

An Information Architecture to Enable Business Sustainability

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Abstract

This paper aims to present the research results which focus was on the development of an information architecture (IA) to enable business sustainability.

Through a definition of sustainability that goes beyond the widely accepted triple bottom line approach (balance among the social environmental and economic dimensions of sustainability) and includes three other dimensions to it – spatial, political-institutional and cultural – current managerial tools on sustainable development/CSR (corporate social responsibility) were analysed and, based on identified gaps, a managerial framework, which adds to existing tools, was developed.

The mentioned framework helps companies to identify, develop and manage, together with partners, relevant information and knowledge within their networks. Moreover, the main activities of such network were identified based on case studies and validated through a Delphi exercise. The field work was also the basis to recognise current and needed relevant information to be shared and behaviours/actions to be taken across the network in order to enable the network to evolve towards sustainability.

The field work results allowed the development of a sustainability maturity model so firms can verify in which maturity level they are in regarding each of the activities analysed. The idea is to help companies to elaborate specific and tailored strategies to progress, together with partners, towards higher sustainability maturity levels.

Furthermore, the research results were also the basis for the development of the envisaged IA. Such IA was proposed to add to the other dynamic tools developed along the research (such as the management framework and the maturity model) and it presents the relevant information needed to be shared within the network as well as possible controls, mechanisms (focusing on information systems and information technologies), constraints and outputs to be achieved while the network progresses in sustainability performance.

Introduction

Enterprises increasingly depend on information and its transformation into knowledge in order to be able to generate innovations¹ in shorter periods of time aiming at creating unique competitive advantages. In this context, greater importance is acquired by the Information Architecture (IA) field. This happens because Information Technology (IT) and its fast diffusion is regarded to be at the heart of the current pattern of competition and, therefore, to enable companies to differentiate themselves from competitors and create single tailored experiences of the purchasing process with its customers.

However, despite technological advance, there is a great gap between the informational resource IA and its use across a firm's boundaries. In other words, it is still a

¹ In this work, innovation is seen as a process of introducing a new product, process, service or organizational form into the marketplace and the social sphere. Therefore, innovation is concerned with the creation of wealth and quality of life, and the criterion for innovation is the effect it has on the economic and social milieu where it occurs [Cox & Loveridge, 1999].

challenge to design an effective IA taking into consideration the information needed to be shared with actors located, apparently, at a company's external environment².

The aim of this research comes exactly to meet this challenge of identifying relevant information to be shared and jointly managed across a firm's network as well as important actions or behaviours necessary to be fostered through such network in order to shape business sustainability. Furthermore, the work also focuses on key elements that can either support or constrain this information flow and, as a consequence, firms in walking the sustainable development path³.

The research developments are built upon a critical view of the current understanding of the creation of value and competitive advantages in both supply chain management and Corporate Social Responsibility (CSR) fields, which have adopted a financial rhetoric of bottom lines (e.g., social, ethical and environmental) embedded in reassuring the economic shareholder logic. Moreover, in contemporary management models and systems learning occurs when each new cycle of improvement is about to begin, based on feedback mechanisms and the good and bad experiences during the last implementation cycle. As a contrast, a management tool is suggested to enable learning to take place also during each implementation cycle so firms are better prepared to undertake evolutionary leaps in sustainability performance together with its network partners. Next, a maturity model is portrayed to help companies in identifying an individual path to be followed to progress both in performance and in responsibility. The sustainability maturity model is then used as basis to propose the envisaged IA model, which is designed focusing on the information to be shared and behaviours to be encouraged in a firm's network as opposed to the traditional approach or a focus on the supporting technologies.

Business Sustainability

The following proposed definition [Bursztyn et al., 1999; EU, 2004; UN, 2004] adds three dimensions of sustainability into the business context expanding from the two previous familiar models, named triple bottom line [Elkington, 1998] and five capitals model [Porritt, 2001; SIGMA, 2001; BSI, 2003], in order to enhance the understanding of how firms should build competitive advantages aligned with its responsibility towards society and the natural environment.

Thus, business sustainability now depends on the integration of six dimensions of sustainability into mainstream decision making and core operational processes as articulated systems:

- Social sustainability: includes principles of equal rights of human dignity and social solidarity into both the social and human/intellectual capitals;
- Ecological sustainability: includes the principle of solidarity with the Planet and its richness, as well as with the biosphere into the environmental capital;
- Economic sustainability: includes intangibles into both the manufactured and financial capitals. It is measured by the ability to build economic wealth and equally deliver both social and ecological sustainability;
- Spatial sustainability: measured by the ability to achieve an equality among the sustainability (economic, environmental and social) embedded in the business activities and those entrenched in the sustainability net processes⁴ – across products and services life cycle – taking into consideration all countries and regions in which the

² Cf. Soares [2000]; Hane [2000] and Dillon [2001].

³ The word path implies that business sustainability is a continuous process of evolution in which a company will be seeking to achieve its vision of sustainable development in uninterrupted cycles of improvement, where at each new cycle the firm starts the process at a higher level of business sustainability performance.

⁴ See definition of sustainability net on next item.

organisation and its partners operate, and being transparent and responsive to all stakeholders;

- Institutional-political sustainability: represents a pre-requirement for the continuity of any course of action in the long term. It comprises the organisation's set of values and beliefs; culture; strategies, paying attention to long term issues and the inter-linkages or alignment between different policy areas; and ability to learn and innovate; all of which based on core ethical values and universal principles⁵ so they can serve as reference to maintain and drive the organisation's actions/behaviours in the long run;
- Cultural sustainability: shaped by respect of local, regional and national affirmations in all countries and regions in which the organisation and its partners operate, which goes beyond complying with laws, due to the context of the standardization imposed by globalization.

As a consequence, business sustainability relies on integrating the improvement of triple bottom line performance with long-lasting core values and behaviours – based on universal principles –, which drives the structure and actions of the organisation and its sustainability net partners, and are evenly applied throughout its network of relationships in all countries and regions in which the organisation and its partners operates; respecting and supporting the differences and affirmations within these regions.

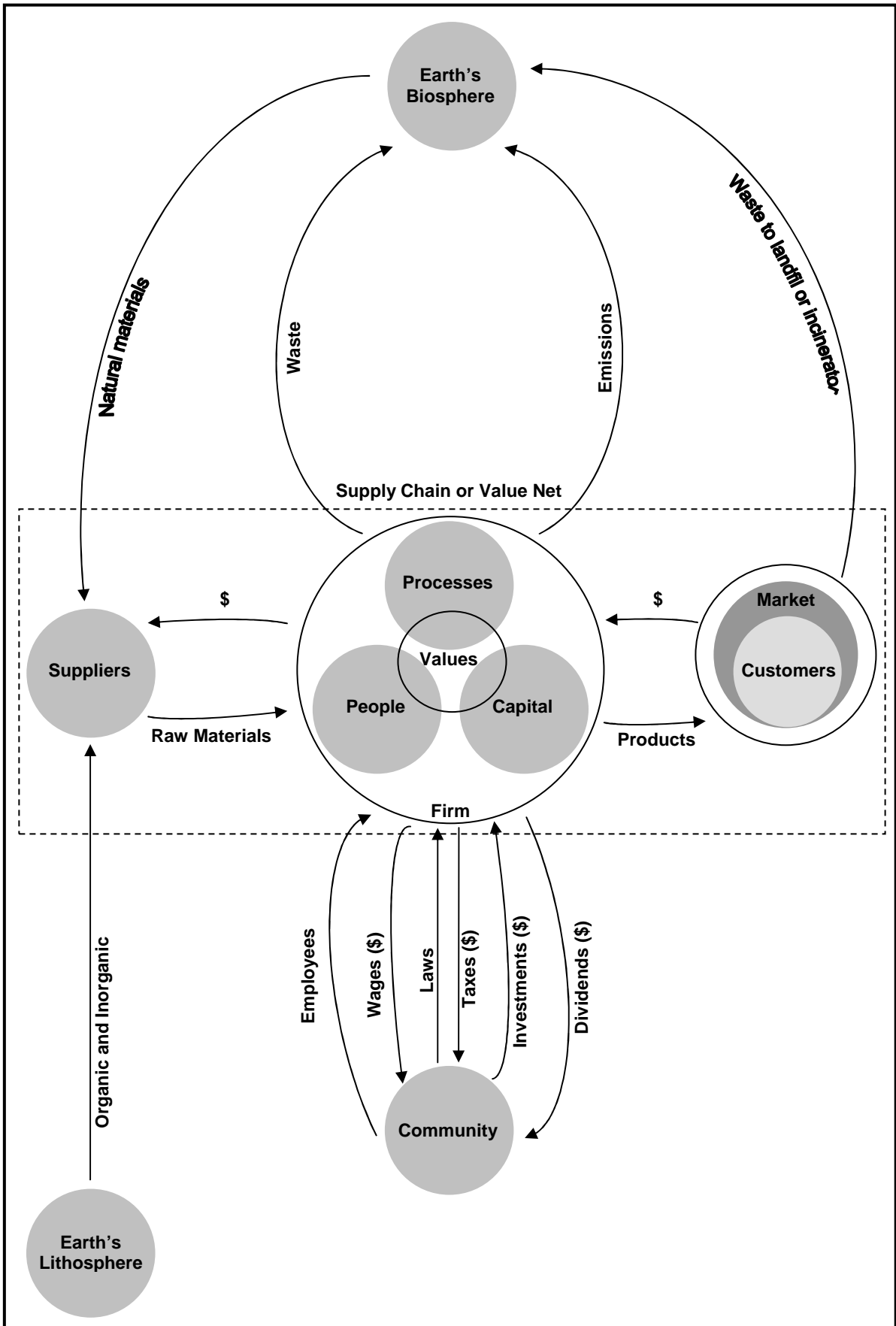
Sustainability Net

Taking into account an evolution of the concept of value chain introduced by Porter [1985] until the current paradigm of supply chain management, or value nets [Bovet & Martha, 2000], one can see that from the analysis of value within a firm [Porter, 1985], through the integration of customers in the chain [MacStravic, 1999] and later the incorporation of suppliers/delivers (as well as customers) [Bovet & Martha, 2000] into a network of value creation; value is still translated by an 'economic' bottom line. Value, in this context, is decoded in financial returns to shareholders based on the efficient delivery of products and services which are partially customised with the ultimate goal of satisfying customers' needs.

However, in order to be able to deliver wealth aligned with social and environmental benefits to shareholders and also to stakeholders within society, value has to be redefined. Thus, a new concept of sustainability net is introduced as an evolution of the value net. The **sustainability net** is a network where different stakeholders interrelate with one another seeking the delivery of economic, environmental and social aligned value to and by all nodes of the network, which are shaped by the spatial, institutional-political and cultural dimensions of sustainability across a firm's network of relationships and influence. In this context, in the depicted Figures 1 and 2 one is able to locate the main differences between value net or supply chain network and the sustainability net.

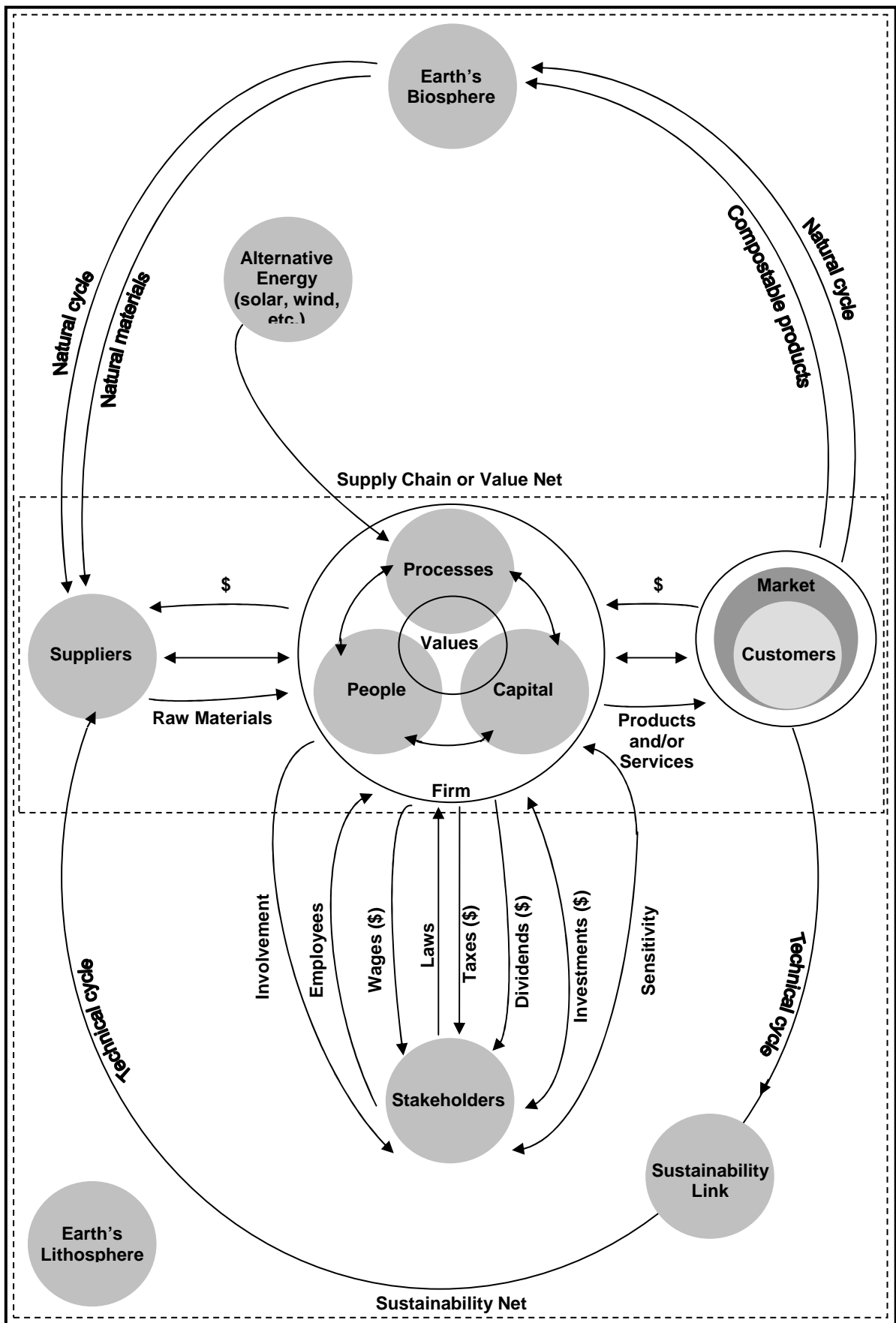
⁵ Universal principles can be simply understood as the laws and principles ruled by Nature. These are the basic universal principles that should be relevant to all human relationships and in all organisations, such as justice, impartiality, honesty, integrity and trust; all of which are obvious and prove their validity by themselves [Covey, 1997].

Figure 1 – Typical 20th Century Company



Source: adapted from Anderson [2004]

Figure 2 – Progressive Company



Source: adapted from Anderson [2004]

The Role of Information Architecture

A traditional IA is defined as the group of data or information, applications or systems and IT infrastructure needed to support the internal and external information flows the organisation needs to support its business [Periasamy & Feeny, 1997; Rodrigues & Ferrante, 1995; 2000]. However, according to McGee & Prusak [1994], there is an eminent importance of focusing on the user once the traditional and still present approach on technical practice⁶ is an inefficient IA on delivering products centred on customer's needs. Therefore, the way individuals behave towards information – acquiring, filtering, analysing and communicating – becomes as important as the information itself [McGee & Prusak, 1994].

In this direction, Davenport & Prusak [1998] claim that an IA should build a bridge between behaviours, processes, specialised personnel and other organisational elements, such as management methods, organisational structure and physical space. Hence, an IA should be able to lead individuals to the place data is located improving the possibilities of using them efficiently, beyond allowing users to reuse information already obtained. Its product should be the information one needs, in the right place and moment, specifying the categorisation of information types and the relationship between different information elements [Gordon, 2000; Curtis, 2000]. Thus, an IA should describe not only information locations, but also the responsibility for it, by whom it was already used, to whom it is addressed to and if it is or not accessible [Davenport & Prusak, 1998]. The ultimate objective is to design an IA as an essential tool to explore the relevant information strategically, capable of generating competitive advantage.

As a result, an IA should be developed aiming at bringing information to where it is needed to support the decision making processes and also for its use in corporate competitive applications that transcend autonomous business's units [Tapscott, 1997] allowing all the involved parties to speak the same language [McGee & Prusak, 1994]. Moreover, sustainable development requires information to be produced at the quality needed by the users in the value chain, while supporting the necessary changes in the information life cycle by foreseeing future information needs.

Such conceptualization⁷ is in line with the definition of IA developed by Rosenfeld & Morville [1997; 2002] and Brancheau & Wetherbe [1986], who claims that IA is a high level map of the information requirements of an organisation that is process oriented since it crosses functional boundaries [Martin, 1990; Sowa & Zachman, 1992] aiming to support a firm's value-adding business processes [Kettinger, Teng & Guha, 1996].

In this scenario, the behaviours or actions which are needed from all actors within the sustainability net to shape business sustainable development – by aligning the six dimensions of sustainability into the organisation's and its sustainability net partners core operations – are as important as the information which is needed to be produced and delivered along the network to sustain a business competitive advantage.

Hence, a sustainability IA model must incorporate another dimension in its structure to be effective in delivering knowledge dissemination and promoting fundamental behaviours to be followed across the sustainability net. The new dimension refers to the identification of generic behaviours or actions needed to be fostered along the sustainability net. This is critical not only to encourage more efficiency and efficacy in the management of relevant information to produce and disseminate new knowledge and sustain a business competitive advantage with responsibility, but also to internalise the six dimensions of sustainability into a business's strategy and core operations across the network. Table 1 summarises the main differences between a traditional IA model and the envisaged sustainability IA model.

⁶ Focusing mainly on the T of IT [Laudon & Laudon, 1996; 1999].

⁷ Cf. Peek [2000]; Klingener [2001]; Farnum [2002]; ASIS&T [2001; 2004].

TABLE 1: Differences Between Traditional and Sustainability IA Models	
<i>Traditional IA Model</i>	<i>Sustainability IA Model</i>
<ul style="list-style-type: none"> - Data → Information - IS or applications - IT infrastructure 	<ul style="list-style-type: none"> - Information → Knowledge - Behaviours or actions needed to align the 6 dimensions of sustainability along the sustainability net - Technology: IS + IT

Source: Cagnin [2005]

To sum up, the effective integration of social and environmental strategies, the creation of a knowledge base among partners and the generation of responsible actions along the sustainability net can all be catalysed through an IA. Critical in this direction is the integration of a business' core strategy with its social-environmental and IT strategy as well as with all relevant policy areas. The IA has thus a fundamental role to play to coordinate these strategies and actions along the sustainability net in order to reach products and services that are responsible both socially and environmentally.

Sustainability Net Value Activities

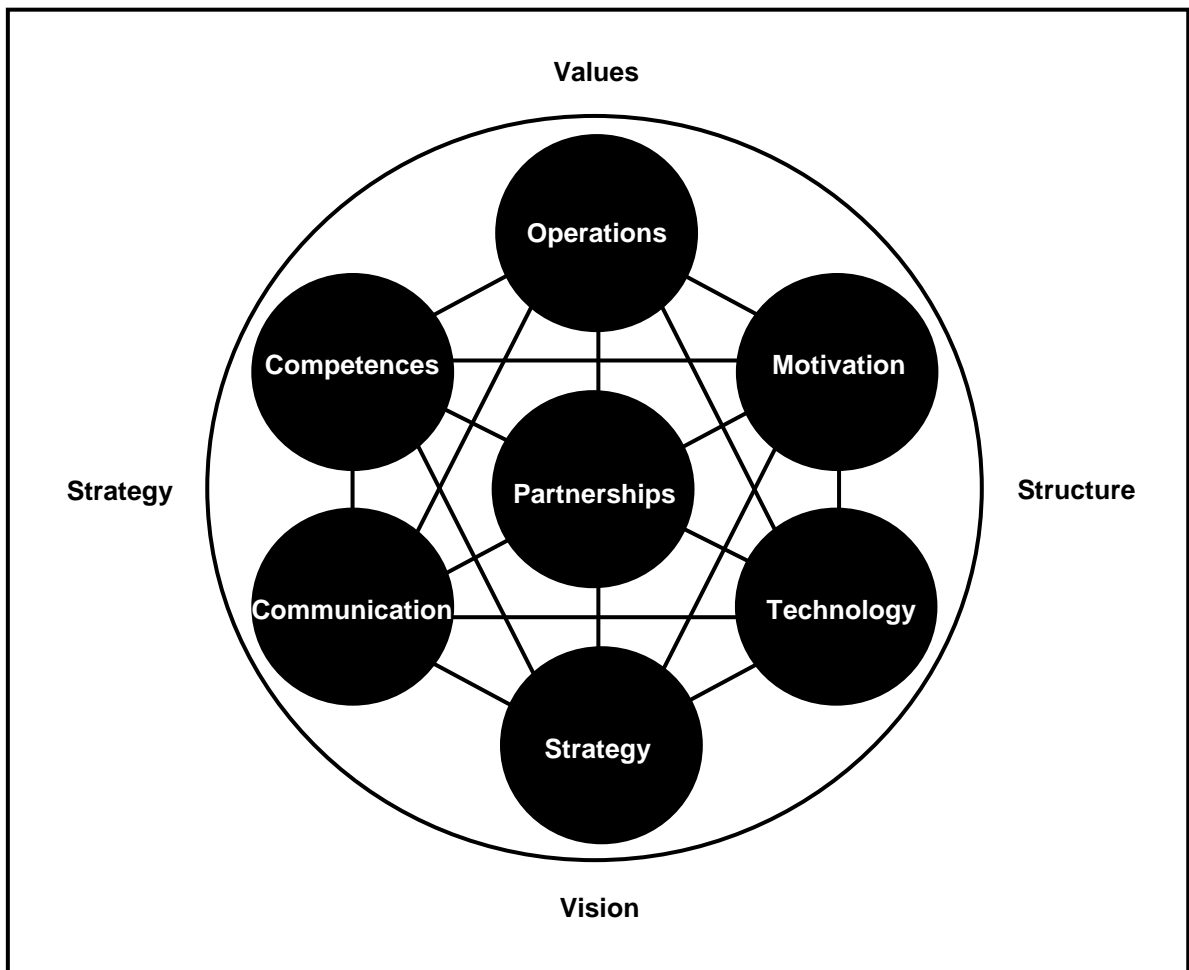
In a traditional value chain the value activities are those which work together to determine a firm's sustainable competitive advantage. Value in this context is translated in financial returns to shareholders based on operations efficiency and/or customers and/or suppliers/delivers engagement, with the ultimate objective of satisfying customers' needs.

On the other hand, value in the sustainability net is defined as a balance among economic, environmental and social assets to be delivered to and by all parties in the network. In this case, sustainable responsible competitive advantages also depend on the interaction of such activities. Hence, the creation of value depend not only of operations efficiency, customer satisfaction and economic returns to shareholders, but also takes into account broader stakeholders' needs towards society's improvement of quality of life. The underlying principle is that enterprises are embedded in a broader system with which they interact. In this context, the value activities of the sustainability net are the building blocks by which a firm creates products and services valuable to its stakeholders.

Therefore, instead of focusing on the activities needed for the creation of a product within a firm (and sometimes including its suppliers/delivers and/or customers) as in a traditional value chain, the heart of the sustainability net becomes the interaction among all actors within the network and the activities which are necessary to develop responsible products and services throughout their life cycle. In this direction, one might think that by aligning and integrating all operations and their supporting activities across products and services life cycle would be enough to achieve this objective.

Nonetheless, to ensure that the six dimensions of sustainability are embedded in a firm's core operations (including those which compose a traditional value chain), these operational activities must not only be integrated throughout the sustainability net, but also be in alignment with a common strategy among the actors in the network to enable value to be created to and by all nodes of the net. Moreover, the development of such common strategy depends on an interactive dialog and active participation and understanding among involved actors in order to enable the whole network to pursue the same vision of sustainability. Therefore, the accomplishment of such vision is thus dependent on how each firm and its sustainability net partners interacts and aligns such value activities across the network. Figure 3 shows the sustainability net value activities and its interconnections. These activities require abilities which are intrinsically inter-related, interactive, complex and inter-dependent and that must be learned and practiced simultaneously.

Figure 3 – Business Sustainability Activities Model



Management Model

The management tool developed in this research was based on a broad management system that can be applied to any business. It was designed based on the continuous improvement cycle found on the PDCA as the key process for driving learning and innovation in an organisation. The choice of the PDCA cycle, integrated with the learning and innovation spiral as basis of the proposed model, was due to its fundamental application in most contemporary advanced management tools.

Nevertheless, the learning process embedded in the envisaged management model differs from the one entrenched in other management tools. Normally, the process of learning occurs only when the organisation starts a new cycle of improvement and, therefore, incorporates the necessary changes based on the good and bad experiences that happened along the last implementation cycle. In the envisaged management model here to be described, learning also occurs according to the learning capabilities accumulated with the systems operation which is integrated in the next improvement cycle. However, the learning process to be ingrained in the envisaged management model is based on a continuous process that also takes place during each implementation cycle. Hence, when a new cycle is about to begin the enterprise will be armed with better and clearer opportunities to give an evolutionary leap in sustainability performance (balance among economic, environmental and social performance) in alignment with the involved partners in the sustainability net. The basis of this evolutionary leap is in the ability of

building a continuous collaborative learning process founded on an inclusive and active dialogue process among all parties in the sustainability net.

The interdependency among partners in the sustainability net, illustrated by Figure 3, means that all parties are dependent on the collective success of a company and vice-versa. It also means that all parties are vulnerable to failure by other participants. Therefore, trust must be achieved by developing confidence of all parties into each and every link of the sustainability net's intent and behaviour [Lund, 2003]. To build this kind of trust all parties need to engage as equals in dialogue through an inclusive approach. In the end, companies need to demonstrate their true intentions and have to be open and willing to let stakeholders influence them [Olsen, 2003].

Furthermore, the important issues to ensure the development of effective and lasting partnerships are the existence of a common identity (a true feeling of who 'we' are as partners as well as of who each actor is as individuals) and the existence of legitimacy (important to sustain credibility, recognition and success). Here, each engaged actor should perceive its differences as a strength or enrichment of the partnership approach, instead of using these differences to hamper the process of collaboration by hindering the partners in being constructive and result-oriented [Hardis, 2003].

Consequently, an ongoing active communication process based on close cooperation and an inclusive dialogue approach enables the development of mutual trust and transparency; since trust cannot be taken for granted from the outset. Instead, trust among partners is a very sensitive process and is easily undermined. Hence, it needs to be continuously encouraged and stimulated by practicing everyday what is preached. Furthermore, the ability to communicate with different audiences – all stakeholders in the sustainability net – and in diverse and specific languages becomes essential in this circumstance.

Dialogue is thus crucial and it means that it is important to listen to others and to give everybody an opportunity to state their opinion. According to Shelton [1997], the basic principles of dialogue are: capacity to listen intensively; commitment to stop judging; and willingness to transform one's own beliefs and suppositions. The simple recognition of others feelings or points of view break down existing limits, brings coherence to everybody involved and build revolutionary ideas of what is possible.

In this scenario, the kind of dialogue needed to enable a business to build a continuous collaborative learning process among all parties in the sustainability net and thus allow a evolutionary leap in sustainability performance to take place, can be translated in the organisation's capability of developing a 'meta learning' process along the sustainability net.

The expression 'meta learning' was created by Losada [1999] and defined as "the ability of a team to dissolve attractors that close possibilities for effective action and to evolve attractors that open possibilities for effective action". Meta learning can also be understood as the ability of learning how to learn. It is not learning about some content but rather about how to think [Losada, 2001].

In this perspective, being able to bring together in a management model the elements that comprises high performance teams into an inclusive dialogue approach with all stakeholders in the sustainability net seems critical to create a continuous collaborative learning process among all parties in the network and, therefore, bring value to all involved parties and allow an evolutionary leap in sustainability performance to materialize. Hence, the PDCA cycle in the proposed management model is the foundation to achieve a dynamic evolutionary tool which seeks a business's continuous sustainability performance improvement and thus its responsible relationship with the natural environment and overall society. The broad stages of this management system are described in Table 2, which includes the need of an inclusive dialogue approach with all stakeholders in the sustainability net permeating all processes. This is believed to be the basis to drive the achievement of high performance continuous learning and to bring ultimate value to all parties involved along the sustainability net. Following, Table 3 presents the business sustainability management model, which highlights the main

processes that should be performed inside each stage of the business (broad) management system (Table 2) related to the organisation's value activities across the sustainability net (Figure 3).

TABLE 2: Business Broad Management System		
Stages	PDCA Cycle	Meaning
Stakeholders Participation Based on Inclusive Dialogue and Continuous Learning	Decide to be in business	It is the stage of thinking and reviewing past and present decisions and performance to decide whether to be or not in business (changes needed) according to competitive and environmental changes and the range of feedback the firm is able to build. Furthermore, it is time to define a vision for sustainable development to be pursued in alignment with the six dimensions of sustainability, which should be commonly agreed with the business sustainability net partners
	Design the business	P It is the process of planning how the business must be shaped in order to achieve the vision of sustainability via the definition of a strategy and necessary targets to be met. It aims to build the expected future by designing how the business strategy will be implemented
	Run the Business	D It is to implement the defined strategy and its designed plan every day. It becomes essential to compare the actual results (the way it is now – as it is) with the expected ones (the way the organisation wishes to be – as it ought to be), through a feedback process, in order to shape sustainability and learning along the process
	Monitor the Business	C It is to monitor all necessary information of how the business is running and evaluate the obtained results based on developed indicators. This will enable the organisation to make an assessment about whether what it had originally hoped to accomplish was actually achieved (gap analysis) so it can establish future capability of analysis and decision making processes
	Sustain the Business	A It is a process developed by every day's activities. It depends of being able to meet everything that was defined in the earlier plan stage, based on universal principles, cooperation, innovation and continuous learning, but also based on the diverse range of feedback and partnerships the company is able to build. From the single individual, passing through the organisation and its relationships, seeking to consider the overall society. In the end, it is about improving economic, social and environmental integrated performance, knowing that one depends and leverage the other. Understand 'yesterday' tuned and looking for 'tomorrow' – to maintain a balance between past and future, between what is known and what is new (something unpredictable) – is the requirement to success. It is thus a reflection about what has actually worked and not worked, and then to adjust the organisational thinking and actions for the future. This phase is where sustainability performance evolutionary leaps can occur bringing, as a consequence, processes of innovation and the changes needed for survival and to sustain competitive responsible advantages in the future

Source: Cagnin [2005]

On Table 4 it is possible to see the behaviours/actions which are believed to be necessary to be fostered and managed in order to help firms and network partners to walk the path to sustainability. Such behaviours/actions would apparently be located in the column 'Sustain the Business' within Table 3, but they will be further opened into detail in the next section of this paper when outlining the maturity model.

TABLE 3: Business Sustainability Management Model

Sustainability Net Value Activities	Management System Stages				
	Decide to be in Business	Design the Business	Run the Business	Monitor the Business	Sustain the Business
	Stakeholders Participation Based on Inclusive Dialogue and Continuous Learning				
Strategy	strategic architecture definition	strategy definition	Business Sustainability Maturity Model – Business Path to Sustainability Comparing present performance (as it is) with the business and its network vision for sustainability (as it ought to be) in order to keep the firm on track of its designed vision	monitor, analyse and evaluate the business and its interactions across its network to support the decision making processes	Hypotheses of what constitutes a common vision for business sustainability – Behaviours/actions to be fostered through the Sustainability Net Verify if the firm achieved its objectives and preparing the whole network to walk into a higher sustainability maturity level
Partnerships	possible partners and alliances identification	design partnerships selection, building and leveraging		monitor, analyse and evaluate partners performance and their interrelationships as well as their active participation along the network	
Motivation	possible motivational and participative processes identification	design motivational processes selection, building and leveraging		monitor, analyse and evaluate motivational processes, including the actions taken to enable the creation of an inclusive dialogue across the network	
Competences	core competences and possible core products, services and experiences identification	design competences selection, building, leveraging and core competences protection		monitor, analyse and evaluate competences building and leveraging aiming at unlimited competences sharing, but protecting core competences	
Communication	possible communication processes and channels identification	design communication processes among organisational activities and partners in the network		monitor, analyse and evaluate established communication processes, as well as information and knowledge sharing among all stakeholders in the network	
Technology	possible technology infrastructure identification	design the technological infrastructure selecting the IT that best fits the organisation and its partners, and decide whether to develop and/or purchase commercial IS		monitor, analyse and evaluate the technologies in use to align the activities in the network, as well as new technological needs and possibilities, and how to integrate them with the ones currently in use	
Operations	define how the main operational activities along the network should perform integrated	design the development and integration of the main operational activities along the network		monitor, analyse and evaluate both the business and its network partners sustainability performance, as well as their activities alignment, beyond the reporting mechanisms currently in use	

Source: Cagnin [2005]

TABLE 4: Strength of Influence of Behaviour Statements on Business Sustainability

<i>Value Activities and Statements</i>		<i>Strength of Influence*</i>
Strategy	01 All strategies within the organisation (e.g., information, technology, social-environmental, etc.) must be aligned with the business strategy along the value chain to ensure that all choices will fit the business' needs	100%
	02 It is crucial to have a shared vision relevant to all organisational levels in order to reach a point where every collaborator within the organisation works towards achieving the same vision	89%
	03 Leadership plays a fundamental role based on insights about environmental circumstances, the market place and society. These insights enable a leader to create a vision that strongly appeals to stakeholders and mobilizes their commitment	100%
	04 A creative and successful culture is based on common values and principles, information sharing, participation in the decision making process, a learning environment and creative, flexible thinking	90%
Partnerships	05 Based on research and insight, it is important to define mission and values before seeking stakeholder engagement, in order to keep the business on the path of its defined strategy and to avoid imbalanced responses to stakeholders concerns	92%
	06 Relationships based on trust depend on building a process of dialog where partners transparently share their values and beliefs, their existing and possible opportunities and constraints, aim to identify common objectives, select among agreed actions and thereby gain value from the relationship	84%
	07 Key to business success is consultation and collaboration with each stakeholder in order to reconcile environmental, social and economic priorities	77%
	08 It is critical to invest in educational programs to enhance the community's and society's awareness of environmental and socially responsible business actions in order to achieve business sustainability	76%
Motivation	09 Motivation is a process of engaging people by helping them to find meaning and satisfaction in everything they do. Building a clear individual sense of ownership, responsibility for achievements, a global vision and commitment to results are necessary actions to build a motivational environment	92%
	10 Dialog is key to connect people to the end-state the business is aiming to create, in its raising awareness of and belief in the organisation's mission, providing the opportunity to identify common values and objectives, and to put greater meaning into working life	100%
	11 To maximise the benefits of motivation, reward systems and compensation plans should be developed to meet each individual's need and to empower people to creatively solve business problems to meet their objectives in a socially responsible and ecologically sustainable way	85%
	12 Enabling each individual to themselves change their ideas about the way things work is the action needed to build a responsible environment in which everybody can live and experience common values and beliefs	80%
Competences	13 A balance between protecting core competences and sharing competences is key to developing new business opportunities and the organisation's capacity to learn and innovate	70%
	14 Selecting which competences to develop and integrate into core products and services with speed, innovation and cost effectiveness is crucial to leverage the business' capabilities and to seize new opportunities	83%
	15 Within the context of the organisation's stated mission, a creative and flexible approach to individual and group experience-based learning and to skilful knowledge management are necessary to enhance the organisation's capabilities	92%
	16 The business' objectives must be designed by matching the skill profile with continuous investment in training and education to enhance the business' capabilities	75%

TABLE 4: Strength of Influence of Behaviour Statements on Business Sustainability

<i>Value Activities and Statements</i>		<i>Strength of Influence*</i>	
Communication	17	Key to creating relationships based on trust, where intuition and rational analysis are complementary components of the decision making process, is to develop agreed communication channels and processes to meet each stakeholder's needs	79%
	18	Investments of time and resources in speaking to and consulting with various stakeholders is critical to ensure each stakeholder has a good understanding of the business and equally so that the company understands its stakeholders' needs and aspirations	86%
	19	Identifying, selecting, developing and leveraging agreed communication channels and processes with stakeholders is crucial to identify their priorities for products and services and to find out how much customers value different activities and standards for each product/service	77%
	20	Inter-personal communication channels are crucial in processes of innovation and organisational change, innovation adoption and diffusion within one business, and similarly with one company and its network of relationships	85%
Technology	21	Companies, in their essence, are coordination mechanisms (they exist to orient work, materials, ideas and money flows) using available technologies to coordinate activities in the value chain in a cheaper, smarter, more efficient and more sustainable way	66%
	22	Within the context of a stated mission and long term objectives, key to achieving self-organisation capability (systemic evolution or the ability to deal with chaos and the need for change) is to build a flexible infrastructure to enable communication and information flow throughout the business' network of relationships	90%
	23	Every company has to master all technologies that affect the way they create value for their clients	91%
	24	Information and knowledge management, supported by Information Technology (IT) and Information Systems (IS), provide the means that allow the organisation to exceed its performance standards in seeking to keep one step ahead of the competition	91%
	25	New technology development should meet business needs, the needs of stakeholders and the pursuit of sustainability (the needs for social responsibility and ecological sustainability). Therefore, critical to developing or buying new technologies is to get closer to the end user, and to listen to and understand their needs	90%
Operations	26	Tactical levels in the organisation should link long-term plans and operational day-to-day actions in a way that is designed to support plans, evaluate new developments and reflect on performance with the aim of continuous improvement	90%
	27	Tactical levels in the organisation should periodically plan/review existing actions, consult stakeholders and be proactive whenever possible to anticipate change and put measures in place to support social-environmental responsibility	80%
	28	Tactical levels in the organisation should disseminate essential information thus making clear desired performance patterns and desired tools to support decision making processes in order to maintain/improve customer service levels and expected costs of the business' operations	90%
	29	Operational levels of the business should meet standards, indicators and regulatory requirements by operating according to defined strategies and policies in order to optimise the positive economic, environmental and social impacts of the business' operations	100%

TABLE 4: Strength of Influence of Behaviour Statements on Business Sustainability			
Value Activities and Statements		Strength of Influence*	
Operations	30	Operational levels of the business reflect the organisation's values and demonstrate the business' ability to act responsibly and ethically. Therefore, being able to monitor performance indicators is crucial in achieving business sustainability and so information and knowledge management play a critical role	100%
	31	Breaking down organisational functions, hierarchical departments and structures is the course of action needed to remove functional 'silos', to build the necessary flexibility to allow better information flow and to focus operations on systemic processes and systems	100%
	32	The sustainable development of business is achieved by using renewable sources of energy and fewer natural resources	90%

Source: Cagnin [2005]

Field Work

The percentages outlined on Table 4 are related to the Delphi outcomes and express the participants view on the relevance of each statement to build business sustainability. Table 5 presents then the final results and places the thirty two statements in a hierarchical order of importance. These statements were a result of the work conducted within two contrasting case studies, a regulated and a non-regulated company. The idea of undertaking such case studies was to understand if the different competitive environment and business drivers within which each firm operates would also result in different views of the needs for business sustainability. Moreover, the Delphi exercise unlocked not only how each of the thirty two statements, and as a consequence each value activity within the sustainability net, influences business sustainability, but also how each value activity influences one another. Table 6 shows the mutual influence the value activities have on each other. Finally, the Delphi exercise was also the methodology used to identify the elements for building the envisaged IA model, which is briefly described on Figures 4, 5 and 6.

Maturity Model

The following levels of the proposed sustainability maturity model described on Table 7 is based on the IDEF_0 methodology and founded on the evolution of values rooted in universal principles as well as the maturity of behaviours which can lead to business maturity development along the sustainability net. Its aim is to shape a possible path towards business sustainability and, therefore, support enterprises with a model which offers the possibility for each firm to individually assess its position regarding five sustainability maturity levels and, as a consequence, build a strategy along the sustainability net to progress towards higher levels of sustainable development.

Conclusion

The proposed sustainability IA aims to enable a continuous performance evolution of an organisation and its sustainability net partners regarding continuous individual's learning, information and knowledge creation, sharing and management, as well as fostering behaviours which can lead the network to achieve, together, higher levels of sustainability maturity.

TABLE 5: Statements Assessment and Hierarchy of Statements Influence on Business Sustainability			
<i>Value Activities and Statement</i>	<i>Importance of Statement for Business Sustainability (Weighted Average – 0 to 4)</i>	<i>Final Position Sorting by Weighted Average</i>	
Strategy	Statement 01	3.722	2
	Statement 02	3.105	17
	Statement 03	3.579	5
	Statement 04	3.250	12
Partnerships	Statement 05	3.077	20
	Statement 06	3.000	21
	Statement 07	2.769	23
	Statement 08	3.154	15
Motivation	Statement 09	3.308	11
	Statement 10	3.538	6
	Statement 11	3.000	21
	Statement 12	3.000	21
Competences	Statement 13	3.000	21
	Statement 14	3.667	3
	Statement 15	3.250	12
	Statement 16	2.917	22
Communication	Statement 17	3.214	14
	Statement 18	3.214	14
	Statement 19	3.231	13
	Statement 20	3.154	15
Technology	Statement 21	3.111	16
	Statement 22	3.000	21
	Statement 23	3.091	19
	Statement 24	3.455	8
	Statement 25	3.364	10
Operations	Statement 26	3.500	7
	Statement 27	3.100	18
	Statement 28	3.100	18
	Statement 29	3.600	4
	Statement 30	3.800	1
	Statement 31	3.444	9
	Statement 32	3.100	18

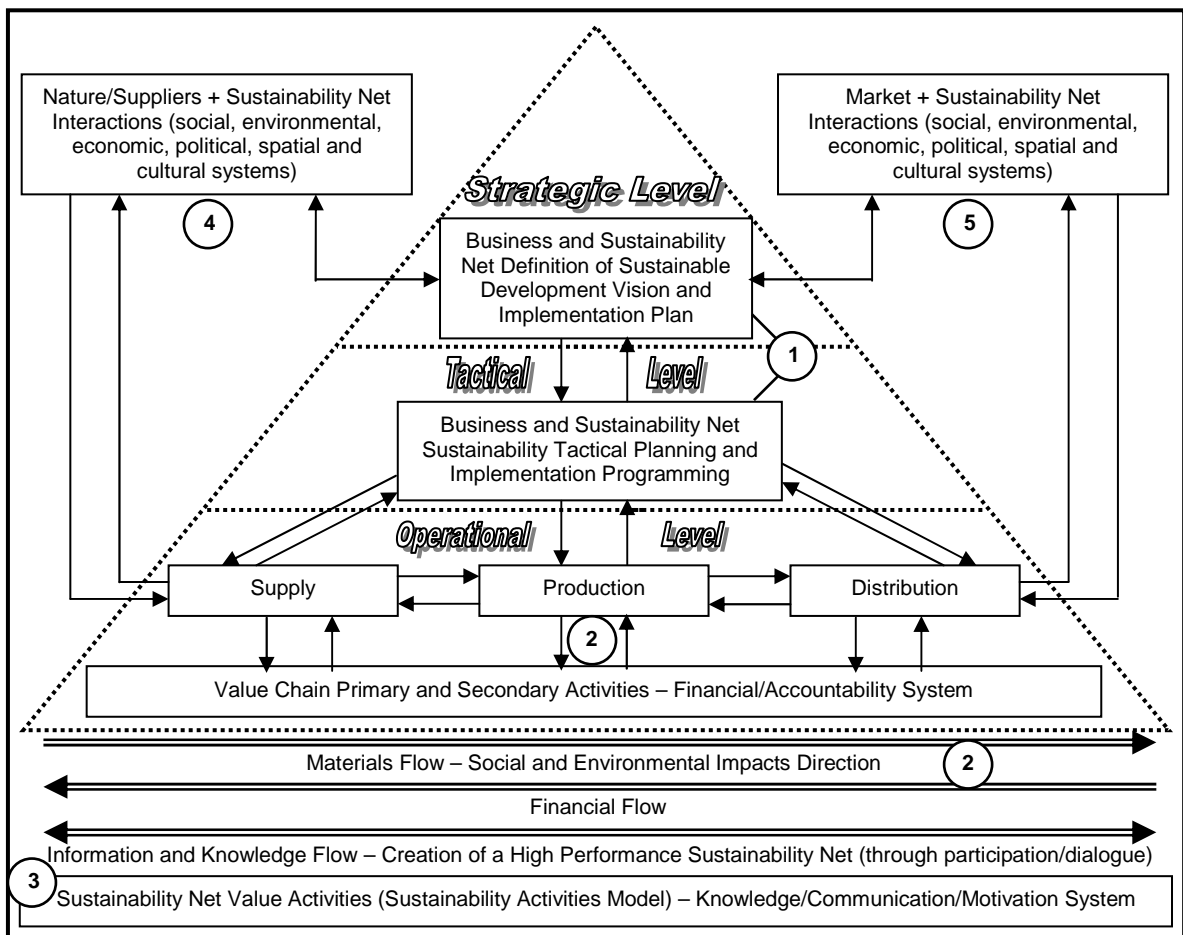
Source: Cagnin [2005]

In order to progress the work here undertaken, one of the propositions would be to use of the outcomes identified in the present research in the elaboration of strategies and/or policies for either the implementation of management systems or the definition of the necessary actions to move firms and other actors in the sustainability net towards higher sustainability maturity levels, as well as the refinement of current sustainability evaluation methodologies carried out by organisations, both individually and in group.

TABLE 6: Value Activities Interrelationships – Analysis Direction ↗							
Value Activities	Strategy	Partnerships	Motivation	Competences	Communication	Technology	Operations
Strategy		20.2%	20.6%	15.2%	5.7%	16.5%	21.8%
Partnerships	27.8%		17.0%	11.1%	15.6%	15.1%	13.3%
Motivation	27.0%	6.2%		16.1%	14.4%	14.8%	21.7%
Competences	24.8%	8.5%	17.5%		11.6%	17.4%	20.2%
Communication	24.0%	7.5%	11.8%	13.8%		19.5%	23.4%
Technology	22.6%	7.0%	12.6%	21.6%	11.5%		24.7%
Operations	27.7%	15.6%	6.0%	14.1%	9.1%	27.4%	

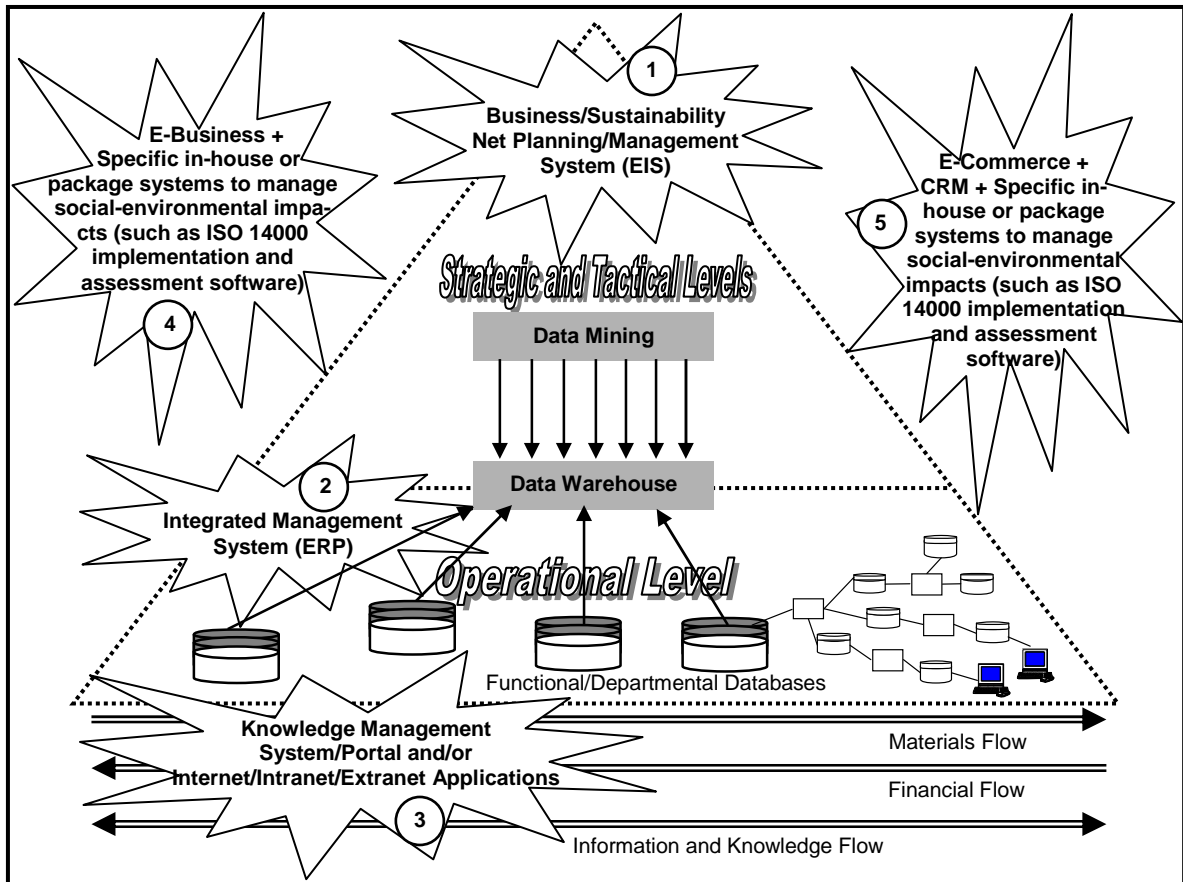
Source: Cagnin [2005]

Figure 4 – Business Sustainability Information Architecture



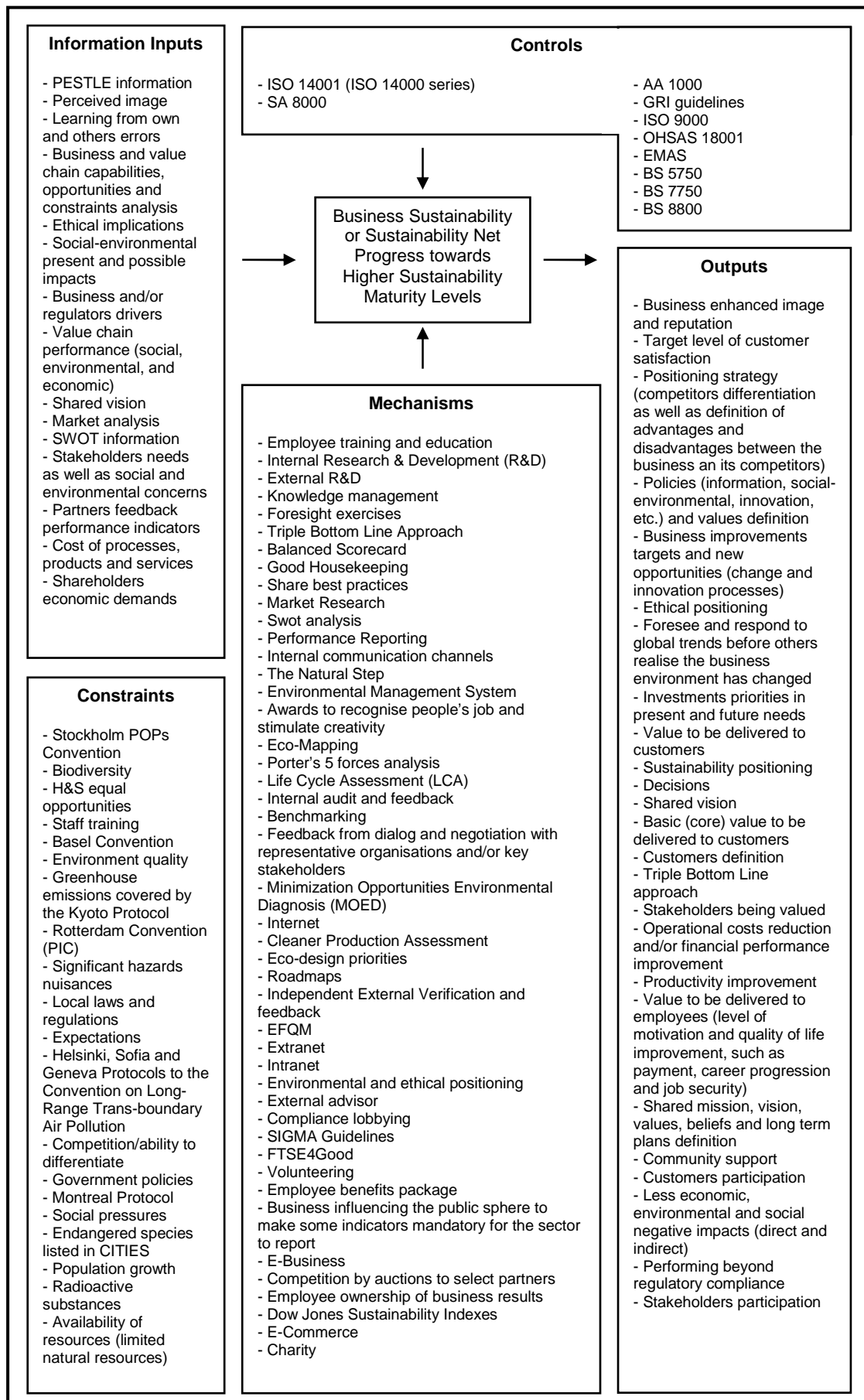
Source: Cagnin [2005]

Figure 5 – Business Sustainability Information Architecture X Information Technology



Source: Cagnin [2005]

Figure 6 – Sustainability Information Architecture Model



Source: Cagnin [2005]

TABLE 7: Business Sustainability Maturity Model – BSMM

Value Activity	Maturity Levels				
	1- Ad Hoc	2- Planned in Isolation	3- Managed with no Integration	4- Excellence at Corporate Level	5- High Performance Sustainability Net
Strategy	<ul style="list-style-type: none"> - overhead, driven by regulation, complaints, management directives and cost of accidents and impacts - no processes or controls in place and no support from leadership/senior management - success depend on individual efforts; change factors as an unpredictable serendipity - sustainability functionally isolated; firm's main objective is to gain capital efficiency - objectives only partly known 	<ul style="list-style-type: none"> - systematisation of existing practices - objectives identified but not in alignment with business target (to gain operational efficiency) - supporting mechanisms are informal, according to needs (access to past information) - policies defined and the firm has strengths in doing similar work; focus on processes and activities planning - change factors as processes and activities interdependence 	<ul style="list-style-type: none"> - decision based on risk/reward - integration starts; but still seen as separate subject - objectives are known; firm's target is to gain product/service quality and main objective is to enhance the firm's image - negative impacts prevention driven by processes - balance between emotions and rationality not achieved - responsibility assigned to a unit or team - measuring is coordinated 	<ul style="list-style-type: none"> - customers as driver; focus on productivity and efficiency - target is on costs reduction aiming competitive advantages - seek social-environmental improvement; goals quantified and measurable; objectives revised; focus on planning and controlling multiple activities - exists shared vision, individual awareness and leadership - positive emotions leads to creativity and intuition - formal & powerful processes 	<ul style="list-style-type: none"> - sustainability driven firm - positive emotions (ratio at or above 2.90) leads to creativity across the sustainability net, focus on innovative ideas - participative process; strategies and activities aligned and integrated across the net - collaborative innovation and continuous sustainability performance improvement system; inter-group learning - values (universal principles) embedded in every process
Partnerships	<ul style="list-style-type: none"> - selection driver is price - hierarchical structure - functionally driven - competition among partners 	<ul style="list-style-type: none"> - selection driver is delivery - matrix structure where partners interact and proactive collaboration starts to be felt 	<ul style="list-style-type: none"> - selection driver is quality - distributed coordination structure where structured collaboration starts to be felt 	<ul style="list-style-type: none"> - stakeholders engage and trust is leveraged through dialogue - communities of practice structure (focus on values) 	<ul style="list-style-type: none"> - driver is trust; values and mission are jointly defined - symbiotic network structure - education across the net
Motivation	<ul style="list-style-type: none"> - environment of we/they competition between individuals - behavioural structure with no sense of ownership 	<ul style="list-style-type: none"> - structure of individual teams (no focus in collective performance); reward/punishments systems - cooperation starts to be felt 	<ul style="list-style-type: none"> - cooperation between inter-dependent teams - informal training of sustainability and necessary skills and practice 	<ul style="list-style-type: none"> - teamwork; reward systems - dialogue & conversations lead to individual discovery/learning - teams share experiences 	<ul style="list-style-type: none"> - self-managing teamwork; high performance teams in the net - inclusive dialogue and active participation; common vision
Competences	<ul style="list-style-type: none"> - information – paper processing and fast accountability - no individual, team or organisational learning 	<ul style="list-style-type: none"> - information – general support; comply with speed requirements - individual learning to comply with functional roles 	<ul style="list-style-type: none"> - information – improve decisions - team learning promoted to improve decision making and business efficiency 	<ul style="list-style-type: none"> - information – strategic resource - training and education - quality of transferable knowledge is predicted 	<ul style="list-style-type: none"> - information flow free and a common base of knowledge in the net maximise individuals learning and creativity
Communication	<ul style="list-style-type: none"> - minimal processes and channels in place 	<ul style="list-style-type: none"> - processes and channels are project to project basis 	<ul style="list-style-type: none"> - based on the firm's core competences and objectives 	<ul style="list-style-type: none"> - based on feedback loops and information persistence - interpersonal and technological channels in use 	<ul style="list-style-type: none"> - based on cross-boundary learning and knowledge flow - intuition and rational analysis become complementary
Technology	<ul style="list-style-type: none"> - focus on manual individual routines automation; craft development character - embryonic 	<ul style="list-style-type: none"> - data-based; IT used to build systems that crosses functions and allow data sharing; stimulus to support decisions 	<ul style="list-style-type: none"> - Information based; IT used to build applications centred on processes rather than functions; synchronised with the strategy 	<ul style="list-style-type: none"> - flexible infrastructure basis to enable communication and information flow through the firm; firm's self organising capability 	<ul style="list-style-type: none"> - cooperative sustainability net - network's self organisation - continuous learning/adaptation - creativity in decision making
Operations	<ul style="list-style-type: none"> - focus on understanding and establishing basic processes that are not linked to strategy; end-of-pipe solutions; individual abilities 	<ul style="list-style-type: none"> - policies support practices; aim to reduce impacts with better use of materials & natural resources - structured processes/activities 	<ul style="list-style-type: none"> - firm-wide understanding of activities, roles & responsibilities - idea for integration/alignment - streamlined processes/activities 	<ul style="list-style-type: none"> - autonomous, flexible and integrated processes/activities; use of renewable energy sources and fewer natural resources 	<ul style="list-style-type: none"> - processes/activities/values aligned across the net; functional silos removed (information flow) - systemic processes/systems

Source: Cagnin [2005]

References

- Anderson, R. (2004), Climbing Mount Sustainability, *Quality Progress*, Vol. 37, No. 2, pp. 32-37.
- ASIS&T (2004), Fifth Annual ASIS&T Information Architecture Summit – Breaking New Ground, Texas.
- Bovet, D. M. & J. A. Martha (2000), *Value Nets: Breaking the Supply Chain to Unlock Hidden Profits*, John Wiley & Sons Inc.
- Brancheau, J. C. & Wetherbe, J. C. (1986), Information Architecture: Methods and Practice, *Information Processing and Management*, Vol. 22, pp. 453-463.
- BSI (2003), *The SIGMA Guidelines: Putting Sustainable Development into Practice – A Guide for Organisations*, Published by BSI for the SIGMA Project.
- Bursztyn, M. et al. (1999), C&T para o desenvolvimento sustentável – Formulação e Implementação de Políticas Públicas Compatíveis com os Princípios do Desenvolvimento Sustentável definidos na Agenda 21. http://www.mma.gov.br/port/SE/agen21/21_bras.html
- Cagnin, C. H. (2005), *An Information Architecture to Enable Business Sustainability*. PhD Thesis, PREST.
- Covey, S. (1997), Putting Principles First. In Gibson, R. (ed.), *Rethinking the Future*, Nicholas Brealey Publishing Ltd, pp. 34-46.
- Cox, D. & Loveridge, D (1999), *Innovation for Development Toolkit*, Report Prepared for UNESCO.
- Curtis, G. (2000), Information Architecture Practice: An interview with Gayle Curtis Modern Media, Washington: American Society for Information Science, pp. 11-12.
- Davenport, T. H. & L. Prusak (1998), *Ecologia da Informação*, São Paulo: Futura.
- Dillon (2001), *Practice Makes Perfect: IA at the End of the Beginning*, Washington: American Society for Information Science.
- Elkington, J. (1998), *Cannibals with Forks: the Triple Bottom Line of 21st Century Business*, New Society Publishers.
- EU (2004), *The Lisbon Strategy: The Lisbon Strategy for Economic, Social and Environmental Renewal*. <http://europa.eu.int/comm/lisbon_strategy/intro_en.html>
- Farnum, C. (2002), Information Architecture: 5 Things Managers Need to Know, *The Information Management Journal*, pp. 33-40.
- Gordon, S. (2000), Information Architecture Practice: An Interview with Seth Gordon Zefer, American Society for Information Science, *Bulletin of the American Society for Information Science*, Vol. 26, No. 6, pp. 13-15.
- Hane, P. J. (2000), ASIS gets an 'ASIST': Information Scientists Embrace Technology, Medford: Information Today, pp. 24-25.
- Hardis J. (2003), Social Multipartite Partnerships. In Morsing, M. & Thyssen, C. (eds.) *Corporate Values and Responsibility – The Case of Denmark*, 1st ed, Samfundslitteratur, Narayana Press, pp. 199-210.
- Kettinger, W.; Teng, J. T. C. & Guha, S. (1996), Information Architectural Design in Business Process Reengineering, *Journal of Information Technology*.
- Laudon, K.C. E J.P. Laudon (1996), *Management Information Systems: A Contemporary Perspective*, New Jersey: Prentice Hall.
- Laudon, K. C. E J. P. Laudon (1999), *Sistemas de informações*, LTC.
- Losada, M. (1999), The Complex Dynamics of High Performance Teams, *Mathematical and Computer Modelling*, Vol. 30, pp. 179-192.
- Losada, M. (2001), The Art of Business Coaching, 2nd General Conference of the Specialization Course, Brasilia.
- Lund, J. E. (2003), Partnerships in Practice. In Morsing, M. & Thyssen, C. (eds.) *Corporate Values and Responsibility – The Case of Denmark*, 1st ed., Samfundslitteratur, Narayana Press, pp. 179-191.
- Martin, J. M. (1990), *Information Engineering*, Prentice-Hall, Englewood Cliffs, Vols. 1, 2 and 3.

- McGee, J. & L. Prusak. (1994), *Gerenciamento Estratégico da Informação: Aumente a Competitividade e a Eficiência de sua Empresa Utilizando a Informação como uma Ferramenta Estratégica*, Rio de Janeiro: Campus.
- McStravic, S. (1999), *The Value Marketing Chain in Health Care: The Value Marketing Chain Concept Finds a Place in the Health Care Environment*, *Marketing Health Services*, Vol. 19, No. 1, pp. 14-19.
- Olsen, L. H. (2003), *Corporate Accountability – the Case of Denmark*. In Morsing, M. & Thyssen, C. (eds.) *Corporate Values and Responsibility – The Case of Denmark*, 1st ed., Samfundslitteratur, Narayana Press, pp. 229-239.
- Peek, R. (2000), *ASIS Summit 2000: Defining Information Architecture*, *Information Today*.
- Periasamy, K. P. & Feeny, D. F. (1997), *Information Architecture Practice: Research-Based Recommendations for the Practitioner*, *Journal of Information Technology*, No. 12, pp. 197-205.
- Porritt, J. (2001) *The World in Context: Beyond the Business Case for Sustainable Development*. Cambridge: HRH The Prince of Wales's Business and The Environment Programme – Cambridge Programme for Industry.
- Porter, M. E. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, New York: Free Press.
- Rodriguez, M. V. & A. J. Ferrante (1995), *Tecnologia da Informação e Mudança Organizacional*, Rio de Janeiro: Infobook.
- Rodriguez, M. V. & A. J. Ferrante (2000), *Tecnologia de Informação e Gestão Empresarial*, Rio de Janeiro: E-Papers.
- Rosenfeld, L. & Morville, P. (1997), *Information Architecture for the World Wide Web*, 2nd ed., Sebastopol, CA: O'Reilly & Associates.
- Rosenfeld, L. & Morville, P. (2002), *Information Architecture for the World Wide Web*, 2nd ed., Sebastopol, Calif.: O'Reilly & Associates, Inc.
- Shelton, C. (1997), *Quantum Leaps*, Butterworth-Heinemann.
- SIGMA (2001), *The SIGMA Project – Sustainability in Practice*, *The SIGMA Guidelines: Pilot Draft*, SIGMA Project Management Team. <<http://www.projectsigma.com>>
- Soares, J. C. C. (2000), *Modelagem de Sistemas de Informações para o Gerenciamento de Cadeias Logísticas: uma Demonstração das Possibilidades de Aplicação na Indústria de Petróleo*, Florianópolis: Ph.D. Thesis, EPS/UFSC.
- Sowa, J. F. & Zachman, J. A. (1992), *A Logic-Based Approach to Enterprise Integration*, *Enterprise Integration Modeling: Proceedings of the First International Conference*, Cambridge: The MIT Press, pp. 152-166.
- Tapscott, D. (1997), *Economia Digital*, São Paulo: Makron Books.
- UN (2004), *Agenda 21*.
<<http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm>>