits through strategic IS assets are amplified and value is even more difficult to isolate. Furthermore, this is reinforced by the ambidextrous relationship described in the last paragraph. Therefore, future research should develop appropriate frameworks for strategic IS assets related KPIs in order to capture IT-enabled cross-unit synergies.

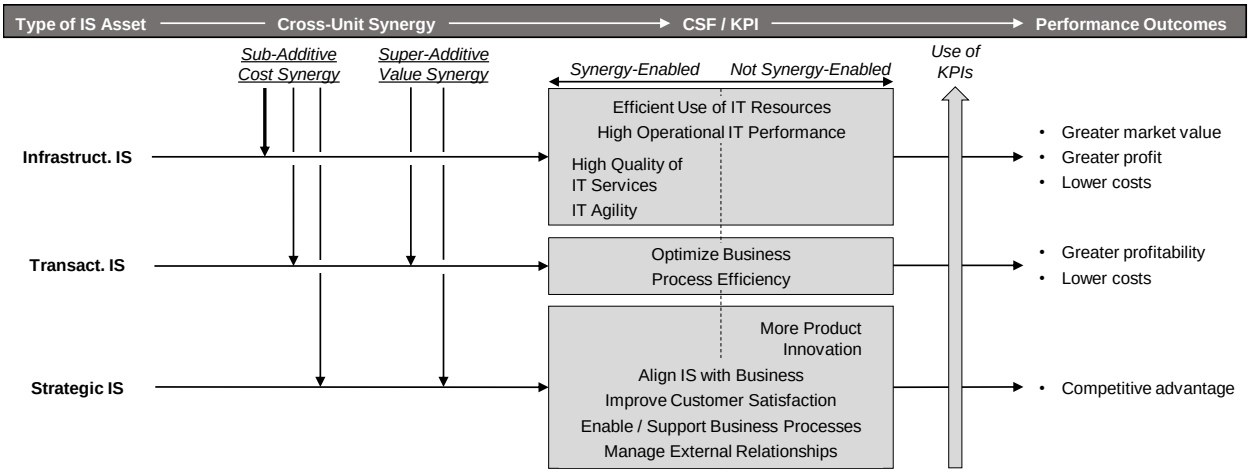

Figure 2. Proposed Relationship between IS Assets, Cross-Unit Synergies, CSFs, and KPIs.

Our study aims to investigate a future research direction proposed by Schryen (2013) and thus contributes to IT business value research. We find that the disaggregation of IS assets into infrastructural, transactional, and strategic IS can be valuable as these IS types account for different types of cross-unit synergies. Furthermore, by exploring and mapping CSFs and KPIs on this process, we made a first step in opening the "grey box" (Schryen 2013). This helps to illuminate how different types of CSF are supported by IT-enabled cross-unit synergies and to what degree the accomplishment of these CSFs can be measured by KPIs. Moreover, the application of our results is not restricted to multi-unit firms. First, the results can also be transferred to other networked relationships, such as buyer–supplier relationships, thus also contributing to the field of IT-based value co-creation (Grover and Kohli 2012). Second, we made a first step in applying the CSF and KPI method to IT business value research in the context of different types of IS assets, which can serve as a suggestion for future studies in this research area.

The study is also expected to help multi-unit firms facing challenges in managing and measuring synergies of different types of IS assets, thereby contributing to managerial needs as well. Multi-unit firms should distinguish among different types of IS assets regarding investment decisions and make appropriate prioritizations to maximize return. Furthermore, the proposed KPIs can be easily adopted in any multi-unit firm that aims achieve CSFs through IT-enabled synergies.

However, the results of our study must be interpreted with caution due to the following limitations. First, we followed the suggestions of Eisenhardt and Graebner (2007), conducting multiple case studies to enhance robustness and repetitiveness. However, as the generalizability of case study methodology is still limited, more empirical work is necessary to validate our findings. Second, other factors – such as the heterogeneity of business groups, the strategic importance of IS, and environmental considerations – might influence both synergies between business units as well as supported CFS (Bhatt and Grover 2005; Cho and Shaw 2009; Saraf et al. 2012). Furthermore, IT business value researchers broadly agree that IT capabilities and complementary organizational capabilities create competitive advantage rather than

investments in IS assets per se (Bharadwaj 2000; Melville et al. 2004). Hence, further research should extend our results by taking other organizational and contextual factors into account. Third, we did not compare how successful IS assets were leveraged in our cases in terms of performance effects. However, it would be promising to investigate the extent to which synergies amplify performance effects of different asset types and whether the reliance on KPIs influences this relationship. Fourth, we classified IS assets into three types and found different degrees of synergies and the support of diverse CFS. However, a more granular classification of IS assets could reveal additional insights into value creation in multi-unit firms.

Appendix

Type of IS Asset	**CSFs and Related KPIs**
Infra-structural	Efficient use of IT resources: IT overall costs, IT costs per business unit, IT costs as a percentage of turnover, IT costs per employee, total number of IT employees, IT employees per business unit, total cost of ownership, depreciation and maintenance costs, IT implementation costs. High operational IT performance: Solution rate, response time, production loss through breakdown, up-time, capacity, workload. High quality of IT services: User satisfaction, incidents per service, incidents per user, service maturity level, number of incidents, service quality, net promoter score. IT agility: Agility Index, development costs vs. operational costs.
Transactional	Optimize business process efficiency: Enhanced user productivity through automated processes, value added per user, reduced transaction costs, reduced working capital, reduced inventory costs, output increases through IS.
Strategic	More product innovation: Additional turnover / gross margin through IT-enabled product innovations. Align IS with business: Index by surveying division employees, percentage of business group goals supported by IT goals. Improve customer satisfaction: Increased turnover per group of customers, survey index. Enable/support business processes: None. Manage external relationships: None.

Table 5. Example List of KPIs Identified.

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