

Shared Domain Knowledge in Strategic Green IS Alignment: An Analysis from the Knowledge-Based View

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Abstract

In this paper, we argue that the inclusion of environmental sustainability aspects increases the complexity of Information Systems (IS) alignment. The business value of IS and their potential to render firms more sustainable can only be leveraged if IS are strategically aligned. The literature from relevant academic disciplines is reviewed to lay a theoretical foundation. We define the term Green IS strategy, introduce a strategy typology, and integrate environmental aspects into Green IS alignment. The alignment process is determined by social aspects that are analyzed from the knowledge-based perspective in this research. We find that sharing of knowledge between the domains of business, IS, and sustainability is a premise for Green IS alignment. In this context, the importance of internally transferring tacit knowledge between different organizational actors on corporate, competitive and functional level is emphasized. Finally, we discuss implications for research and practice and make recommendations for further research.

1. Introduction

In the last years, the political and societal debate about climate change has intensified significantly. Business executives and politicians start to realize that the indispensable development towards a more sustainable economy will be the central principle of corporate management in the 21st century. Lubin and Esty [28] identify sustainability as the next macro-economic 'megatrend' that will alter markets and business models. Sustainability-oriented management is expected to induce disruptive innovations, thus influencing market characteristics on a macro-economic scale. In the recent economic downturn, the G20 governments have invested \$400 billion of their stimulus funds in clean technologies and sustainability initiatives [28]. But although the need for a fundamental transformation of economic activities is indisputable, the identification of effective measures proves to be challenging.

The environmental impact of information technology (IT) is addressed by the IS research community under the headline of *Green IT*. This stream of research mainly focuses on energy efficiency enhancements of initiatives that result in the reduction of operational costs and carbon dioxide emissions – and thus have a positive financial and environmental impact [10]. However, Green IT measures typically have a limited scope, whereas Green information systems (IS) initiatives have a broader potential. Green IS do not only address the negative environmental impacts of IT, but are seen as enablers for reductions of the environmental footprint of the entire organization by driving a transformation of the firm, e.g., through the reengineering of business and production processes [46].

Apart from environmental aspects, IS are essential for business processes and strategy nowadays [9]. Indeed, companies can only benefit from the potential of IS, leading to improved organizational performance, if information systems are strategically aligned with the core business [26]. The alignment of IS and business strategy is a topic that is discussed by the IS community for a long time and it is one of the most challenging tasks for Chief Information Officers (CIOs) [29]. To leverage the potential of Green IS, the new challenges concerning environmental sustainability must also be considered in the IS strategy. Thus IS strategy must not only be aligned with the business strategy, but with the corporate sustainability strategy as well. This additional dimension of strategic alignment makes the challenge of effective and efficient deployment of IS even more difficult. Since this topic has not been addressed by the IS research community until now, we formulate the following research question:

RQ1: How can aspects of environmental sustainability be integrated into strategic IS alignment?

The effectiveness of strategic alignment has been studied under the theoretical lens of the knowledge-

based view due to the fact that IS alignment has a social and an intellectual dimension [40]. In this context, it is argued that strategic alignment is closely linked to knowledge transfer and sharing of domain knowledge. Alignment requires the internal transfer of knowledge from IT executives to business executives and vice versa, resulting in a shared understanding of business, sustainability, and IS. Referring to this, we define our second research question:

RQ2: Which organizational actors are involved in the internal transfer of knowledge between organizational units being relevant for Green IS alignment?

To answer these research questions, the paper is structured as follows. After the introduction we lay the theoretical foundation for analyzing Green IS alignment. We discuss strategic aspects of sustainable management and propose a definition for the term *Green IS strategy*. We then introduce a typology of four distinct Green IS strategies that was developed in prior research and assists IS and business executives to conceive the competitive potential of Green IS. Next, we integrate aspects of environmental sustainability into the process of strategic alignment and identify domains and management levels being relevant for the alignment of Green IS, thus addressing RQ1. In section three, we review extant literature referring to the concept of strategic IS alignment from the knowledge-based view. We introduce the concepts of internal knowledge transfer and shared domain knowledge. Next, we present enablers of alignment that refer to the social dimension of this process. Based on these theoretical insights and referring to RQ2, we analyze the specific characteristics inherent to Green IS alignment. We classify this research and identify organizational roles that are involved in the Green IS alignment process. We consolidate our insights from the theoretical discussion and formulate propositions that describe characteristics of Green IS alignment on corporate, competitive, and functional level. Finally, we summarize the results of this work, discuss implications for research and practice, and indicate areas of further research.

2. Theoretical Background

2.1 Environmental Sustainability in Strategic Management Research

Sustainable management practices regard the impacts of the firm under consideration of the triple bottom line, referring to a long-term process of simultaneously optimizing economic, environmental and social outcomes to ensure the enduring activity of business

operations. Sustainability "is in the process of becoming a competitive and strategic issue" [12]. Corporate sustainability has gained in importance for companies due to rising pressure from stakeholders [17], but most organizations regard sustainability as a complex challenge without recognizing related opportunities [5]. Environmental issues are associated with risk reduction and cost-cutting, but technology-related overall strategies that create competitive advantages and sustainable, profitable growth, can hardly be found until now [35].

Apart from the fact that sustainable business practices are an essential condition for the future of our society, sustainability-related innovations are appreciated by consumers who increasingly reflect this attitude in their preferences and buying behaviors [28]. Environmental commitment can differentiate a business firm from its competitors while enhanced efficiency of processes comes along with higher productivity and improved firm competitiveness [35]. There is empirical evidence for a positive relationship between corporate responsibility and firm performance [14].

Stead, Stead and Starik [41] define sustainable strategic management (SSM) as "strategic management processes that are economically competitive, socially responsible, and in balance with the cycles of nature. [...] SSM strategies are integrative and designed to develop long-term competitive advantage of products and services by simultaneously enhancing the three dimensions of sustainability." The authors differentiate between strategies on corporate, competitive and functional level. They claim that corporate strategy should be guided by triple bottom line thinking and that sustainability strategies on competitive level should focus eco- and socio-efficiency. The sustainability goals are achieved by the implementation of SSM strategies, techniques and processes (such as life cycle analysis, triple bottom line accounting and sustainability reporting) on the functional level.

Olson [34] emphasizes the crucial significance of aligning sustainability strategies with business, IT, and technology strategies. A holistic approach, involving various domains such as IT product and service design, supply chain optimization and reengineering of business processes, is required to make IS an important enabler of sustainability [44]. Thus IS strategies must consider the impact that Green IS can have on firm competitiveness and environmental sustainability.

2.2 Defining Green IS strategy

To facilitate a common understanding of the key terms, we now define 'Green IS strategy' and its underlying components. The term *green* refers to technologies and

processes that are environmentally friendly, i.e., which have a lower negative impact on the natural environment than conventional ones. The environmental impact of green technologies refers to the environmental footprint during their lifecycle [31] while the environmental impact of green processes refers to the reduced need for input resources, decreased pollution, and the reuse of materials [2].

The term *Information Technology* (IT) is applied to describe computer hardware, software, and peripheral equipment [21]. The concept of *Information Systems* (IS) “combines both the technical components and human activities within the organization as well as describing the process of managing the lifecycle of organizational IS practices” [8]. IS comprise Information and Communication Technologies (ICT) (such as physical servers, office computers and network devices), shared services (such as databases or storage), and business applications (such as ERP systems). Furthermore, IS include IT human resources (such as skills and knowledge), and the IT managerial capability for organizational core activities and business transformation [38].

Green IT practices are mostly focused on the IT energy consumption of data centers and computers in the office environment, whereas the cross-functional characteristics of *Green IS* facilitate environmental management systems and the reinvention of business and production processes [10], [13]. Molla and Abareshi [31] argue that *Green IT* refers to the negative first-order environmental impact (production, use, and disposal of IT), whereas *Green IS* refer to the positive second-order impact (greening of business and production processes) and third-order impact (reduced environmental impact of the end product’s lifecycle) as well [19]. In line with Watson, Boudreau and Chen [46], we argue that *Green IS* (which includes *Green IT*) has a wider scope and encompasses all IS-based initiatives, allowing for a reduction of the environmental footprint of the entire organization.

To elucidate the difference between *Green IT* and *Green IS*, we provide some practical examples: Currently firms mainly focus on the implementation of mainstream *Green IT* measures (hardware procurement and energy-efficient operations) since the reduction of IT-based energy consumption is directly linked to cost savings [6]. *Green IS*, by contrast, promise a much greater, organization-wide potential to measure, monitor, report and reduce the firm’s environmental footprint, but the transformation of the business with the help of *Green IS* requires a holistic long-term strategy [32]. *Green IT* tackles the decrease of IT-related power consumption that accounts for approximately 2 % of global greenhouse gas emissions (“IT as a problem”) while *Green IS* allow for

innovative solutions that address the remaining 98 % (“IT as a solution”) [13].

In the context of this research, we adopt an organization-centric conception of *IS strategy*, which is defined by Chen et al. [8] as “an organizational perspective on the investment in, deployment, use, and management of information systems”. In this conception, IS strategy has an organization-wide scope, is an integral part of corporate strategy, and is not limited to specific business units. It can support competitive strategies as well as it can shape them [18], depending on the role of IS within the organization. This role depends on the shared view and managerial perception of IS infrastructure and capabilities while the specific business requirements are fulfilled through dynamic alignment. In line with Chen et al. [8] and Elliot [13] we define *Green IS strategy* as follows:

Green IS strategy is the organizational perspective on the investment in, deployment, use and management of information systems (IS) in order to minimize the negative environmental impacts of IS, IS-enabled products and services, and business operations.

2.3 Integrating Aspects of Environmental Sustainability into Strategic IS Alignment

Based on these theoretical insights, we now address our first research question. For achieving alignment of *Green IS* strategies, we propose to extend IS/business alignment by the integration of sustainability aspects. In section 2.1, three relevant alignment domains (business, *Green IS*, environmental sustainability) and three levels of strategic management (corporate, competitive, functional) were identified. This results in nine strategic fields. As presented in figure 1, *Green IS* must take into account the business domain as well as the environmental sustainability of the organization and its products.

	BUSINESS DOMAIN	GREEN IS	ENVIRONMENTAL SUSTAINABILITY
CORPORATE LEVEL	Corporate Strategy	Organization-wide Role of Green IS	Corporate Environmental Footprint
COMPETITIVE LEVEL	Competitive Strategy	IS-related Product Characteristics	Sustainable End Products
FUNCTIONAL LEVEL	Business & Manufacturing Processes	IS-enabled Processes	Internal Process Efficiency

Figure 1. Domains and Levels of Green IS Alignment.

The corporate strategy level is the overarching construct of the corporation that facilitates strategic direction. Corporate strategy envisions a long-term

perspective of corporate development and gives guidance for decision-making. The corporate sustainability strategy focuses on the environmental footprint of the entire organization, formulates a sustainable long-term vision and determines the attitude of the corporate management towards environmental topics. Its goal is to integrate the triple bottom line thinking into all levels of the organization and it defines the major goals of the corporation with reference to sustainability. The strategies at corporate level strongly shape values and mindsets – and thus influence corporate culture and public perception of the organization. The Green IS strategy at corporate level defines the organization-wide role of Green IS. As explained above, this role is determined by the perception of Green IS through the corporate management.

The competitive strategies of the business units strive for the achievement of competitive advantage through specific positioning in the target markets under consideration of competitors. Sustainability strategies at competitive level focus on the business case for cleaner production technologies and green products and are strongly context-dependent. Environmental measures that target internal processes can improve resource efficiency and reduce costs whereas market-oriented green products can enhance revenues and profitability through product differentiation. Green IS strategies at this level can either support the business strategy in a reactive manner or they can shape the business strategy proactively. The focus of distinct Green IS strategies differs widely.

While competitive strategies determine a firm's position in a specific market, the actual value is created inside the firm, guided by its functional strategies. On this level, firm-specific resources and capabilities constitute the basis for the competitive advantages that are accentuated and focused by the higher-order strategies. Functional strategies determine the operations and processes of the different departments of the firm. The major goal of functional strategies is the achievement of effectiveness and efficiency. Sustainability strategies can foster redesigning of business and manufacturing processes. This increases the production efficiency and decreases resource consumption and waste disposal costs. Differentiation can be enabled through Design for Environment. This approach aims at reducing the product's environmental footprint, which can represent a unique customer value for both ethical and economic reasons [2]. Green IS can enhance resource efficiency of internal business and production processes through automation, material management, and travel reductions. Moreover, processes can be redesigned with innovative technologies under the premise of superior efficiency.

In this way, the environmental footprint of the organization can be decreased. On the other hand, technological innovations have found their way into numerous products, from traffic management systems to smart homes. These new technologies decrease the environmental footprint of end products and facilitate differentiation from competitors [35].

Obviously, the trend towards corporate sustainability adds a third dimension that must be considered in strategic IS alignment. For this alignment, the corporate, competitive and functional levels of strategic management are relevant and must be addressed by Green IS strategies.

2.4 Introducing a Typology of Green IS Strategies

To illustrate how Green IS can be deployed in a strategic way, we now introduce a typology of Green IS strategies [27]. This typology consists of four generic Green IS strategies which address corporate, competitive and functional level. These generic strategies outline four different approaches of defining the organization-wide role of Green IS and can guide the formulation of strategic targets for Green IS under consideration of different firm contexts. The characteristics of the distinct Green IS strategies are illustrated in table 1.

Table 1. Typology of Green IS Strategies [27].

	Green IS for Efficiency	Green IS for Innovation	Green IS for Trans- formation	Green IS for Credibility
Corporate level: organizational perspective on Green IS	Green IS are used to reduce costs	Green IS are used to achieve environmental technology leadership	Green IS are used to achieve business leadership	Green IS are used to improve stakeholder satisfaction
Competitive level: strategic goal of Green IS	Implement business strategy	Foster innovation	Reengineering of business processes	Minimize environmental impacts
Functional level: sources of competitive advantage based on Green IS	IS support competitive strategies by enhancing internal process efficiency	IS improve environmental characteristics of product lifecycle	IS support environmental strategies by decreasing footprint of internal processes	IS improve footprint of the enterprise and of end products

The *Green IS for Efficiency* strategy corresponds to the organization-wide target of superior resource efficiency as part of a corporate sustainability strategy that seeks cost leadership. This is probably the most

prevalent strategy at this moment and appears to be adequate for mass-volume producers with intense industrial processing in particular. Business success is imperative and profitability is an absolute necessity for all kind of environmental initiatives. Corporate management perceives environmental sustainability as a means to support the traditional core business. The main goal of Green IS strategy on competitive level is to support and implement the prevalent business strategy. IS are not part of the end product and on functional level, Green IS measures aim to enhance the efficiency of internal processes to facilitate operational cost reductions.

The *Green IS for Innovation* strategy is appropriate for companies that strive for environmental technology leadership. The corporate sustainability strategy aims at environmental innovations which differentiate the firm from its competitors. At competitive level, the strategic goal is to develop products with superior ecological characteristics the customers are willing to pay for, i.e. products which have an exceptionally low environmental impact during their lifecycle based on environmental innovations. Green IS play a significant role at functional level to build IS-based capabilities for environmental management and innovation.

The *Green IS for Transformation* strategy aims at industry leadership with the help of a profound business transformation fundamentally based on environmentally-friendly processes which are enabled through Green IS initiatives. This strategy is reasonable for companies from the service industry where core business processes and products are based on IS. For these companies, IS are critical to the achievement of competitive advantage which aims at a business leadership position based on low cost and low environmental impacts. This is a suitable approach in highly price-sensitive markets. The competitive strategy is shaped by the organizational transformation which is driven by Green IS. On the functional level, this strategy seeks for business process reengineering that allows for a cost and environmental leadership position.

The *Green IS for Credibility* strategy aids companies that pursue sustainability with a more holistic approach. This strategy aims at becoming a "good corporate citizen" by taking the claims of internal and external stakeholders into account. Transparency and credibility are major goals of the company and the corporate reputation is understood as a valuable asset. The top management anticipates that the extraordinary dedication for sustainability leads to a first-mover advantage and pays off in the long-term. The competitive strategy is shaped by the opportunities that emerge from the consequent implementation of Green IS. Firms pursuing this strategy even invest in

unprofitable Green IS initiatives with the goal of reducing first, second and third order environmental impacts. Green IS are part of the end product and enable competitive differentiation. The positive corporate image helps to attract new customers and to intensify the relationships with existing ones.

3 Strategic Alignment from the Knowledge-Based View

3.1 Knowledge Transfer and Shared Domain Knowledge

In the literature of strategic management and IS research, the knowledge-based view, which is related to the resource-based view (RBV), has recently gained in importance. This theory is rooted in concepts being studied in psychology, sociology, and evolutionary biology [11]. Knowledge can be defined as "a justified belief that increases an entity's capacity for effective action" [1]. Knowledge is held by individual employees and it is mandatory for the utilization of tangible resources within a business firm. Knowledge can represent a state of mind, an object, a process, a condition, or a capability.

The knowledge-based view considers knowledge as a unique firm resource and understands the internal transfer of knowledge between different business units as a unique capability. From this theoretical perspective, knowledge sharing between different domains is decisive to enhance the building of core competencies and strategic know-how [1]. Grant [15] explains that "at the heart of this theory is the idea that the primary role of the firm, and the essence of organizational capability, is the integration of knowledge". The integration of knowledge is understood as the sharing and combination of knowledge between different business units that facilitate the effective application and creation of new knowledge [26]. Since knowledge-based intangible resources can hardly be imitated, they can result in a long-term competitive advantage [1].

However, knowledge-based competitive advantage is not rooted in the knowledge itself but in the effective application of the knowledge. For this reason, knowledge transfer plays a critical role. According to Tsai [43], "organizational units can learn from each other and benefit from new knowledge developed by other units. Organizational units are embedded in a network coordinated through processes of knowledge transfer and resource sharing." Argote and Ingram [3] state that "knowledge transfer in organizations is the process through which one unit (e.g. group, department, or division) is affected by the experience of another."

Grant [16] argues that the transferability of knowledge depends on the type of knowledge. Explicit knowledge refers to knowing about facts and can be shared through communication, whereas tacit knowledge, which is related to know how, can only be revealed through its application. Kearns and Lederer argue that tacit knowledge can be transferred among executives through the participation in strategic planning processes [24]. The collaboration of executives from different domains of the same organization leads to the application of their tacit knowledge. The outcome is the formulation of explicit strategies that are based on shared domain knowledge.

Nelson and Cooprider [33] classify shared domain knowledge as mutual understanding of executives from different domains, which is characterized by appreciating the needs, constraints, and contribution of each other. Reich and Benbasat [40] define shared domain knowledge as "the ability of executives [from different domains], at a deep level, to understand and be able to participate in the others' key processes and to respect each other's unique contribution and challenges." In line with the three managerial levels that were identified as being relevant for Green IS alignment (section 2.3), Ranganathan and Sethi [36] argue that domain knowledge should be shared by top managers, executives, and functional managers.

We conclude that shared domain knowledge is decisive for the formulation of strategies that address multiple domains of the business organization. Explicit knowledge can be shared through communication, whereas tacit knowledge can only be shared through its application, e.g., through the participation of executives from relevant domains in collaborative planning processes.

3.2 The Social Dimension of Aligning IS and Business Strategy

Alignment between business strategy and IS strategy implies that IS support and leverage critical processes of the core business effectively [4]. Kearns and Lederer [24] explain that the alignment process is a unique firm capability. As a consequence, IS alignment converts the infrastructure technologies, which are equally available to all firms, into a source of competitive advantage. Wade and Hulland [45] underline the significance of internal relationships between the IS department and other organizational units of the firm.

Through reviewing the relevant literature, we identified and consolidated enablers of strategic alignment (see table 2). It becomes obvious that the social dimension, the shared domain knowledge in particular, is of major

significance for the effectiveness of strategic alignment between the IS and business domain.

Table 2. Enablers of IS/Business Alignment.

Source	Enabler of Strategic Alignment	Social Dimension
Luftman and Brier (1999) [30]	Senior executive support for IS	X
	IS executives involved in strategy development	X
	IS executives understand the business	X
	Well-prioritized IS projects	
	Business/IS partnership	X
	IS demonstrates leadership	
Kearns and Lederer (1999) [23]	Alignment as bilateral process	
	Communicate corporate strategy (mission statement, objectives, competitive strategies) to IS management	X
	Integrate IS planning with business planning	X
	Assure top management participation in IS planning	X
Kearns and Lederer (2003) [24]	Knowledge sharing between CIO and CEO can uncover IS opportunities	X
	Collaborative organizational processes for IS and business planning	X
Rathnam, Johnsen and Wen (2004) [37]	Improve business strategy development process	
	Collaborative strategy development between IS and business departments	X
	Define when and how new technology is introduced into strategy development	X
	Focus business needs	X
	Include CIO at executive council	X
Tarafdar and Qrunfleh (2009) [42]	Linking business and IS planning such that strategic IS plans support business plans	X
	Exploit IS-based strategic opportunities by scanning emerging technologies for new products/markets	
	Proactive influence of CIO in strategic planning	X
	Formal and informal contact between CIO, CEO, COO and CFO	X

Reich and Benbasat [40] explain that two different streams of research dealing with the alignment of business and IS can be found in the literature. The first approach focuses on analyzing the structure and applied methodologies of alignment (the intellectual dimension), whereas the second approach investigates "the actors in organizations, examining their values, communications with each other, and ultimately their understanding of each other's domains." In this

research, we focus on shared domain knowledge, which refers to the second approach, the social dimension of strategic alignment. In this context, "strategic alignment of information systems refers to the extent to which the IS mission, objectives, and plans support and are supported by the business mission, objectives, and plans [20].

Kearns and Sabherwal [26] argue that knowledge sharing between the IT department and the corporate management is a necessary prerequisite for linking IS to the strategic targets of the business firm. In this context, they explain that shared domain knowledge is substantial for the understanding and appreciation of the opportunities that recent technologies and IS can provide to the core business. The success of sharing IS and business domain knowledge is determined by the competence, partnership, and communication between these domains. The communication between IT and business executives is a crucial requirement for successful alignment and is determined by communication frequency, technologies, and information flows [22].

4 Shared Domain Knowledge in Strategic Green IS Alignment

In line with our previous argumentation and according to the insights of [24] and [26], we maintain that explicit knowledge can be transferred among business, sustainability, and IS domain via communication, whereas tacit knowledge must be transferred between organizational actors via processes that lead to the application of the knowledge, e.g., strategic planning processes that are conducted by executives from business, sustainability, and IS domain. Kearns and Lederer [24] explain that "this cross-participation is necessary to elucidate the tacit knowledge that often remains undiscovered and is not shared in the organizational knowledge base and to make this personal knowledge explicit at the organizational level. While explicit knowledge might be shared in other ways, tacit knowledge is linked to the individual and must be discovered through a knowledge sharing process."

These processes result in shared domain knowledge [25] and the shared knowledge is expressed through explicit strategies that leverage the potential of Green IS by appreciating IS-related opportunities in a multidisciplinary and holistic way. The sharing of domain knowledge and the collaborative development of strategies is central to the alignment process. The outcomes are aligned strategies and a mutual understanding, which allows for an adequate implementation of strategies at functional level [40].

Referring to research question 2, we now identify organizational actors at corporate, competitive and

functional level that are relevant for the successful alignment of Green IS strategies [7].

4.1 Relevant Actors at the Corporate Level

Role	Responsibility
Corporate Level: Board of directors	
Board of directors	- Ensure an effective strategic planning process - Ratify business, IS, and sustainability strategy - Ensure that sustainability initiatives and IS-based processes complement the business model and support strategic goals
IS strategy committee	- Provide strategy direction and the alignment of IS with business and sustainability issues - Verify strategy compliance
Sustain-ability committee	- Formulate a sustainability strategy - Define firm-wide, measurable sustainability goals - Promote dialogue with stakeholders

On corporate level, the corporate strategy must integrate aspects of environmental sustainability and define the organization-wide role of IS. Thus knowledge sharing between the board of directors, the IS strategy committee and the sustainability strategy committee is mandatory to ensure organization-wide alignment between business, IS and environmental sustainability. The cooperation of the authorities from these three domains in formulating a shared vision is a prerequisite for a consistent long-term strategy [25].

Reich and Benbasat [39] argue that the mindset of top executives and a mutual understanding are more decisive than collective actions. They define long-term alignment as "the state in which [top] business and IT executives share a common vision of the way(s) in which IT will contribute to the success of the business unit" [40]. In the scope of an empirical study they found out that shared domain knowledge of the top management allows for a shared vision that results in long-term alignment (over five years). In line with Reich and Benbasat [40] we encourage research on the alignment process on corporate level and develop our first and second proposition:

P1: Shared knowledge between the business, IS and sustainability domains results in a shared vision of the role and contribution of IS to the firm's business and environmental goals.

P2: A shared vision of the role and contribution of IS to the firm's business and environmental goals is positively associated with long-term Green IS alignment.

4.2 Relevant Actors at the Competitive Level

On competitive level, the communication between the CEO and CIO is crucial to leverage the business value of IS through effective and efficient provisioning of services and processes. It is important that the CEO

appreciates the opportunities that new technologies provide for innovative business practices while the CIO must understand the specific needs and requirements of the business [36]. Equally, knowledge-sharing between CIO and CSO is important to assess the potential of IS in making the firm's processes and products more sustainable while raising awareness for environmental issues in the IT department.

Competitive Level: Executive management	
CEO	- Align and integrate IS and sustainability strategy with business goals - Align IS operations with business processes - Cascade strategy and goals down into the organization
CIO	- Drive IS strategy development and execute against it, ensuring measurable value is delivered, currently and in the future - Educate executives on dependence on IS, IT-related costs, technology issues and insights, and IS capabilities
CSO	- Ensure the implementation of the sustainability strategy throughout the organization - Evaluate business case of sustainability initiatives - Promote sustainability issues and raise awareness among executives and employees

Kearns and Lederer [24] explain that "CIO participation is indicated by attendance at business planning meetings, formulation of business goals, frequent access to the CEO, and regular informal contacts with other members of top management; CEO participation is indicated by regular contacts with the CIO, involvement on an IT steering committee, knowledge about competitors' uses of IT, knowledge about IT opportunities within the firm, and treatment of IT as a strategic resource."

The sharing of domain knowledge through communication and planning processes at competitive level results in a mutual understanding of business, sustainability, and IS strategies, which are harmonized through the alignment process. The commitment towards business goals, environmental targets, and IS plans results in short-term alignment (one to two years) [40]. The alignment at this level assures that the potential of IS-related opportunities to leverage competitive advantage [25] and environmental sustainability are fully exploited. Based on these insights we formulate our third proposition:

P3: Collaborative planning processes between CEO, CIO, and CSO result in aligned strategies that leverage the potential of Green IS in the short term.

4.3 Relevant Actors at the Functional Level

On functional level, steering committees for IS and sustainability should prioritize investments and monitor the implementation of sustainability initiatives. Cooperation between business executives

and these steering committees enables the identification of environmental measures that are implemented through cross-functional teams. By doing so, innovative solutions can be developed and firm competitiveness can be increased through the creation of transdisciplinary knowledge. Sustainability-related knowledge can be assimilated by the employees through information meetings and training.

Functional Level: Supporting committees	
Business executives	- Define the business requirements - Understand IS infrastructure and capabilities - Act as sponsor for sustainability projects
IS steering committee	- Define project priorities - Assess strategic fit of proposals - Perform portfolio reviews - Monitor relevance of latest developments in IT from a business perspective
Sustainability steering committee	- Identify suitable environmental and social initiatives - Provide relevant information to organizational units and encourage sharing of knowledge - Training of employees

The implementation success of the higher level strategies at functional level is dependent on IS-knowledgeable business executives and business-knowledgeable IT managers [36]. We argue that the same is true for the aspects of environmental sustainability. For this reason, sustainability-specific knowledge must be transferred through training to business and IT managers to raise awareness. This leads us to our fourth proposition:

P4: Implementation success of Green IS strategies depends on business-, IS-, and sustainability-related knowledge among functional line managers.

The organizational roles presented in this section are recommendations and have to be adapted to the firm-specific context. Nonetheless, the organizational integration of IS- and sustainability-related roles with explicitly defined competences and responsibilities is of major significance to enable the alignment of these three interrelated domains. Internal transfer of knowledge between these domains must be facilitated through communication, specified information flows and clear responsibilities to facilitate shared domain knowledge.

5. Conclusions

The trend towards a more sustainable economy permeates all organizational levels and domains, and IS research and practice have become increasingly involved in this topic. Environmental sustainability can enhance profitability through superior resource efficiency and competitive differentiation, but the alignment between business, IS and environmental

strategy is a prerequisite for long-term success. This paper aimed at the integration of sustainability aspects into strategic IS alignment and at the identification of organizational actors that are relevant in this context.

We analyzed the social dimension of strategic alignment through the theoretical lens of the knowledge-based view and identified enablers of strategic alignment. We argue that strategic Green IS alignment affects the business, sustainability, and IS domain and is a necessary prerequisite for leveraging the full business and environmental potential of IS. We emphasize that sustainability adds a third dimension to the process of strategic alignment and state that three different levels of strategic management should be considered. It became obvious that the transfer of explicit and tacit knowledge is decisive for the creation of shared domain knowledge, which is an antecedent of strategic IS alignment. The collaboration in strategic planning processes, knowledge sharing and above all the relationship between executives from different domains are decisive for the success of strategic Green IS alignment. A mutual understanding enables the utilization of IS to advance the business with innovative technologies and to decrease the environmental footprint of the business firm.

The IS research community as well as practitioners have to acknowledge that corporate sustainability adds a new dimension to the already complex challenge of strategic alignment. We presented four distinct Green IS strategies that can guide strategic investments. Green IS strategies must be addressed on corporate, competitive and functional level and imply an internal transfer of knowledge between business executives, sustainability management and IT department. Only if knowledge is shared and applied collaboratively between these three domains, Green IS can improve long-term firm profitability and advance environmental sustainability of business practices.

To illustrate how this knowledge transfer can be facilitated, we presented specific actors and their responsibilities within the organization. On corporate level, the board of director has to collaborate with the IS and sustainability strategy committee to formulate a shared vision and a long-term strategy. The executive management, in particular the CEO, CIO and CSO, must align competitive strategies and set specific goals to leverage the business value and environmental potential of IS. The actual implementation of environmental initiatives must be accomplished and verified on functional level by executives and steering committees.

However, this research has some limitations. The findings have a limited generalizability because they are derived from theory without empirical evidence. Obviously, this field is of transdisciplinary nature and

thus we propose further investigation of this topic through collaborative research of scholars from the management and IS research community. We suggest further studies that examine our four propositions and our conclusions drawn from this theoretical analysis. Moreover, we assume that valuable insights can be gained through in-depth case studies which investigate roles and responsibilities involved in strategic IS/business alignment and corporate sustainability.

10. References

- [1] Alavi, M. and D.E. Leidner, "Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", *MIS Quarterly*, 25(1), 2001, pp. 107–136.
- [2] Albino, V., A. Balice, and R.M. Dangelico, "Environmental Strategies and Green Product Development: An Overview on Sustainability-Driven Companies", *Business Strategy and the Environment*, 18(2), 2009, pp. 83–96.
- [3] Argote, L. and P. Ingram, "Knowledge Transfer: A Basis for Competitive Advantage in Firms", *Organizational Behavior and Human Decision Processes*, 82(1), 2000, pp. 150–169.
- [4] Avison, D., J. Jones, P. Powell, and D. Wilson, "Using and Validating the Strategic Alignment Model", *Journal of Strategic Information Systems*, 13(3), 2004, pp. 223–246.
- [5] Baumgartner, R., "Corporate Sustainability: Developing the Business Case", in 12th International Sustainable Development Research Conference, Hong Kong, 2006.
- [6] Bengtsson, F. and P.J. Ågerfalk, "Information Technology as a Change Actant in Sustainability Innovation: Insights from Uppsala", *The Journal of Strategic Information Systems*, 20(1), 2011, pp. 96–112.
- [7] Carter, M., V. Grover, and J.B. Thatcher, "The Emerging CIO Role of Business Technology Strategist", *MIS Quarterly Executive*, 10(1), 2011, pp. 19–29.
- [8] Chen, D.Q., M. Mocker, D.S. Preston, and A. Teubner, "Information Systems Strategy: Reconceptualization, Measurement, and Implications", *MIS Quarterly*, 34(2), 2010, pp. 233–259.
- [9] Croteau, A.-M. and F. Bergeron, "An Information Technology Trilogy: Business Strategy, Technological Deployment and Organizational performance", *The Journal of Strategic Information Systems*, 10(2), 2001, pp. 77–99.
- [10] Dao, V., I. Langella, and J. Carbo, "From Green to Sustainability: Information Technology and an Integrated Sustainability Framework", *The Journal of Strategic Information Systems*, 20(1), 2011, pp. 63–79.
- [11] Eisenhardt, K.M. and F.M. Santos, "Knowledge-Based View: A New Theory of Strategy?", in *Handbook of Strategy and Management*, A. Pettigrew, H. Thomas, and R. Whittington, Editors. Sage: London.
- [12] Elkington, J., *Cannibals with Forks: The Triple Bottom Line of the 21st Century*, Capstone, Oxford, 1997.
- [13] Elliot, S., "Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for ITEnabled Business Transformation", *MIS Quarterly*, 35(1), 2011, pp. 1–1.

- [14] Funk, K., "Sustainability and Performance", MIT Sloan Management Review, 44(2), 2003, pp. 65–70.
- [15] Grant, R.M., "Prospering in dynamically-competitive environments: Organizational capability as knowledge integration", Organization Science, 7(4), 1996, pp. 375–387.
- [16] Grant, R.M., "Toward a Knowledge-Based Theory of the Firm", Strategic Management Journal, 17(4), 1996, pp. 109–122.
- [17] Harmon, R.R. and N. Auseklis, Sustainable IT Services - Assessing the Impact of Green Computing Practices, PICMET, Oregon, 2009.
- [18] Henderson, J.C. and H. Venkatraman, "Strategic Alignment: Leveraging Information Technology for Transforming Organizations", IBM Systems Journal, 32(1), 1993, pp. 472–484.
- [19] Hilty, L.M., P. Arnfalk, L. Erdmann, J. Goodman, M. Lehmann, and P.A. Wäger, "The Relevance of Information and Communication Technologies for Environmental Sustainability – A Prospective Simulation Study", Environmental Modelling & Software, 21(11), 2006, pp. 1618–1629.
- [20] Hirschheim, R. and R. Sabherwal, "Detours in the Path toward Strategic Information Systems Alignment", California Management Review, 44(1), 2001, pp. 87–108.
- [21] Ijab, M.T., A. Molla, A.E. Kassahun, and S.Y. Teoh, "Seeking the "Green" in "Green IS": A Spirit, Practice and Impact Perspective", in 14th Pacific Asia Conference on Information Systems (PACIS), Taipei, Taiwan. 2010.
- [22] Kashanchi, R. and J. Toland, "Investigating the Social Dimension of Alignment: Focusing on Communication and Knowledge Sharing", in 12th Pacific Asia Conference on Information Systems, Association for Information Systems, Editor, Suzhou, China. 2008.
- [23] Kearns, G. and A. Lederer, "The Effect of Strategic Alignment on the Use of IS-based Resources for Competitive Advantage", The Journal of Strategic Information Systems, 9(4), 2000, pp. 265–293.
- [24] Kearns, G.S. and A.L. Lederer, "A Resource-Based View of Strategic IT Alignment: How Knowledge Sharing Creates Competitive Advantage", Decision Sciences, 34(1), 2003, pp. 1–29.
- [25] Kearns, G.S. and R. Sabherwal, "Antecedents and Consequences of Information Systems Planning Integration", IEEE Transactions on Engineering Management, 54(4), 2007, pp. 628–643.
- [26] Kearns, G.S. and R. Sabherwal, "Strategic Alignment Between Business and Information Technology: A Knowledge-Based View of Behaviors, Outcome, and Consequences", Journal of Management Information Systems, 23(3), 2007, pp. 129–162.
- [27] Loeser, F., K. Ereik, and R. Zarnkow, "Aligning Green IT with Environmental Strategies: Development of a Conceptual Framework that Leverages Sustainability and Firm Competitiveness", in 17th Americas Conference on Information Systems (AMCIS), Detroit, USA. 2011.
- [28] Lubin, D.A. and D.C. Esty, "The Sustainability Imperative - Lessons for Leaders from Previous Game-Changing Megatrends", Harvard Business Review, 88(5), 2010, pp. 52–50.
- [29] Luftman, J. and T. Ben Zvi, "Key Issues for IT Executives 2010: Judicious IT Investments Continue Post-Recession", MIS Quarterly Executive, 9(4), 2010, pp. 263–273.
- [30] Luftman, J. and T. Brier, "Achieving and Sustaining Business-IT Alignment", California Management Review, 42(1), 1999, pp. 109–122.
- [31] Molla, A. and A. Abareschi, "Green IT Adoption: A Motivational Perspective", in 15th Pacific Asia Conference on Information Systems (PACIS), Brisbane, Australia. 2011.
- [32] Molla, A., V. Cooper, and S. Pittayachawan, "The Green IT Readiness (G-Readiness) of Organizations: An Exploratory Analysis of a Construct and Instrument", Communications of AIS, 29(1), 2011, pp. 67–96.
- [33] Nelson, K.M. and J.G. Coopride, "The Contribution of Shared Knowledge to IS Group Performance", MIS Quarterly, 20(4), 1996, pp. 409–432.
- [34] Olson, E.G., "Creating an Enterprise-Level "Green" Strategy", Journal of Business Strategy, 29(2), 2008, pp. 22–30–30.
- [35] Orsato, R.J., Sustainability Strategies: When Does it Pay to Be Green?, Palgrave Macmillan, New York, 2009.
- [36] Ranganathan, C. and V. Sethi, "Rationality in Strategic Information Technology Decisions: The Impact of Shared Domain Knowledge and IT Unit Structure", Decision Sciences, 33(1), 2002, pp. 59–86.
- [37] Rathnam, R., J. Johnsen, and H.J. Wen, "Alignment of Business Strategy and IT Strategy: A Case Study of a Fortune 50 Financial Services Company", Journal of Computer Information Systems, 45(2), 2004, pp. 1–8–8.
- [38] Ravichandran, T. and C. Lertwongsatien, "Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective", Journal of Management Information Systems, 21(4), 2005, pp. 237–276.
- [39] Reich, B.H. and I. Benbasat, "Measuring the linkage between business and information technology objectives", MIS Quarterly, 20(1), 1996, pp. 55–81.
- [40] Reich, B.H. and I. Benbasat, "Factors that influence the social dimension of alignment between business and information technology objectives", MIS Quarterly, 24(1), 2000, pp. 81–114.
- [41] Stead, W.E., J.G. Stead, and M. Starik, Sustainable Strategic Management, M.E. Sharpe, New York, 2004.
- [42] Tarafdar, M. and S. Grunfle, "IT-Business Alignment: A Two-Level Analysis", Information Systems Management, 26(4), 2009, pp. 338–349–349.
- [43] Tsai, W., "Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance", Academy of Management Journal, 44(5), 2001, pp. 996–1004.
- [44] Velte, T., A. Velte, and R. Elsenpeter, Green IT: Reduce your Information System's Environmental Impact while Adding to the Bottom Line, McGraw-Hill, New York, 2008.
- [45] Wade, M. and J. Hulland, "Review - The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research", MIS Quarterly, 28(1), 2004, pp. 107–142.
- [46] Watson, R.T., M.C. Boudreau, and A.J. Chen, "Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community", MIS Quarterly, 34(1), 2010, pp. 23–38.