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INFORMATION SYSTEMS CONTRIBUTION TO THE DEVELOPMENT OF A SUSTAINABLE PURCHASING POLICY

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Abstract

Sustainability has become a central corporate concern as well as a key factor of success in terms of both image and productivity. In turn, the purchasing function is crucial to the definition and implementation of a sustainability policy. It drives a company's sourcing activities and connects its other functions (i.e. internal customers) to external suppliers and providers. In short, sustainable purchasing plays a key role in global strategy and therefore requires high performance tools. Information systems, which have come under heavy criticism due to their negative environmental effects, can provide support services while also stimulating and disseminating sustainable purchase policies. This is because despite their poor reputation, purchasing information systems - which are usually designed to manage transactions and generate quick and significant gains through cost-cutting - have evolved to become virtual communities of practice where purchasers collaborate with one another and with internal or external partners to create sustainable value. The present study combines a literature review with a qualitative study to illustrate this emergence and show how information systems can and will contribute to the development of corporate sustainable purchasing policies. Using an exploratory approach and constructivist positioning, a "business forecasting" method is implemented to suggest a possible future for sustainable purchasing management, along with a new role for information systems. Towards this end, a scenario is co-constructed by 12 purchasing function experts responding to questions about their customs and practices and talking about their experiences, the effects of the rising wave of environmentalism, the problems they face in implementing and optimizing information systems and their professional. They also offer a few predictions and suggest new methods and modes of coordination. The study traces the development of new and innovative modes of sustainable purchasing management. These are aligned with a company's global strategy thanks to the use of innovative information systems facilitating the dissemination of policies that purchasing departments implement both internally and externally through the integration of suppliers. Purchasing functions and information system departments work together to reduce the environmental footprint of technology and to exert greater influence on collaboration and teamwork by building an economic environment that is more viable and livable and also fairer. The originality of this article resides both in its sophisticated methodology, which associates several complementary approaches, and in its conclusions, which anticipate a probable future.

Keywords: Purchasing, information systems, sustainability, collaboration, forecasting

INTRODUCTION

The rapid generalization of management information systems (IS) can be partially explained by such systems' ability to improve organizational performance, particularly as regards productivity (Bakos, 1987). Inter alia, information systems enable a leaner management of flows by reducing delays and errors, increasing reliability and responsiveness, eliminating undesirable tasks, optimizing resources and facilitating decision-making (Raymond, 2002). Their strategic role in guaranteeing greater individual and collective efficiency is universally recognized (Lucas, 1975). The powerful connection between senior management and the IS department also attests to this, with the IS strategy exerting direct and crucial influence on the global corporate strategy (Croteau et al., 2001). Information and communications technology (ICT) is a pillar of corporate activity because it (1) embodies competitive advantage in and of itself thanks to its optimization of processes, introduction of a high-performance technological watch function and improvement in knowledge management, while also (2) contributing as a tool that creates indirect competitive advantage through, for instance, the development of new killer technologies (Bernasconi, 1996).

Yet despite their managerial virtues, the rising wave of environmentalism during the 2000s renewed scrutiny of information systems' environmental footprint. According to Gartner (2009), data centers' energy consumption has doubled in five years, with only 3% of this energy being transformed into real value. In France, for instance, information technology-related assets' consumption already accounted for 13.5% of total electricity consumption in 2008, a figure that has continued to rise sharply since (Breuil et al., 2008). With one billion computers due to be either destroyed or recycled worldwide in 2010, the situation is critical. The idea that these goods can be shipped to India or Africa and allowed to pile up on enormous vacant lots has provoked great hostility. Such behavior is disastrous for a company's image. The fact that the production of a microprocessor requires 650 times its weight in chemical and energy resources raises serious questions about companies' intensive and extensive utilization of information technology (IT). Information sources are a source of pollution and their expansion severely undermines the strategic orientations of companies seeking a greener image. Concepts such as "ecological IS" or "sustainable ICT" are widely deplored as greenwashing, i.e., politically correct representations glossing over the image of tools that are very damaging to the environment (Lubbers, 2003).

Professionals often seek solutions to reduce their digital technologies' environmental impact. They try to achieve savings at both the design and utilization levels. The Club Informatique des Grandes Entreprises Françaises noted in its annual report that, "Information systems' sustainable performance is more than ever a challenge and an opportunity for IS departments. Yet sustainable performance must also overcome a number of hurdles, like how to ensure that information systems that are increasingly complex, open and interdependent can function sustainably and provide top performance, or how to take advantage of innovations and new kinds of usage to create sustainable performance and value" (Cigref activity report, 2008). The idea here is that the purchasing function plays a particularly significant role to play since it transforms intra-organizational information systems into integrated management programs (ERP Enterprise Resource Planning) while using the Internet and inter-organizational tools as platforms for managing supply chains and supplier relationships. Lastly, purchasing also plays a key role in companies' overall sustainability policies.

The present study therefore focuses on purchasing functions' management and use of information systems for sustainability purposes. The first section construes purchasing management as a paragon of sustainability since it is this function that wields the action lever that is paramount in environmental, social and societal performance terms. A literature review then highlights purchasing information systems' role in improving performance. The second section describes a research protocol based on exploratory and constructivist approaches associating "business forecasting" and scenario

methods. 12 business experts are interviewed according to a precise interview format and asked to differentiate between good and bad practice. The third section presents a number of predictions grounded in literature and discussions with experts. Purchasing information systems' potentialities with respect to the construction and dissemination of sustainability policies are demonstrated through illustrations and personal accounts.

1. THE STUDY'S UNDERLYING THEORETICAL FOUNDATIONS: INFORMATION SYSTEMS SERVING THE SUSTAINABLE PURCHASING FUNCTION

Purchasing management and information system management both play highly strategic roles in modern companies, particularly large multinationals. This is because purchasing often accounts for more than half of total revenues and constitutes a main source of competitive advantage. Information systems can be used as tactical piloting tools enabling an optimization of operational management, information flows, resource allocation, competitive and technological watch, knowledge management and sharing, internal and external collaboration and decisional analysis. Thus, associating these two functions (IS and Purchasing) creates a powerful internal coalition capable of developing tools that will advance the cause of sustainability in its economic, ecological and social dimensions.

1.1. Purchasing mutates from cost-killing to sustainable value creation

Little by little, large, vertical and very hierarchical firms have been replaced by horizontal organizations that concentrate on what they view as their core business. In turn, this has meant growing reliance on market-based actions (Allal-Chérif, 2007). The purchasing function has developed naturally, with each outsourced activity giving birth to one or several new purchasing portfolios. Relying on external providers for increasingly strategic tasks has created a need for highly qualified and specialized purchasers (Ballaz, 2002). The fact that the purchasing functions are starting to account for a rising percentage of total corporate revenues has underpinned their growth and given them considerable power since each purchasing decision can have major financial consequences (Emiliani, 2000). Purchasers no longer expect prices to remain stable but now "want lower prices. The balance of power has shifted completely because so much information is available online. An abundance of competitors and choices has conditioned customers to look for better quality, faster deliveries and customized products and services adapted to their individual needs at the lowest price. If a company cannot satisfy all of these criteria, customers will go elsewhere to find another one that can" (Monczka et al, 2009). The current crisis has further amplified this phenomenon. At the same time, it appears that after a period during which Purchasing frantically sought to cut costs and rationalize processes, it now concentrates on things like technological watch, innovation, sustainability and global B2B marketing (Comité 21, 2005). Purchasing has become a guarantor of suppliers' diversity and integrity. Purchasers and their supplier partners' joint search for cost rationalization are starting to replace cost cutting.

Yet consulting companies continue to suggest cost-killing methods that are "totally out of sync with current managerial thinking, which advocates long-term relationships" (Perrotin and Soulet de Brugière, 2007). Although costs remain an important issue, they are managed differently in purchasing structures characterized by an advanced level of maturity. A 2009 study by Planning Perspectives Inc. has shown that firms with the worst supplier relationships are in decline as exemplified by General Motors (with a score of 144/500) or Ford. This can be contrasted with firms that score best in this respect, such as Toyota (399/500) or Honda. Cost and a lack of transparency are the main sources of conflict between carmakers and suppliers. A leading advantage for Japanese brands has been their superior management of relations with preferred suppliers (Monczka et al, 2009). Solid mutual trust is what has enabled Toyota to draw up ambitious plans characterized by a 30% cut in costs between

2010 and 2013. This reduction involves a joint search for new technologies, materials and processes that cost less. It is a win-win, innovation-based development strategy.

The fragmentation of the productive system increasingly implies recourse to subcontractors and a growing need for integration (Allemant, 2006). The emergence of networked companies has led to a redefinition of firms' relationship to their territories (Veltz, 1996). Right-sourcing and in-sourcing have started to replace outsourcing. As a solution, cooperative management of the purchasing function is a budding success (Figure 1) that very few companies had thought about before the crisis but which suddenly became much more popular afterwards.

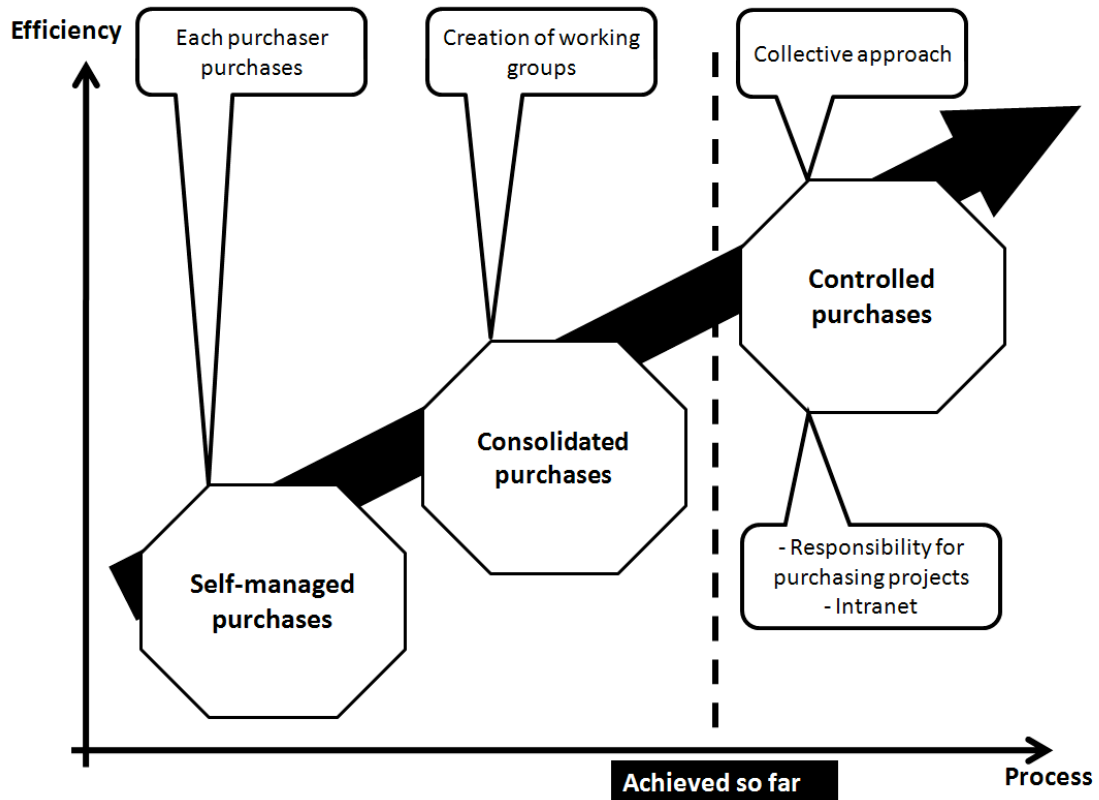


Figure 1 The evolving efficiency of purchasing (Perrotin and Soulet de Brugière, 2007)

A cooperative management of the purchasing function can only be found in a few very mature pioneering companies such as Schneider Electric, IBM or Nestlé. This method has gained many fans since the outbreak of the economic crisis and is being applied to both internal and external collaborations. Internally, it can materialize in the form of (1) synergies between Purchasing and other functions such as Research and Development or Marketing, (2) decisions taken jointly by different hierarchical levels, and (3) cross-departmental project management run by purchasing professionals. Externally, the main forms of a cooperative management of purchasing are (1) the technological co-development or co-design of products in conjunction with suppliers, (2) innovation sponsoring, (3) the assisted piloting of production (4) the integration of information systems, (5) the automation or externalization of some purchases, and (6) collaborative strategic management (Perrotin, Soulet de Brugière, 2007; Allal-Chérif et al., 2010).

1.2. Inter-Organizational Information Systems (IOIS) serving the purchasing function: the advent of purchasing information systems

Networks enable members to concentrate on their core business and externalize the rest of their activities. They organize interdependency relationships between multitudes of firms (Barringer and Harrison, 2000), coordinate physical, financial and information flows and establish standards. An e-purchasing information system constitutes a platform that is specific to a network of purchasers and suppliers, enabling them to communicate and collaborate. It is a “virtual” and “decentralized” site (Pensel, 2004) where companies can meet and interact with one another and with partners such as IT service providers, consultants, banks, insurance companies or marketing firms. Unlike traditional markets, electronic markets make massive usage of ICT. They are more transparent, making it easier to create relationships among a large number of actors found anywhere in the world and helping people to obtain information more easily about companies, products, technologies or legislation (Allal-Chérif, 2008).

Different authors will have different ways of referring to the inter-organizational relationships that have been developing between companies since the early 1980s (thanks to ICT). Fréry (1996), for instance, has counted 45 categorizations. This proliferation of references reflects the heterogeneity of peoples’ viewpoints as well as the diverse nature of a reality that is often perceived and described in a vague and confused manner. Most difficult to understand is the frequently used construct of a “network” (Benda, 2003). The theory of strategic networks linking different organizations shows how they work together to obtain a competitive advantage that they cannot achieve by themselves (Ouchi, 1980; Thorelli, 1986). Purchasing information systems gives firms that do not know one another but possess complementary “talents” a vehicle for meeting virtually, irrespective of the distance involved or the cultural barriers they face. It also allows them to communicate and work together on a site that can then become a place of collective creation. Purchasing information systems operate like a network of networks, creating relationships between companies that are not accustomed to working together but which may have good cause to do so.

Miles and Snow (1992) have presented different ways of developing inter-company relationships in the form of networks. “Stable” networks correspond to the establishment of long-term partnerships, akin to the connections tying distributors to their suppliers or suppliers to their own suppliers. “Internal” networks involve the subsidiarisation of activities within a company in which different departments operate as if each constituted a separate entity. “Dynamic” networks are ad hoc associations geared towards specific objectives. They are rooted in interventions by the company with responsibility for coordinating exchanges between partners. Purchasing can be part of three types of networks and even serve to pilot them. E-purchasing tools’ fundamental role in running such networks has been progressively reinforced over time. Specifically, such tools enable: (1) companies that differ in nature to pool assets and fulfill certain tasks through collective engagement; (2) a contract-based management of relationships between members possessing some awareness of their interdependency but seeking to highlight their common interest, thereby improving each party’s individual situation; and (3) intra-network linkages, frequent interactions, exchanges and resource sharing. Increasingly complex tools have been implemented to sustain the considerable information flows being developed (Thorelli, 1986). Purchasing information systems create interdependent networks between suppliers and distributors “focused on the search for a distinctive sustainable competency based on mutual learning” (Filsler, 2002).

Clemons et al. (1993) have defended the idea – entitled “The Move To The Middle Hypothesis” – that even if ICT helps to reduce transaction costs, it does not draw companies deeper into markets but moves them instead towards commercial communities where they can concentrate on their core businesses and entertain very close sustainable relationships. Purchasing information systems are a response to researchers’ “premonitions” or efforts to anticipate both changes in the relationships between actors operating in one and the same market as well as their strategic moves. Four criteria can

be used to distinguish corporate networks: whether they have a high or low degree of specificity; and whether their logic is additive or complementary (Heitz and Douard, 2000). In particular, additive logic consists of creating new competencies and resources by exploiting the competencies or resources of other companies cooperating within the same network. It is this pooling of complementary activities that helps to bolster the value chain of companies in a transactional network. “Situating to the bottom right of the schema (...) transactional networks emphasize exchange relationships between partners - starting with their reliance on the market – while enabling them to take charge of or reinforce part of the firm’s value chain “ (Heitz and Douard, 2000).

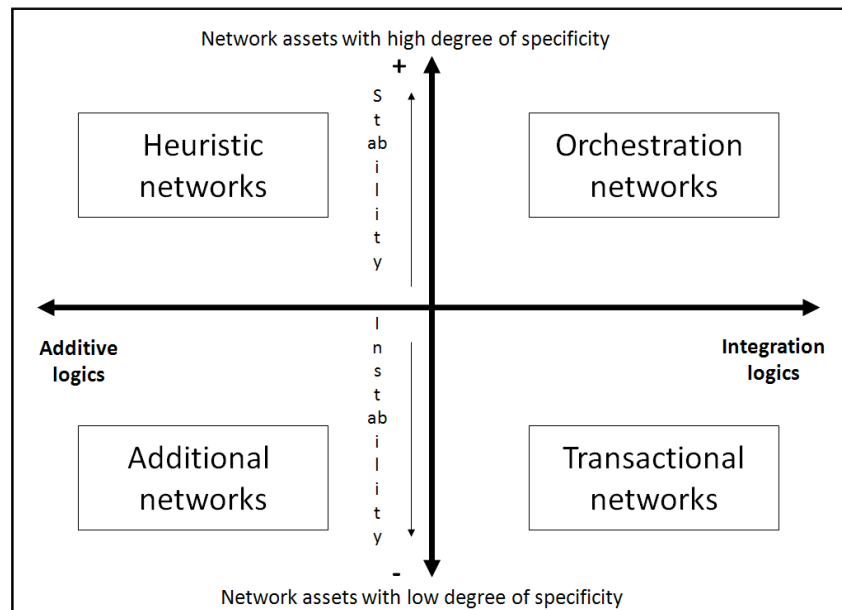


Figure 2 Network analysis matrix (Heitz and Douard, 2000)

Commercial relationships have been slow in incorporating social relationships. Trust-based controls and/or social controls have been the topic of much research into how trust is built, its role in business partners’ choice and its status as a competitive advantage (Guibert, 1999). “Trust makes it possible to (1) restrict exchange-related risks in situations of uncertainty, (2) dissuade partners from behaving opportunistically, (3) reduce transaction costs, and (4) improve the quality of cooperation” (Beaujolin-Bellet and Nogatchewsky, 2005). Purchasing information systems increase uncertainty by bringing together actors who are unfamiliar with one another. The mode for selecting participants is not always very transparent, creating suspicions about how one’s new interlocutors might behave. It is very difficult for network members to adopt a win/win attitude and above all to convince themselves that fellow members are pursuing the same approach. In short, purchasing information systems cannot eliminate imbalances in power and control. Quite the contrary, “transactional” purchasing information systems accentuate such variables. The kind of altruistic transparency that emphasizes common interest must overcome risks like (1) opportunism (Kumar and Van Dissel, 1998), (2) the manipulation of information to partners’ detriment (Han et al., 2004), and (3) free riders who might disseminate false information or use resources without offering them to other members (Kumar and Van Dissel, 1996). The strategic challenge also involves managing trust and shared performance (Clemons and Weber, 1990) through an in-depth modification of the balance of power between actors (Stern and Craig, 1971).

1.3. Purchasing information systems: disputed tools in the service of sustainability

ICT longevity has a very bad reputation. “For three-quarters of a century, or since the invention of the first modern computer (...) IT specialists have been like people trying to build a chimney fire in an air-conditioned room ... without ever wondering what’s strange about that!” (Lequeux and Challande, 2009). A number of studies have demonstrated how ICT has deeply modified inter-organizational relationships and considerably improved logistics chain management (Cash, Konsynski, 1985; Malone, Yates, Benjamin, 1987; Benghozi, 2001, Tran, 2004, Allal-Chérif, Favier, 2008). Both observers and professionals attribute to these technologies the ability to cut transaction costs and increase the quality and rapidity of interactions between business partners. It is thanks to ICT’s rise that people could - and will still be able to - reduce the transport sector’ ecological footprint by building public transportation systems. In a green book on green IT and sustainability published in 2009, the French Association of Professional IT Consultants and Software Engineers explained that, “Dematerializing commercial transactions enables online purchasing and optimizes logistics chains. By restricting the transportation of goods and persons in this way, it cuts energy consumption and the associated greenhouse gas emissions”. It is thanks to the introduction of ICT that industries’ energy efficiency has made such progress, notably through an optimized management of lighting, heating and temperature control.

Thus, IOIS implements ICT to improve relationships between firms. However, ICT also plays an increasingly important role in relationship between business and the ecosystem, or the “human, social, geographic, urban and rural environment” (Lequeux and Challande, 2009). Information System departments can innovate and offer proposals that are decisive for the conservation of natural spaces while limiting consumption of energy or other resources and helping in the battle against global warming. More specifically, just measuring the “sustainability” of an economic activity (or at least estimating this) requires very reliable and high performance IT tools. Information systems make it possible, for example, to find ways of measuring a product’s pollutant substances or contribution to global warming in CO₂ equivalency terms. This carbon footprint can be analyzed and lowered by means of an information system that will compare the company’s environmental performances to current standards (like ISO 14001 or SA 8000) or given objectives.

A sustainable or version 2.0 management of Information System departments would involve three complementary dimensions that must be aligned with a company’s global strategy (Figure 3). The first dimension involves ecology “for its own sake” (Lequeux and Challande, 2009). Two ICT-related challenges can be noted at this level. Firstly, there is the problem of the growing amount of electricity that is being consumed (and therefore requires control). This can be apprehended in conjunction with the need to avoid running out of the natural resources required to produce electricity. To become greener, information systems must optimize both equipment and premises (Jarrosson, 2009). It is therefore crucial that sustainable materials and components be used. The second dimension revolves around information systems’ ability to suggest that “internal customers” use tools that can bring people closer together – at least virtually – by reducing travel requirements. Examples include messaging, video-conferencing or digital working spaces. Suggestions might also pertain to energy saving systems such as e-Learning or R&D simulations (Lequeux and Challande, 2009). Information System departments also support telecommuting, which saves time, money and energy for companies and employees alike. Distance working accounts for up to 30% of some activities in companies like HP or Schneider (Allal-Chérif, 2010). Lastly, a third dimension involves corporate cultures and materializes in activities like green mailings or the eco-intranet.

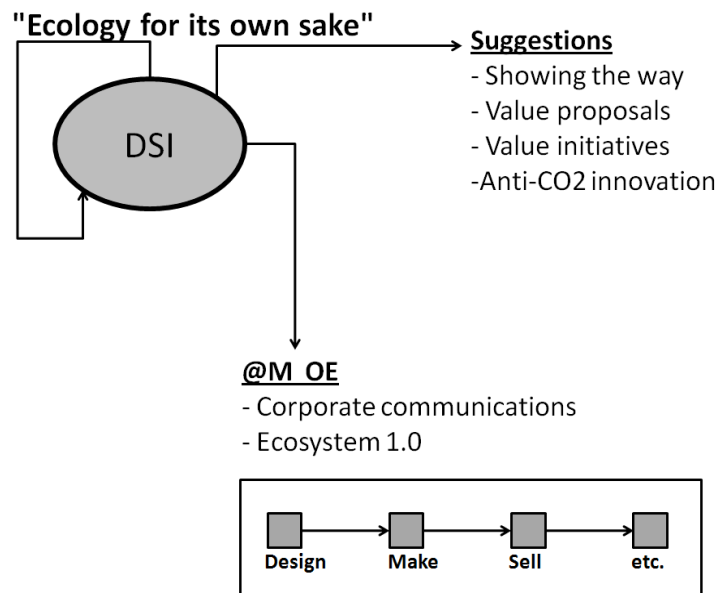


Figure 3 Ecosystems and green IT (Lequeux and Challande, 2009)

Above and beyond the purely financial dimension of cost-cutting facilitated by purchasing information systems, such IS also feature a very strong social dimension insofar as they help many employees to link up via a single platform where they can exchange information, conduct negotiations, share resources and collaborate on projects. This means that economic relations cannot be dissociated from social relations, some of whose components - particularly trust - influence commercial mechanisms and embody the principle that economic activities are first and foremost comprised of social activities and networks (Granovetter 1985; Ratnasingam, Pavlou and Gefen, 2005). For companies to be able to work together, it is indispensable that the individuals representing them agree about the conditions of their collaboration and learn to know and trust one another. Purchasing information systems can offer high performance virtual communities of practice leading to (1) greater fairness, (2) ambitious codes of conduct, and (3) actors' coordination around a sustainable corporate approach, as illustrated in the Text 1.

“People already know how new information and communications technologies affect the global economy. **But how crucial are they to its sustainability aspects?** Two examples from European steel-maker Essilor illustrate the positive side of this relationship: logistics systems that have enabled and supported a large number of actions aimed at reducing defects and waste while optimizing inventory; and the frequent use of this network for WebMeeting audio or video-conferences that considerably reduce the need for travel, hence the associated energy expenses and other costs. Essilor also benefits from ICT advances and tries to keep up with developments and innovations in this area (...). The company reports information relating to various sustainability aspects by implementing - albeit not exhaustively - GRI Global Reporting Initiative benchmarks. It deploys a so-called business intelligence tool derived from the Hyperion® HFM financial reporting product. After studying specific solutions, Essilor decided to use the same Hyperion® software to create a coherent dedicated application called Sustainability, which it combines with the Figures financial reporting application whose sole vocation is extra-financial reporting. The choice to use a dedicated tool can be easily explained. **Sustainability is a cross-departmental function that is entirely integrated into strategy and daily life** at Essilor, which is constantly trying to catalyze, federate and coordinate operations and people. The preferred method is to rely on existing networks and systems. The company can only gain deep knowledge of sustainability indicators if each of its units appropriates this

directly. **By delegating the reporting of social and environmental data to its financial officers, Essilor is increasing data reliability and attributing to non-financial information the same importance as financial information enjoys.** The company encourages and values the daily actions of specialists working on many different sustainability aspects. Nevertheless, much work still needs to be done to help extra-financial reporting achieve the same level of quality as financial reporting already has.

Text 1 *Essilor, 2006 activity report*

After this literature review of the main sustainability factors explaining the evolution of purchasing - and of the information systems associated with this function - the second section proposes an innovative methodology intended to look beyond current practices and imagine how ICT might contribute more directly and effectively to the development and dissemination of a sustainable purchasing policy.

2. AN EXPLORATORY AND CONSTRUCTIVIST METHODOLOGY: “BUSINESS FORECASTING” ASSOCIATED WITH A SCENARIOS METHOD

The future is a way of achieving a collective desire and common will (Thamain, 2009; Boyer and Scouarnec, 2009). To apprehend the future of purchasing functions and discover how they might use information systems to go green, it is worth scrutinizing the expectations and forecasts of the actors working in this function. The purpose here is to adopt a “global, rational and appropriation-oriented approach” that is action-oriented (Hatem and Pr el, 1995; Boyer and Scouarnec, 2009). After all, purchasing function management should be part of a long-term vision based on a precise and subtle perception of weak signals announcing future developments, detected by persons immersed in the purchasing sphere but who want to have some influence on and control over their business. The aim is to identify future ruptures and discontinuities by extrapolating from the past in a way that allows people to make preparations and take measures allowing them to face these changes with tranquility (Jouvenel, 1999).

2.1. Exploratory methodology, constructivist positioning and qualitative approach

“Depending on researchers’ experience, training, beliefs and values, they tend to prefer one approach rather than another” (Thi tart, 2007). Purchasing information systems are relatively new tools that have generated a more or less limited number of studies. Hence the idea of exploring such virtual technologies and their universe to try and deduce theories and predictions that can be useful for the future. The principle being applied here is based on “generating theory” (Glaser and Strauss, 1967) or “building theory” (Eisenhardt, 1989). In their book, Glaser and Strauss presented “grounded theory” as a general methodology enabling the generation of new theories in social and human sciences (Guillemette, 2006). A polemic tone is adopted in the style of an appeal to researchers that they find a different way of conducting scientific research (Dey, 1999). This can be contrasted with the hypothetical-deductive method where researchers explain phenomena based on postulates. Here, it is only current theories that are illustrated using empirical data that is no more than an example. In the present study, the starting point is the sum total of practices used by actors-experts offering their vision of a preferable future path for purchasing information systems.

Grounded theory derives from an immersion in the empirical data that is associated with the theories covering the phenomena being observed. These are “new theories” that supplement existing theory and explain new situations. In a purchasing information system framework, the large number of cases and general the diversity can help to generate a theoretical model corresponding to the cases for which data is being collected, while also being at least partially generalized to other cases. This model will be

constructed thanks to observations and analysis of the data that is collected during interviews and which explains how purchasing information systems function as well as the different interactions between them and their users. The overall goal is to better apprehend the positive and negative effects of the rise of purchasing information systems; anticipate their progression and subsequent development; and offer recommendations on their strategic eco-positioning. This will be followed by an exploration of their varying uses, one that will account both for some purchasing information systems' associated properties and for users' characteristics. This qualitative approach derives both from our exploratory orientation and from the relatively limited number of purchasing information studies – although the distinction with a quantitative vision is not always very clear or relevant (Glaser and Strauss, 1967; Baumard and Ibert, 1999). Many authors have attested to the richness of this kind of qualitative approach and to its descriptive and explanatory capacities (Miles and Huberman, 2003).

“The label of quantitative methods has no real meaning in any social science. At best it is a generic expression covering a range of interpretive techniques aimed at describing, decoding, translating and achieving meaning. What it does not seek to understand is the frequency of the more or less natural phenomena that are produced in the social world. Operating in a qualitative mode means focusing on linguistic symbols and attempting thusly to reduce the distance between signified and signifier; theory and data; and context and action” (Van Maanen, 1979). Qualitative approaches may be criticized for their strong dependency on the number and representativeness of cases - and also because they imply generalizations based on a limited number of observations or experiences - but today they constitute a scientific research method that is recognized for its analytical power and ability to explain organizational phenomena running over a relatively long period of time. In particular, this approach is suitable within the progressive development framework that characterizes purchasing information systems.

Epistemological positioning has had a major influence on the way in which this study was run and on its findings. It is therefore important to clarify this positioning to justify the method chosen, validate the knowledge produced and legitimize the results obtained. A choice had to be made between the three epistemological stances proposed in literature: positivism; interpretivism; and constructivism (Wacheux, 1996). More specifically, constructivism focuses on social interactions and processes as modes for explaining a reality (Berger and Luckmann, 1966) that is produced by the logical individual actors who are participating in it (Boudon, 1979) and which therefore undergoes permanent reconstruction (Baumard, 1997). It is the rationality of action manifested by each of the actors involved in particular decisions - in this case, purchasing processes - that will determine the reality of the situations in which they find themselves (Girin, 1990). Individuals make constructions and are constructed by engaging in interactional phenomena together with other individuals, in a particular environment and using certain tools that force them to make choices. The images held by the actors who use purchasing information systems are shaped by their experiences. Purchasing information systems only exist because their users can describe their functioning, advantages and shortcomings.

2.2. Purchasing forecasts: towards structural and functional anticipation

The purpose of this article is to co-construct, according to rigorous principles, a shared representation of purchasing information systems' utilization within a purchasing function management framework, thanks to viewpoints expressed by the dozen actor-experts whom we interviewed (Thamain, 2009). “Albeit imperfect, this anticipation of changes, discontinuities and eventualities” in a purchasing function is not a question of managerial vision (Boyer and Scouarnec, 2002). Faced with the increasingly sustained and violent turbulences affecting the business world, forecasting has become indispensable for companies seeking to prepare themselves to face competitors who are also trying to anticipate the future and position themselves in relation to it. After all, environmental changes can to some extent be predicted and even partially controlled. The desire to adopt a proactive attitude towards sustainability, i.e. to avoid being overwhelmed by rising environmentalism, is also an argument in favor of using business forecasting within this kind of framework. Prepared adaptation will always be

much more effective than simply reacting to the unexpected. Moreover, it is through the use of forecasting as a means for identifying potential problems that timely solutions have the best chance of being discovered and applied (Julien et al., 1975). A scenarios method is a good way of “stimulating the imagination and reflection” of selected experts since they are supposed to envision how the purchasing function - construed as a complex set of professions, relationships and tools – might evolve towards a possible future. The role that information systems play in the changing management of the purchasing function, plus their role as levers of sustainable action will emerge naturally through these scenarios.

“Business forecasting involves anticipating possible outcomes in terms of the competencies, activities and responsibilities associated with a particular profession. It helps people to imagine which element (possible kinds of knowledge and qualifications, expertise or professional know-how, behavior and knowledge of how-to-behave) is most apt to serve individuals and organizations’ future purposes. Toward this end, it needs the actors-experts from the business(es) being analyzed to co-construct their possible future(s). By so doing, it encompasses thinking about individual professions and work organizations” (Boyer and Scouarnec, 2005). Thus, the present article tries to imagine all of the sustainability components constituting a purchaser’s function over the next few years, and how information systems can contribute to each of these components. The purchasing professionals we interviewed accepted to co-construct a new profession for purchasers, based on virtual purchasers born out of the changes in their old profession and its convergence with others, characterized by new qualifications and kinds of expertise; new tools; and a markedly different behavior towards their organizations and the environment.

The contextual apprehension stage first consisted of a theoretical state of the art concerning (1) companies’ increasing difficulty in adapting to the socio-economic environment, (2) the fundamental role that the purchasing function plays in defining a sustainability policy, and (3) the need for new tools to facilitate the dissemination and implementation of this policy. 12 purchasing professionals were selected and asked about their sustainable purchasing practices and the role that information systems play in these practices. These actors-experts were first subjected to a semi-directive interview intended to reveal the different facets of the problems they face and to get them to propose recommendations and new ICT utilizations within a sustainability framework. The pre-formalization stage enabled initial analysis of the interviews’ contents, an early structuring of the role of purchasing information systems and a distinction between stronger hypotheses and weaker assumptions. The construction stage enabled a comparison of these actors-experts’ viewpoints by organizing a second interview during which everyone’s vision was subjected to reciprocal criticism. The validation stage then featured co-constructed recommendations aimed at creating a positive effect on the phenomenon in question (Boyer, Scouarnec, 2009).

2.3. Selection of business experts and interview protocol

For this study, 12 purchasers and purchasing managers were chosen from companies of varying sizes and different sectors. This diversity allowed for a sufficient heterogeneity of viewpoints to cover the lion’s share of competencies, activities and responsibilities associated with the kinds of purchasers who were the object of analysis. To minimise subjectivity and interpretation effects, only half of these experts were previously known to the interviewers. On the other hand, to facilitate the climate of trust and confidence needed for a study of this nature, out of the pool of previously unknown experts, the researchers would only approach ones who had been recommended. The actors were asked to give some meaning to their practices by taking a step back and qualifying the events, actions, values, experiences and problems that they faced on a daily basis (Thiétart, 2007). The project’s exploratory status and focus on the future was coherent with this approach since the business experts being interviewed would talk about their experiences, answer one another and communicate specific experiences relating to the themes in question. Thus, it is a whole research universe that was reconstructed, with the singularity of each background and viewpoint considered crucial in evaluating

lines of questioning and potential hypotheses (Rogers, 1945). Table 1 summarizes some of the actors-experts' characteristics and gives each a code that will be referred to in the interview discussion below.

Purchaser's code	Function	Company size (staff numbers)	Revenues	Sector of activity
A1	Purchasing Manager	400,000	€104 billion	IT
A2	Purchasing Manager	270,000	€75 billion	Food
A3	IS/Purchasing Manager	200,000	€19 billion	Electricity
A4	Purchasing Director	120,000	€180 billion	Energy
A5	Purchasing Manager	100,000	€40 billion	Machines
A6	Purchaser	70,000	€20 billion	Cosmetics
A7	Purchasing Manager	55,000	€10 billion	Distribution
A8	Purchasing Director	9,000	€5,1 billion	Telecoms
A9	Purchasing Director	8,000	€2,5 billion	Textiles
A10	Purchasing Director	1,400	€800 millions	Healthcare
A11	Managing Director	47	€200 millions	Equipment
A12	Managing Director	20	€50 millions	IT consultancy

Table 1 Presentation of panel of purchasing manager interviewees

The interview guide was developed thanks to a literature review of authors who have been purchasing function professionals for the past 10 to 30 years. They also relied on a dozen interviews where actors-experts were contacted and introduced to the project. Each person's centers of interest and specialties contributed to the adaptation of an interview guide reflecting people's experiences and tastes. Some were particularly sensitive to sustainability or information system issues whereas others were more concerned by relations with (or the integration of) suppliers, with still others being concerned by their personal survival in their companies because they sensed their function was under threat in a hostile future. To prepare these interviews, the researchers made sure to have a good knowledge of the competencies and functions of each interviewee as well as the characteristics of their companies.

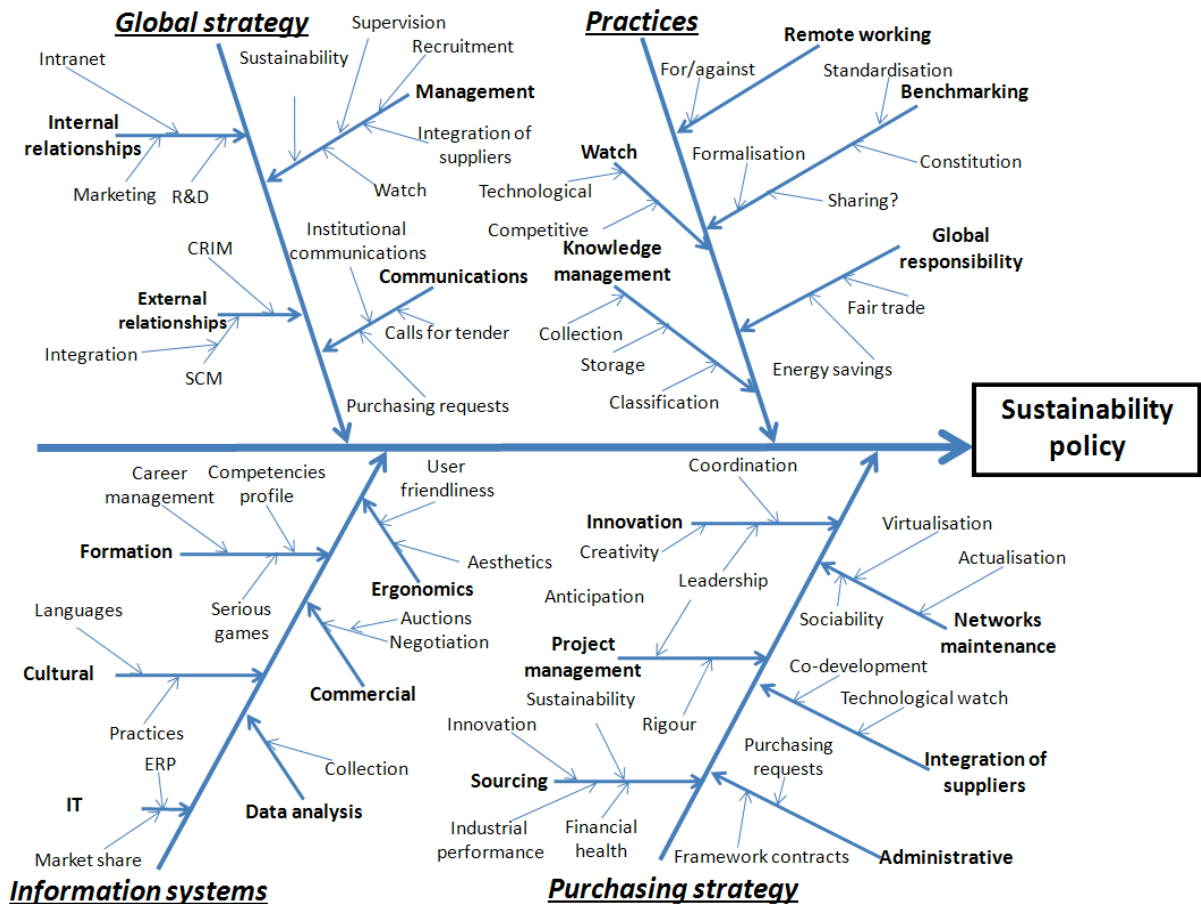


Figure 4 Interview guide themes

An initial wave of free exploratory interviews was conducted with the chosen 12 actors-experts in an attempt to identify future trajectories for the purchasing function. The wide range of people questioned meant that it was possible to cover all of the themes found within the guide. Over the course of these initial interviews, no references were made to other participants' responses. A second wave of semi-directive extension and confirmation interviews was then conducted in reverse order to enable a new look at the axes identified and further specify experts' opinions. This second wave also allowed for comparisons of sometimes diverging viewpoints along with a series of arbitrages culminating in a coherent scenario for the next few years regarding sustainable purchasing and the role played by information systems in such changes. The purpose of these interviews was to get people to express their opinions and visions of the future with a high degree of clarity and even a modicum of risk taking. For instance, the initial non-directive part of the data collection process consisted of conversations in which subjects' words were not oriented in any direction but where the interviewer merely asked them, as necessary, to revisit or deepen certain concepts (Thiétart et al; 2007). A semi-directive interview guide that was specific to each expert was then developed to obtain complementary information and illustrations. The second interview not only allowed subjects to clarify their viewpoints but also to comment on what everyone else was saying.

The interviews made it possible to outline a scenario of how purchasing function management will evolve over the next few years, with a paramount role being attributed to sustainability. Purchasing information systems are supposed to help managers to establish, disseminate and improve viable, livable and fair purchasing practices. Such innovative management modes will be suggested in a typology of internal and external collaborations; description of specific competencies for tomorrow's purchasers; and new vision of the virtual collaborative communitarian economy.

3. PURCHASING INFORMATION SYSTEMS: NEW TOOLS FOR A NEW SUSTAINABLE PURCHASING POLICY

Since the 1990s, purchasers have often been assimilated with cost-killers, meaning that their main mission consisted of minimizing sourcing costs. However, given the extreme pressure on prices and suppliers, what came out of this has been un-fair trade characterized by destabilization maneuvers and bargaining practices, along with highly compartmentalized management focused on independent profit centers and short-term profitability objectives. These harmful approaches are often approved by managers who lack knowledge of the professions involved in running a purchasing function or else who do not know how to manage customer/supplier relationships. The actors-experts that we interviewed all agreed that such practices are destined to disappear and be replaced by management focused on sustainable value creation and corporate partnerships. Some even invoked radical changes in practices involving the use of new tools as well as the implementation of a new form of purchaser intelligence, one that might be more creative and agile. The role of information systems in these new practices had in fact already been anticipated by some researchers who explained that “ICT can (...) encourage the adoption of more environmentally-friendly practices throughout the economy. It already plays a crucial role in the development of environmental decisional aid systems and in the way it enables different actors to modulate their behavior towards a sustainable management and use of natural resources” (Breuil et al., 2008).

3.1. The rise of sustainable e-purchasing: managing relations with integrated suppliers

As explained by A5, “In our business, the integration of suppliers has become fundamental. We must be humble and accept that our suppliers have business expertise that we lack. Our roadmap reprises our suppliers’ roadmaps. Our future depends on them and our success depends on their success”. In some sectors like automobiles, IT or aeronautics, the integration of suppliers is a key strategic axis for companies. The advent of concepts such as integrated SRM supplier relationship management and CRM customer relationship management illustrate this evolution. According to A2, “We understood that we could not make profits on our suppliers’ backs but that we had to consider them as extensions of ourselves and treat them more fairly by valuing their talents”. Extended companies (also called “virtual” due to their intensive use of information systems) illustrate this trend, which is tied to companies’ growing externalization of increasingly strategic activities. This has led to the advent of new and more cooperative or integrated forms of subcontracting featuring joint objectives and the pooling of knowledge, competencies and resources in a bid to achieve success through collective endeavor. For a leader company, piloting such clusters - spaces that are both real and virtual - can be achieved via purchasing information systems that are no longer mere tools for transaction management but have become veritable nerve centers supporting all community activities. It is through such networks that sustainable policies and all ecological initiatives are transmitted to actors and assessed according to indicators that are defined jointly. Information systems encourage the development of fair but remote clusters by considerably reducing the need for geographic proximity and actors’ need to travel as much.

A10 explained that functions like “project purchaser”, “transversal (cross-departmental) purchaser” and “purchasing coordinator” will develop considerably to the detriment of older denominations such as “product purchasers” or “country purchasers”. Purchasers will support project managers - and even in certain cases replace them - moving from one project to another. “The same person will be involved in sourcing all the components of a given project and then move onto the next one”. This method differs significantly from the one used most frequently at present, where one person takes responsibility for sourcing a category of products or services across a very large number of different projects. This especially applies to project purchasers who pilot all purchasing activities relating to

their projects, as opposed to product purchasers who must fit into a very cumbersome hierarchy where they have to report to several senior levels while delegating responsibility for other tasks to lower levels. Tomorrow's purchasers will therefore have to develop a much broader vision of the company, as witnessed by the advent of the kinds of internal interfaces that purchasers are dealing with today. Note that such interfaces are more accurately depicted as new prerogatives for purchasers, and not as constraints. They still need to be managed, however, with logistics chain participants establishing partnerships characterized by pooled resources, risks and profits. Relationships constructed in this manner are extremely complex and purchasing information systems will have a crucial role to play in their formalization and optimization. Flows of information, merchandise and capitals will have to be organized very rigorously. Integrating logistics on an inter-firm basis means first and foremost improving information exchange processes. The reliability and regularity of these exchanges will sustain forecasting and planning, thereby enabling an agile management of flows. Collaboration and anticipation will generate considerable reductions in shipping costs due to logistics synergies.

Thus, organizational proximity can be supplemented by electronic proximity in a way that cumulates or replaces inter-firm geographic proximity and helps companies to access their collective strengths and overcome individual weaknesses. Yet virtual proximity is not the same thing as real proximity. After all, there is no effective substitute for human contact, as witnessed by the way in which automotive suppliers concentrate their activities near their car manufacturer customers by forming Advanced Suppliers Sites or Industrial Suppliers Parks. Combining physical and geographic proximity would appear to be the best way for them to optimize performance in quality, cost and delay terms (Chen and Renault, 2002). As A8 says, purchasers "need to travel less but is completely utopian to imagine that they won't have to travel at all simply because they use IT. Clearly, this would be fantastic from a green perspective but the best thing in business is always a good handshake. We need to see the our contacts otherwise than through the deformed prism of a webcam. We have to go see them and feel comfortable with them to ensure that everyone wants to work together".

Purchasing information systems encourage other forms of highly innovative inter-company associations, as described by A7 who uses inter-supplier coaching. This involves selecting high development potential suppliers from emerging countries or asking Western suppliers to support their counterparts' growth by transmitting know-how. Information systems are used to choose different countries, with financial information systems being used to choose potential partners and communicate with them. These purchaser initiatives - building relations with distant competitors to turn them into partners - create three-sided relationships that benefit everyone: the customer who gets a more efficient local supplier; the coached supplier who gains in maturity much more quickly than would otherwise be possible; and the supplier coach who gets new business opportunities and a chance to develop durable alliances. As A7 says, "We are not the benefactors of humankind. Our vision is not altruistic. We are acting in our own interest to prepare our future. If a sustainability approach does not guarantee profitability in the short and medium run, it will be abandoned immediately".

Sustainability constitutes a new mode for differentiating and consolidating companies' competitive positions. Companies will try to anticipate things and be proactive in order to appropriate tendencies and take advantage of them. Towards this end, it is indispensable that information systems be applied as part of a watch approach. This is because ICT facilitates the early detection of indispensable but weak signals (Lesca, Ménif, 2002). The purchasing function - which is the interface between a company and its environment and which communicates with all other functions (i.e. its internal customers) - plays a strategic role in watch activities in general and in sustainable watch activities in particular. This new form of surveillance, which focuses on competitors and suppliers' viable, livable and fair strategies, requires highly perfected and costly technologies. Developing and pooling information system prototypes is a solution that makes it possible to benefit from the latest innovations at the lowest cost while attaining decisive competitive advantage. For instance, as noted by A3, "Some coopetitions with competitors (revolving around the development of the new technologies used by everyone depending on their needs) have produced outcomes well beyond what we hoped for and

encouraged us to go further down this path. We also work together with suppliers and suppliers' suppliers to integrate tools and shorten our cycles' duration". Moreover, the purchasing function's growing ability to manage supplier knowledge has helped to increase visibility of their potential in the field of sustainable sourcing (Farastier and Ballaz, 2004).

Sustainable, responsible and ethical purchasing will also become a standard applied to all sourcing activities, i.e. it will no longer be viewed as a more or less marginal aspect of purchasing. Mature purchasing functions are very close to senior management and strongly influence the development of more sustainable practices. Rather than economic calculation, it is the stability of partnerships, the stimulation of innovation and the development of new projects that become the priority. Unilateral decisions are no longer taken in the exclusive interest of one stage in the supply chain – what happens instead are joint decisions that help to consolidate the overall structure. "Total Cost of Ownership", which encourages purchasers to establish "cost out" (cost reduction) policies, is replaced by "Total Value of Ownership", which encourages "value in" (joint value creation) practices. "Win-win" approaches were once primarily marketing-oriented without any real materialization in the purchasing domain, but they have become a general marching order and a concrete practice, due to the fact that their performance is recognized as being more efficient than "win- lose".

3.2. Information systems as tools for measuring, analyzing and aiding decisions relating to a sustainable management of the purchasing function

On 13 May 2008, the European Commission presented a communication whose object was to highlight ICT's present and future role as a formidable driver for energy efficiency. The main ambition of this programme, entitled "Apprehending energy efficiency challenges through ICT", was to bring together actors from the ICT and energy spheres to stimulate possible synergies. Thus, this is an approach in which energy purchasers are key actors. The communication included two axes. Firstly, the ICT sector, which is a net consumer of energy, should be able to improve its own energy efficiency with respect to the components, systems and applications upon which it relies. Secondly, the ICT sector is a vehicle for improving energy efficiency across the whole of an economy - which is increasingly dependent on ICT nowadays – by enabling new business models and superior monitoring and control of activities. As a purchaser specialized in energy in a company that sells energy, A4 is particularly sensitive to these problems. "Energy is a question of who has the strongest nerves! We see sustainability as a key issue for both customers and suppliers, even as we try to act as trailblazers in this area to avoid being victimized by a green dictatorship. We have carried out an in-depth modification of our practices, products and internal and external relationships while also perfecting our measurement tools to achieve a broader and more precise vision of our environment". All of the purchasers interviewed in the present study were aware of very sudden changes that will occur over the next few years and sought to be the actors of this evolution rather than the victims.

In our information society, territorial engineering is also a question of controlling information systems in a public policy regulatory context shaped by national and European initiatives. Decision-makers' sharing of – and access to – useful information requires high performance information systems in a technical context defined by the over-abundance of geographic sources of information, the development of environmental diagnostic tools and the management of spatialized information. States are leading purchasers and generally very up-to-date in terms of sustainable practices. They also have the means to invest in technologies allowing them to fulfill their ambitions. Public purchasing managers have much spatio-temporal information about the territories they oversee. They must also contend with a complex assembly of information systems that have not been integrated into diversified functions: diagnostics and strategic piloting; decisional assistance; or measurement and procedural management.

Sustainability is at the heart of all these issues, not only as a key objective for public policy but also because it de facto implies an interlinkage between areas that have been traditionally separated in

terms of their territorial engineering. Sustainability also catalyses people's energies and sense of initiative and is therefore a source of innovation in purchasing and information system management practices. It is with this in mind that purchasers should mobilize the competencies, methods and organizations that they require to achieve a reasoned management of territorial information in a way that serves sustainable purchasing. A3, for instance, said that he was "privileged to be a public sector energy purchaser. Not only do we not only think about making profits but we also have a chance to develop and use technologies that traditional companies cannot afford yet. Some of the interactive decisional tools that I use every day let me make decisions in the general interest and with an eye towards the future. Financial interests are of secondary importance". Ecological performance contrasts with economic performance for most of the experts-actors we interviewed. A2 said, "We have signed the UN Global Compact and got all our suppliers to sign it but the day when I presented plans for auditing and supporting all of these suppliers in a sustainability drive, I was told that it costs too much so we didn't do anything concrete".

Geographic information systems (GIS) are a crucial issue in purchasers' decision-making and in the advent of a future-oriented vision of the markets. Such information systems are currently evolving from production-related IT to collaborative information sharing IT used to manage communitarian projects and redevelop the territories where companies operate. More complete, transparent and higher quality information helps to rapidly raise awareness of problems associated with sustainability and enables an informed decision that should increase the effectiveness of the policies being implemented. For some purchasers, GIS are indispensable. A1 uses them every day to compare sites and markets worldwide, explaining that, "Without geographic tools, I couldn't do my work – almost nothing! All of my decisions are based on data that has been collected and analyzed by digital intelligence of this kind. Geographic information systems help me to assess opportunities and risks and engage in impact studies, in particular in the sustainability arena". GIS also play an increasingly crucial role in choices about transportation, the localization of new structures and sourcing from new emerging country suppliers.

3.3. Re-establishing customers and partners' trust in purchasing information systems

The advent of sustainability in companies, materializing in ethical, fair and ecological trade, has changed the world and led to an in-depth modification of purchasers' behavior. The purchasing function would appear to be a particularly apt area for applying the rules of sustainability, given its openness and actions on the external environment, and because of its interactions with other corporate functions. A European Commission's green book clearly views purchasing as an appropriate activity for a CSR approach, defined as the "willful integration of social concerns throughout the production and sourcing chain, combined with dialogue with all stakeholders". Yet, as explained by Quairel and Auberger (2005), "The purchasing function's current organization slows the dissemination of CSR practices among subcontractors: when suppliers' portfolios are rationalized, this concentrates purchasing among a limited number of large suppliers". Information systems are used to optimize costs more than resources, and also to organize radical competition between suppliers instead of integrating them. As such, information systems provoke mistrust and are associated with purchasers' destructive practices. According to A11, "When we suggest to our suppliers that they collaborate on new IT tools, how do you think that they are going to react? They'll be afraid! They don't want to be controlled by us and be subject to even more pressure than they already are". Companies are not credible when they pretend that they would like to collaborate, as demonstrated in Figure 6. Indeed, the last five years have even seen a marked deterioration in trust levels.

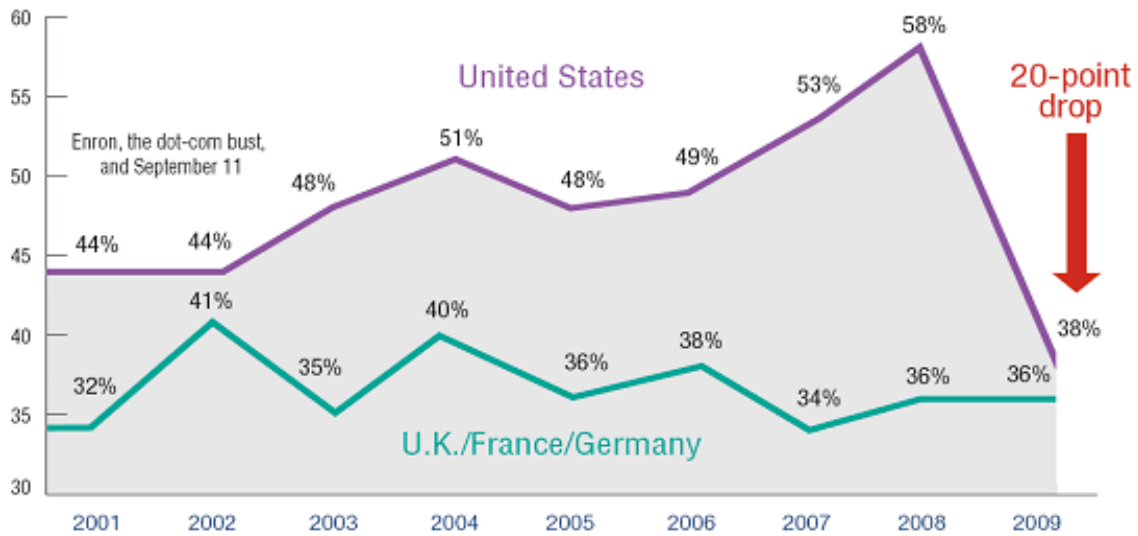


Figure 5 Do you trust companies to do the right thing? (EldermanTrust Barometer, 2009)

Yet, in addition to cost cutting (thus reduction in supply prices), purchasers increasingly value the kinds of suppliers with whom they would like to establish long-term partnerships. Partner suppliers are the kinds of actors who respect production standards, monitor transactions or manage disputes seriously and manifest a certain amount of loyalty. The values associated with sustainable purchases are meant to be shared with purchasers who can then seek other partners defending the same idea. According to France's ALTERECO association, fair trade should satisfy five criteria: solidarity; fairness; directness; transparency; and dignity. Yet, as A1 says, "We are not philanthropists: all of our sustainability and sourcing approaches in emerging countries try to generate business and make money". A6 has confirmed that firms will only initiate a cumbersome and costly sustainability approach if the commercial potential justifies the requisite resources and effort.

With purchasing information systems, each firm can provide very specific know-how and make this available to other firms doing the same. The approach is the same as in a community of practices where everyone contributes to other members' wealth. At the same time, individuals are reluctant to share the things that create value for them without being guaranteed compensation that is at least equivalent. Different parties' calculations and manoeuvres to give as little as possible and receive as much as possible in exchange is one of the things that can make purchasing information systems inoperative. "In these networks, different participating firms are not compensated fairly. The distribution of the gains derived from membership in a network depends on the power dynamics. The companies with the most power are able to extract from other participants a disproportionate amount of the total rents generated by the network" (Bettis, 1998). Power relationships are more accentuated in purchasing information systems than in traditional markets since perceptions of interactions are amplified by the virtual modes of communication that have replaced geographic proximity. Power wielded by some leads to domination over others who must then adopt a defensive posture and reject the tool that they sense their partners want to impose on them. The collective choice of a reliable information system reduces suspicion of partners who do not play by the rules and try to hide their failings by falsifying data. Securing information and ensuring its tracability is crucial in this respect.

CONCLUSION

Representing 13% of all energy consumption in France but only 10% of the several hundred thousand items of waste collected, ICT does not really have a green image. Yet with the possibility of a four

times greater reduction in emissions by 2020 than the amount currently generated (Devoteam), ICT is a powerful lever for action in the field of sustainability. This new dimension, which is crucial for companies' productivity and image, gets them to take new initiatives making their activities viable, livable and fair. Purchasing function management lies at the heart of this new corporate sustainable strategy. It is no longer enough for purchasers to assess suppliers according to criteria like price or even quality and delays. What also counts now is social performance criteria (child labor, remuneration, working conditions, etc.) as well as environmental ones (CO2 emissions, the impact of an activity on nature, recycling, etc.). People rely on purchasing information systems to construct, disseminate and pilot sustainable purchasing policies and improve performance. Products and services that are labeled and have been guaranteed in codes of conduct can cost between 0 and 10% more. Purchasers are prepared to pay this to contribute to their company's good image, especially since such goods often offer better value for money than their more standard counterparts do. Green products remain harder to access, although depending on the sector in question, the relevant branches are becoming more identifiable.

Among other tasks, purchasers must ensure that suppliers adhere to an industrial policy that is compatible with sustainability principles. For this, they increasingly rely on different sorts of purchasing information systems. The awareness is rising that collaboration comprises a major strategic issue enabling people to capitalize upon knowledge, ascertain joint projects and guarantee the financial viability of all commercial partners. Customer and supplier firms must have compatible cultures featuring common strategic objectives and values that they all promote in their dealings with other actors in the market. Sustainable development has become "a major organizational performance criterion", an indicator of the purchasing function's maturity and "a broadening of the concept of total quality" (Comité 21, 2005). It involves the development of new digital collaborative platforms enabling practices that are more in line with the green mindset with which companies would like to associate their image. In short, purchasing has led to an in-depth modification of companies' internal processes and supplier relationship management, since the goal now is the creation of sustainable value. The present study has helped to determine paths towards a sustainable management of the purchasing function thanks to the use of purchasing information systems that are more open, integrated, collaborative and project-focused. Figure 6 recaps the areas where information systems can help to develop, disseminate and ensure the control of new sustainable purchasing policies.

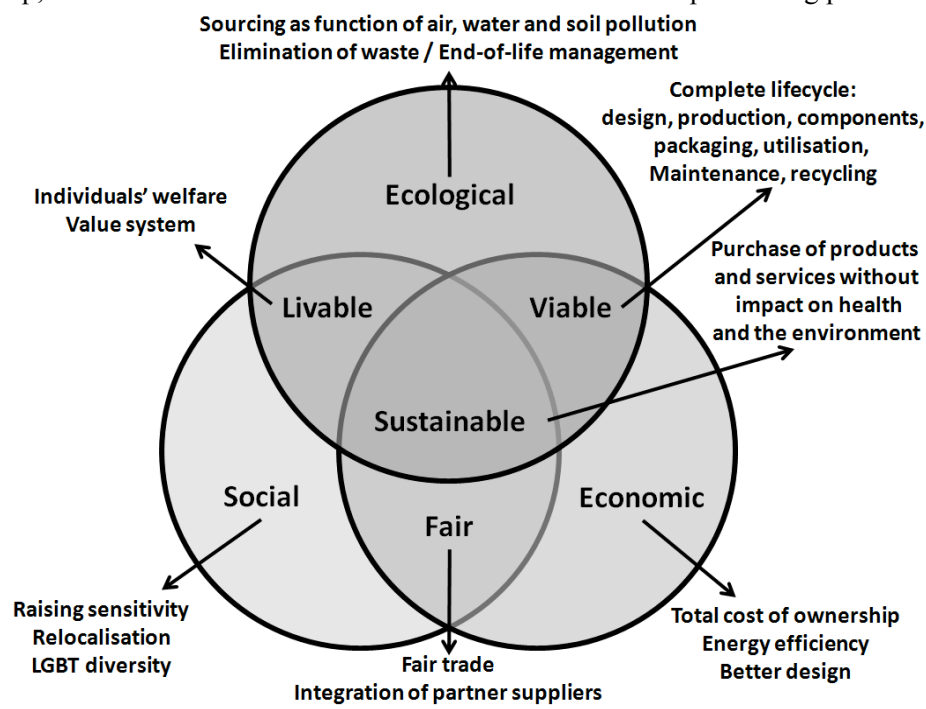


Figure 6 Multiple dimensions of sustainable purchasing

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