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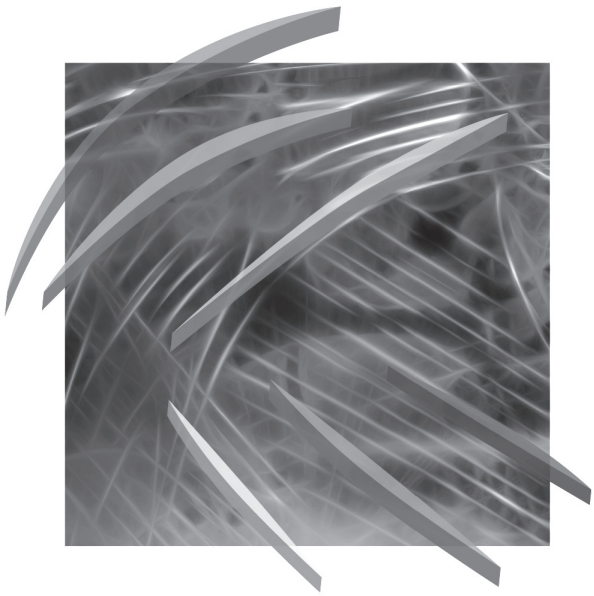

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Eunika Mercier-Laurent
MODEME IAE Lyon University, Lyon, France
eunika.mercier-laurent@univ-lyon3.fr

THE CONTRIBUTION OF INFORMATION TECHNOLOGY TO THE BUSINESS SUCCESS OF TODAY'S ENTERPRISES

Abstract: Companies today have to be smart, reactive and innovative. The main role of Information Technology (IT) is to create the necessary conditions for their sustainable development. This task includes the appropriate organization of data, information and knowledge, but also providing smart applications able to help the company's actors in transforming their ideas into tangible and intangible benefits. This article mentions main enterprise activities including the most important – continuous open innovation. It gives some examples of Information Technology services with "Artificial Intelligence inside" in order to amplify the IQ[1] of both: humans and computers. The influence of current trends such as virtualisation, externalisation, networked enterprise and clouds computing on IT methods, techniques and tools is briefly commented on.

Key words: information technology, business success, business enterprise.

1. Introduction

The global economy has changed the way of working and doing business. In this context the Information Technology has a great role to play. In his book *Business@ The Speed of Thought* B. Gates explains that the organization of the internal and external flow of information and knowledge is basic to for company business success [Gates 1999]. Enterprises have to be agile and need to innovate continuously to survive and to become or remain leader on the world market. SMEs and very small businesses cannot survive without being connected with clients and partners; clusters and social networks are among the last trends.

Information Technology can effectively support the flow of information and knowledge generated by these activities; provide the necessary elements for company management such as decision taking, human resources (intellectual capital) management, innovation process management (innovation capital), customer support, business intelligence, communication, accounting, and others.

[1] Imagination Quotient.

The global innovation process federates all enterprises processes. The goal of IT is to provide available elements for an intelligent support of all activities, to connect and manage relations between internal and external actors. It is also to amplify the extended organization creativity. The new trends in management and others "soft technology" [Jin 2006] as well as a quick progress in technology imposes organizational and behavioural change. Mobility, distance working and learning influence software design.

This article focuses on industrial companies but the same logic can be applied for others including non-profit organizations. Our main experiences are described in [Mercier-Laurent 2007].

2. Technology for business information ecosystems

The companies today cannot survive without information technology. While many organizations use just some basic ones, others have already experienced advanced technologies including artificial intelligence (AI) approaches and techniques.

2.1. Managerial assistant

The global economy has changed the roles of top management and company managers. They are captains, responsible for strategy and company success. To accomplish this task they need the right tools; technology plays a role of intelligent corporate assistant described in [Mercier-Laurent 2007]. More and more they have to take risks. The simulation tools are useful to choose the best solution or to estimate the impact before implementation. To take right and quick decisions, easy access to relevant data, information, documents and experts is vital. Decisions support systems are now able to collect, discover, process and display the available elements of data, information and knowledge. The majority of such applications are expert systems based on technology [Dolenc et al. 1996; Mercier-Laurent 1997] but they could also use other techniques, such as case-based reasoning, constraint programming, neural nets, multisystem agents or hybrid systems in function of the nature of knowledge and expected results [Mercier-Laurent 2007].

Among the measures of progress, the innovation capacity is the most important. This includes the items as whole process management, measures, organisational learning, extended business network, business intelligence, percentage of new products and services per year, joint ventures, image, leadership position and the smart use of technology [Amidon 1997]. Environmental impact has to be also considered; this systemic item was added recently. It is a result of our work on ecodesign systems [Reyes 2008; Mercier-Laurent 2011]. These measures of innovation capital serve as a corporate compass. A software application can help here to measure the distance between current actions and goals. The Entovation test [http://www.inthekzone.com/kiassessment-login.htm] can be improved by adding some AI techniques and

transforming it into a real decision support system including simulation tools (future PhD work).

2.2. Marketing

A marketing department is the bridge between clients, sales and R&D. Its role is also to capture the opportunity of a global market and transform the best of them into the new products and services. While many are focused only on Business Intelligence, innovation with a client is a main factor in shortening the cycle from idea to success [Amidon 1997; Mercier-Laurent 2007]. Some companies run Users' Clubs on a regular basis. Participating clients share their opinion on a quality and relevance of product with their needs, suggest improvements or new products and generate a collective intelligence [Mercier-Laurent 2011]. Large enterprises have Business Intelligence (BI) departments or rely on BI external services. The majority of BI tools are based on statistics or neural networks. AI offer more possibilities through machine learning discovery techniques such as data, text [Proux et al. 2009] and image mining [Hsu et al. 2002].

Other software explores the web to find and analyse visitor's navigation or opinions (using key words and statistics). This kind of analysis is partial because it gives no elements such as why a visitor came here, what he/she found or did not found, what are the other websites he/she visited before and after (his/her interest). Some websites offer the contact possibility via email, other a FAQ list.

Harnessing the social networks to capture the relevant elements of knowledge and opportunities is still a great challenge. Coherence verification techniques should be useful to detect false information. In the case of international company the collective experience could bring a feedback that can be explored to improve the given products or services or help in inventing new ones.

2.3. Communication

The global visibility of a company is vital for its business and leadership. Social networks have brought new opportunities to be visible and to build a digital influence. The majority of actors use them in push mode, publishing the main information about corporate activities, events, training courses. It is most important not to be just present but to manage the actions, relations, opportunity and measure the benefits, image and influence. A company has to learn how to take and measure the intangible profit from social networks – to capture knowledge from clients, competitors, find alliances, create new businesses and invent new business models [Amidon 2003; Skyrme 1998]. Employees, partners and clients are members of various groups of interest and give their opinion on specialised forums. The capturing of this knowledge from the web can influence enterprise strategy and impulse the creation of new businesses. The discovery techniques, such as for example those of natural language processing, can help in finding leaders and experts from comments or blogs.

2.4. Innovation process management

While participative innovation enters to companies, many of them are still practicing the 1st generation management [Savage 1990; Amidon 1997] – only R&D can innovate. Their research and development are confidential, they afraid the leaks and they act in competitors mode. To be more inventive they try a various creativity methods such us a brainstorming, Blue Ocean, lateral thinking, TRIZ and others [Mercier-Laurent 2011]. Selected ideas are transformed into new products and services. While the R&D people are certainly creative, the results from such sessions are limited to incremental innovation; a disruptive one is difficult to make happen in such an environment.

The participative innovation is the next step – the other company professionals are involved, they can also suggest their ideas. Some large French companies, as for example SNCF, La Poste, EDF are practicing this kind of innovation. The weak point however remains the evaluation of ideas – in many large organizations they are evaluated by one person instead of a committee composed of at least three professionals – R&D, marketing and human resources. The first evaluates technological feasibility, second estimates the market and the last verifies the available competency [Mercier-Laurent 2007]. This evaluation can be made through organisational intranet. The selected ideas will then be transformed into new products and/or services. At this stage a virtual consultant such as for ex IcanPilot [www.icanpilot.com] could be useful. It encapsulates the best consultant's knowledge, and guides users step-by--step, through a business growth project including creation of a new business plan or development of a value proposition.

Our CBR-based generator of ideas could serve in the first stage of the innovation process, see Figure 1.

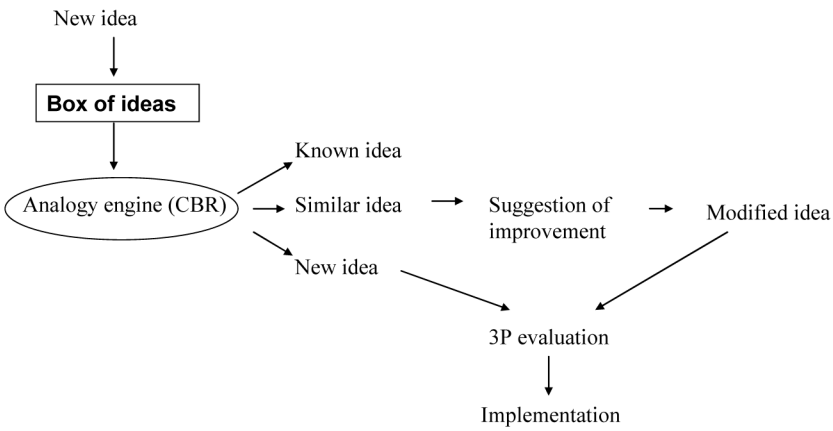

Figure 1. Generator of ideas

Source: [Gruz 1997; Mercier-Laurent 2007].

Any authorised employee can register his/her idea and check if someone else had already a similar one. The ideas collected this way are evaluated by a committee composed of a minimum 3 professionals (3P) – technology, marketing and human resources- and implemented when relevant.

According to H. Schou-Rode [Skovlund 2004] 60% of good ideas come from outside. The stakeholders such as clients, partners and distributors can have brilliant ideas. Innovation with clients [Amidon 1997] or open innovation [Chesbrough 2003] give more chance to get an original idea addressing the real needs or make a disruptive innovation happen.

The innovation process has to integrate the sustainable development principles [Mercier-Laurent, Reyes 2008]. It becomes eco-innovation. An example of such a process is shown in Figure 2.

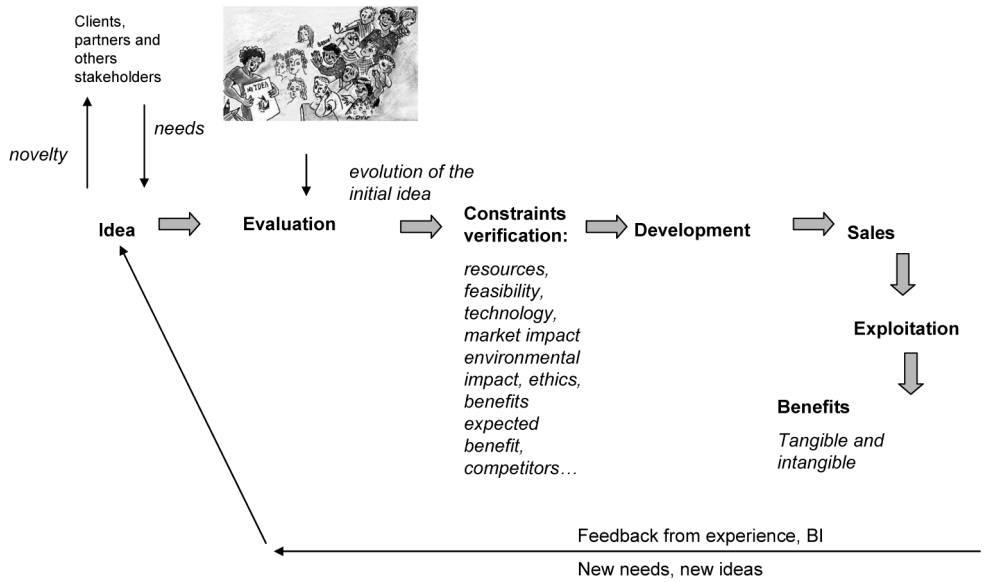

Figure 2. Eco-innovation process

Source: [Mercier-Laurent 2009].

Technology can play various roles here – creativity and evaluation of ideas, constraint verification, simulation before development, design and manufacturing, sales management, customer relations management, recycling, feedback from experience collecting and exploration. The simulation software plays a very important role, because it allow to choose the best and easy to recycle material, reduce impact and optimize and plan the whole process.

2.5. Design and manufacturing

The design of knowledge intensive products such as planes, high speed trains, and other complex industrial equipment implies a global approach and appropriate CAD software being a part of PLM[2] and corporate knowledge flow. Conceptual modelling using for ex KADS[3] allow building collectively and incrementally all conceptual models necessary to produce components, to connect them into the subassembly and to the whole product. In the case of product lines, configuration systems are useful to compose quickly the desired model. The advantage of using a conceptual modelling is the genericity, modularity and reusability – the same general model can serve to design a full line of products and also for incremental innovation.

Legrand Design Department developed Rapid Cost Estimation System for Plastic Parts Production. This CBR-based software for more effective design of electrical boxes includes the technical knowledge, expert experience and reusable models [http://oldsite.kaidara.com].

Constraint programming and other optimization techniques allow the better use of resources. Integrated software such as MES[4] allows having a global view of manufacturing.

2.6. Sales and e-business

Company success depends on the sales strategy and relies on the choice of business model. Two main cases can be considered: products addressing many consumers or knowledge intensive and complex products, such as planes, or other complex equipments very expensive and sold to large organizations. While the first can be easily sold on the web and through distributors, the second needs a special approach. The first group includes easy to use products and others that need assistance or special services, such as computers, cars, industrial equipment. These kinds of knowledge-based services can be provided by the producer or by partners.

The manufacturers of complex equipments usually offer a product line – each specific product can be assembled on client demand. In this case, configuration systems (on- or off-line) bring considerable help. They encapsulate the expert knowledge [Rauch-Hindin 1986; Mercier-Laurent 2007].

The functional economy described in 1997 [Richards, Frosch 1997] now interest researchers and companies. The principle is to offer a given functionality instead of selling just a product, such as moving, printing surfing and others. This is the case of velib (bike rental) in Paris and other French towns. The client just rents a bicycle for time he needs, instead of buying one. An offering company/organisation takes care of the maintenance and availability of products.

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[2] Product Life Management.

[3] Knowledge Acquisition Design System.

[4] Manufacturing Execution System.

E-business technology plays the role of sales amplifier. Basic e-commerce software includes a catalogue, shopping card and secured payment system. The client has to choose a product clicking on image, or searching for it in a list. Many search engines are very poor and mainly key word based. For example if I want to buy jeans on http://www.laredoute.fr/, I have to display 399 models, which is time consuming. Some offer a possibility to see the selected product in 3D [http://www.new3s.com/e-business-3d/default.asp?MenuActive=17] (Dassault software). To our knowledge no one offers the direct association of demand and offer based for example on case-based reasoning techniques. Such a system could help to find directly the product we look for or let us know in a very short time that is not available. If more people want the same or similar product it is up to company strategy to offer it or not. Some software includes a CRM[5]. E-commerce systems are also used to sell services. The-Schneider application, described below, is an excellent example of pre-paid services – selected clients buy a "service card" which gives them access to 24/7 services by an expert.

Small companies organize in clusters to offer together some e-services on-line, such as repairing, transportation, baby sitting and others.

2.7. Customer support & help desk

Diagnosis and maintenance systems were among the first applications of AI [Rauch-Hindin 1986]. The techniques such as expert system, cause-to-effect graphs, case-based reasoning are available and mature, but the choice of technique depends on the nature of knowledge and the user's needs and level. The development of an expert system or a cause-to effect graph for complex equipment is time consuming and expensive – it has to provide the expected services for users and return on intellectual investment for experts. Collective experience based systems are quicker to build and are a considerable help to both customer and company in many fields. They provide also the feedback from experience which could serve to improve products [Mercier-Laurent 2003]. Among many operational applications we can mention plane's engine diagnosis system built on over 10 year experience [Baudin, Mercier-Laurent 1995], or Darty's [http://www.darty.com] help desk support system for home electrical equipment. Such a system must provide an effective assistance in maintenance problem solving, especially in the warranty period. It also provides access to technical data, schemas and other relative documents and can be used for training. Several years ago Group Schneider built a customer support system for 24/7 assistance for clients on line, still in use, see Figure 3.

[5] Customer Relation Management.

Figure 3. On-line diagnostic system

Source: [Mercier-Laurent 2003].

2.8. From resource allocation to intellectual capital management

Another useful technology is those of knowledge trees [Autier, Levy 1992]. The open software developed from this idea by Ligamen [http://ligamen.fr] allows displaying individual and collective competency of a company, university, town or region. It facilitates the work of the Human Resource Manager who has to find the

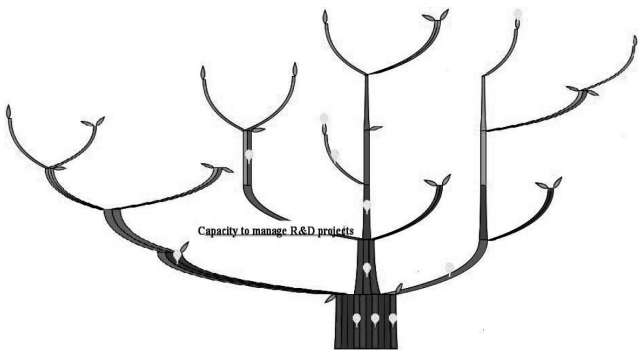

Figure 4. Knowledge tree of a professional group (Ligamen)

Source: [http://ligamen.fr].

right competency for a given project, for a specific client, or simply know who in a company has a unique and maybe strategic skill. The capacity mapping allows knowing the intellectual capital of an organization in order to decide about new projects, new training, new alliances, joint ventures or new companies. An example of a knowledge tree is shown in Figure 4.

Each element represents a capacity of at least one person. The trunk shows common skills, the branches individual or group skills, the flags a position of a person in a group.

The other techniques such as expert systems and constraint programming can also serve for resource allocation – two of our projects are described in [Mercier-Laurent 2007].

2.9. Real time learning and training – learning enterprise

Information Technology, Internet and the global economy have created the necessity and conditions for distance working and learning. E-learning techniques and tools have been experienced in schools, universities and companies and are now mature, allowing 3W[6] learning and training. Through this experience pedagogic approaches as well as content were adapted to distance learning conditions. Smartphone allows mobile-learning.

The next trend is the introduction of games and serious games to learn in given virtual environment and in particular for complex problem solving in hostile environments. The Institute for Creative Technology [http://ict.usc.edu/] was among the first in introducing this kind of learning. They tested the behavioural difference between playing a "flat" game and a serious game. This technology is now used by companies – for example Eurocontrol uses this technique to train air traffic controllers, see also http://www.naseem.name/portfolio/nats-air-traffic-control-trainer/.

Current research work includes the study of the influence through games on attitudes and way of doing things [Perreira Da Silva et al. 2008]. Some experiments aim in helping autistic persons.

2.10. Latest trends: Corporate Social Responsibility (CSR) and Green IT

While the virtualization aims at bringing a contribution to planet protection, the externalization and cloud computing impose some constraints for IT security. Companies have to be careful on the choice of data, information and knowledge elements to externalize.

Among the latest trends the CSR can be considered as an evolution of quality, including environmental aspects, such as CO_2 emission, recycling, new transportation and others. It is also an opportunity for new businesses and new technological

[6] Where, when, what (you want).

applications, for example, Green IT focus on energy reduction in Data Centers, which is in fact a new service offered to clients.

IBM launched a new concept: Smarter Planet [http://www.ibm.com/smarterplanet/us/en/]. In fact it is about a smart business. They suggest solutions for Green IT, health, learning, cities, banking, buildings and other domains of activity. It is a lot of opportunities to compose the appropriate IT solutions with existing technologies and to invent new ones for solving real environmental problems. They also mention clouds computing, which just shift the problem from customer to the cloud.

Some companies such as Group Accor [http://www.accor.com] or Metalsa [http://www.metalsa.com/modelo_metalsa.html] are also communicating about "bien être" (wellbeing). They offer some extra services and improved environment to employees to let them keep focused on their work in order to be more effective. Technology can help in optimizing tasks and resources.

3. Conclusions

The context of a global business involves the choice of right technology and an appropriate organization of information systems. While the majority of enterprises still act using an old "faster, cheaper, better" logic, IT can influence the essential change: from industrial economy to knowledge economy. It imposes a change of paradigm in IT design – from providing access to data, information and knowledge to providing an intelligent assistance for knowledge cultivators in a given context (holistic approach), through a knowledge flow. The "machines" (server, individual computers, smartphone or specific ones) need to be conceived and programmed to effectively help users. They can adapt to their needs and levels using machine learning techniques in order to improve human-digital collaboration. We believe that such a way of innovating and working will influence the design of digital ecosystems [Mercier-Laurent 2009; MEDES 2010].

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UDZIAŁ TECHNOLOGII INFORMACYJNYCH W SUKCESACH BIZNESOWYCH WSPÓŁCZESNYCH FIRM

Streszczenie: Współczesne przedsiębiorstwa starają się być inteligentne, reaktywne i innowacyjne. Główną rolą technologii informacyjnych (IT) jest tworzenie warunków koniecznych do ich ustawicznego rozwoju. To zadanie obejmuje właściwą organizację danych, informacji i wiedzy, ale także dostarcza inteligentnych aplikacji umożliwiających wspomaganie pracowników firmy w transformacji ich wymiernych i niewymiernych korzyści poprzez sprzedaż produktów, usług i ekspertyz. W artykule przedstawione zostały główne zadania firmy, łącznie z najważniejszym – otwartością na ciągłą innowacyjność. Podano przykłady usług IT wraz z ich „wcieleniami" sztucznej inteligencji, w celu wzmacniania IQ zarówno ludzi, jak i komputerów. Skomentowany został wpływ aktualnych trendów, takich jak wirtualizacja, eksternalizacja, przedsiębiorstwa sieciowe i *clouds computing* na metody, techniki i narzędzia IT. Innowacje ekonomiczne, takie jak ekonomia funkcjonalna czy ekonomia wiedzy, tworzą także nowe potrzeby w rozumieniu usług IT oraz zestawu wyzwań badawczych. W części końcowej zostały przedstawione perspektywy ekosystemu z uwzględnieniem czynnika ludzkiego i innowacji „elektronicznych".

Słowa kluczowe: technologie informacyjne, sukces biznesowy, przedsiębiorstwo.