



Universidades Lusíada

Sousa, Fernando Cardoso de
Monteiro, Ileana Pardal

A benchmarking study on organizational creativity practices in high technology industries

<http://hdl.handle.net/11067/1381>

Metadados

Data de Publicação	2015-01-20
Resumo	The aim of this article is to provide a benchmarking list of initiatives that deal with the development of corporate or organizational creativity and innovation in the emerging sectors of bio-technology, nano-technologies, information and communication technologies, and eco-innovation, together with companies of other sectors, perceived as good examples of organizational innovation. Twenty one interviews were conducted with top management in these organizations. The interviews were made by tele...
Palavras Chave	Indústria de tecnologia de ponta, Criatividade nos negócios
Tipo	article
Revisão de Pares	Não
Coleções	[ULF-FET] IJEIM, n. 5 (2013)

Esta página foi gerada automaticamente em 2024-07-26T23:56:11Z com
informação proveniente do Repositório

A BENCHMARKING STUDY ON ORGANIZATIONAL CREATIVITY PRACTICES IN HIGH TECHNOLOGY INDUSTRIES

Fernando Cardoso de Sousa
cardoso_sousa@hotmail.com

Ileana Pardal Monteiro
imonte@ualg.pt

The Research Centre for Spatial and Organizational Dynamics (CIEO)
University of the Algarve, Portugal

Abstract: The aim of this article is to provide a benchmarking list of initiatives that deal with the development of corporate or organizational creativity and innovation in the emerging sectors of bio-technology, nano-technologies, information and communication technologies, and eco-innovation, together with companies of other sectors, perceived as good examples of organizational innovation.

Twenty one interviews were conducted with top management in these organizations. The interviews were made by telephone, addressing specific strategies in three domains: creative management, creative people management, and creativity management. Results indicate that high technology organizations, dependent upon financial support, do not seem to concentrate on corporate innovation, and do not have alternatives to budget reductions made in R&D, due to the present financial crisis, in order to innovate. The remaining companies provided several suggestions as to the way corporate innovation systems can be built and sustained within the framework of the future European innovation policies, devoted to workforce development, the service sector and the SMEs.

Key-words: organizational innovation; organizational creativity; benchmarking; high technology industries

1. Introduction

The idea for this article followed a report from a contract with the Gers Chamber of Commerce, as partner of the European project (Interreg IV B SUDOE) "CREA BUSINESS IDEA", linked to the belief that high technology institutions, in specialized countries or regions, researching for sophisticated products, were likely to have sound policies and practices in order to lure and incentivise the best talent to produce the best products.

Thus, the initial objective of this study was to produce a list of organizational creativity best practices, drawn from the above examples, and to identify the required skills to adapt these best practices to the existing SMEs. This was done, firstly, by analysing current practices of organizations, from the technology and emerging sectors of bio-technology, bio-medicine, nano-technologies,

information and communication technologies, eco-innovation, and the Irish “soft landing” policy.

However, this perspective proved to be inadequate, as it became clear that leading industries, laboratories and universities were highly dependent upon R&D financing and did not possess alternatives to the lack of funding, due to the present crisis. These industries, especially those supported by public funds, did not seem to be able to develop practices of corporate innovation. We, then, decided to take the benchmarking study to companies that had been recommended as good examples of corporate creativity and innovation, no matter the sector in which they operated. And so, the initial objective was expanded to other organizations besides the high technology institutions, suggested by experienced consultants and academics related with EACI - European Association for Creativity and Innovation.

2. Benchmarking on Creativity and Innovation

Management conditions favouring creativity are extensively reported in the literature (Monteiro & Sousa, 2008; Sousa & Andrade, 2007; Sousa, Pellissier & Monteiro, 2012) and relate mainly with the processes described in the methodology. As to the transformation of creativity into profitable innovation, only few studies were found, and the effort of finding listed benchmark practices was vain.

According to Barker (2003), benchmarking is the process of identifying the best practice in relation to products and processes, both within an industry and outside it, with the objective of using this as a guide and reference point for improving the practice of one’s own organization. Benchmarking can take place within an organization, in relation to direct competitors, or in relation to organizations in totally different fields. According to Bandow (2009), two types of benchmarking can be distinguished: general benchmarking and best practice benchmarking. While the first one stands for the mere comparison of an organization’s key data or management ratios, in order to identify areas for improvement, the second one represents the comparison of best performers, in order to learn and adopt their best practices. The latter is the intention of this study.

Several guides and indexes in innovation benchmarking are available in different sources, especially under a quantitative designation (e.g. Atkinson & Andes, 2009). As to innovation, these indexes are important to define criteria and ratings for the chosen units. However, as to creativity, the quantitative approach does not apply because the aim of this study is to describe processes to develop and evaluate creativity, not end results. What we found was that existent indexes of creativity were based mainly on Richard Florida’s (Florida & Tinagli, 2004) conceptions, which do not apply to this investigation. After an intensive search we discovered that the best sources were the web sites of many companies, together with a few books and articles.

For example, Robinson & Stern (1998) provided us a deep analysis, which we include in the line of classics like Schumpeter (1934), Kanter (1983), Peters & Waterman (1982), or Collins & Porras (1994). The authors begin by clarifying that a company can be called creative when its employees do something new and potentially useful without being directly shown or taught, and that corporate creativity systems began in the late XIX century. As in the former Soviet Union, the failure of large organizations to innovate in the U.S. resulted mainly from the widening of the communication gap between management and employees, and the reward system aggregated to idea presentation. The authors report data showing that U.S. companies rewarded each idea, on average, a hundred times more than Japan did, while the net savings per employee suggestion, till 1995, was five hundred times smaller in the US. Shapiro (2001) also agrees that U.S. reward systems first contributed to the fall of the idea suggestion systems, by reducing employee commitment and alignment with company objectives, together with automation and routinization of work. Shapiro states that companies seem to have forgotten that innovation is carried out by people and for people.

As in the words of Kao (1989), established companies must investigate sophisticated intrinsic or non cash rewards to stimulate internal entrepreneurship. Within this line of thinking, it is interesting to report the strategic statement that Collins & Porras (1994) quote from Johnson & Johnson, (...) we are in the business of preserving and improving human life. All of our actions must be measured by our success in achieving this goal (p. 57). "Human" meaning, by order of priority: costumers, employees, management, communities and stockholders. Zhou & Shalley (2008) together with works from other authors (Hage, 1999; Hagardon, 1999; 2000; Lam, 2004) report reasons for employees not to be creative, and possible solutions that management may bring to improve their creativity, either individually (Shalley, 2008) as in group (Paulus, 2008). Also, Perry-Smith (2008) debates whether communities of practice are privileged means to have groups addressing specific kinds of problems on a permanent basis, as well as the importance of links between groups. These links are extensively discussed by Sawyer (2007), who develops all possible aspects of collaboration between groups, and analyses the most creative webs as the ones in which good connections exist among the teams, but in which the teams still enjoy independence and autonomy.

All these assumptions were expected to arise among the innovative industries present in this study, in order to understand how the above concepts work in reality. So this is what we expected from the technology sector - a list of organizational creativity best practices, in order to adapt the required skills for training in SMEs.

3. Research Methodology

According to information reporting on the most innovative technological sectors and countries, the Gers Chamber of Commerce provided indications as to which kind of organizations should be included in the research. The technological

sectors were the following:

- Biotechnology and biomedicine - Biotechnology is technology based on biology, agriculture, food science, and medicine. Biotechnology has applications in four major industrial areas: health care, agriculture, industrial uses of crops and other and environmental uses. Biomedicine comprises the knowledge and research in the field of human medicine, veterinary medicine, odontology and fundamental biosciences such as biochemistry, chemistry, biology, histology, genetics, embryology, anatomy, physiology, pathology, biomedical engineering, zoology, botanic and microbiology.
- Nanotechnology - Is the study of the control of matter on an atomic and molecular scale. Generally nanotechnology deals with structures smaller than 100 nanometers.. Nanotechnology has the potential to create new materials and devices with wide-ranging applications, such as in medicine, chemistry and environment, electronics, energy production, information and communication, and heavy industry.
- Information and Communications Technologies (ICT) - Is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and networks, satellite systems, as well as the various services and applications associated with them.
- Eco-Innovation - Is the production, assimilation or exploitation of a product, production, process, service or business method that is novel to the organization and which results in a reduction of environmental risk, pollution and other negative impacts of resources use. Eco-innovation is a broad concept and is reflected in a large number of technical fields, such as renewable energy, water and waste management, or motor vehicle abatement technologies.

In order to meet the report's purpose and the approach was personalized, following personal contacts with colleagues and institutions related with science, industry and innovation (e.g. Company Association for Innovation; Innovation Europe Network; Technological Innovation Office/National Science and Technology Foundation; Innovation Agency); e-mail addresses taken from the internet (national technological or science institutions, professional and industrial organizations).

More than 100 messages were sent, 32 responses were received and 21 telephone interviews were conducted, lasting for an average of 45 min. From the 15 questionnaires sent by e-mail, after prior agreement, none of the subjects replied.

The interviews, made by telephone or Skype, to top management or scientists, addressed specific strategies in three domains: creative management (leader selection, orientation and training in order to bring creative contributions out of teams and individuals), creative people management (orientations as to hiring, training and retaining highly creative employees), and creativity management (systems for team work and the transformation of creativity into profitable corporate innovation).

4. Results

For each section a general description of the sector is made, followed by the results obtained from the interviews and related documents.

Biotechnology and Biomedicine

Four cases are described: North Carolina Biotechnology Center, Bühler factories, Unilever (Port Sunlight Research Center, UK) and Pfizer.

The U.S. research center is a private non-profit state-funded organization, devoted to support research in organizations and universities. The impact of the economic crisis is causing serious problems and reductions in staff are imminent.

Bühler, situated in Zurich, is a global technology partner for the food industry, chemical processing and die casting. The client presents the need and the teams produce the solution. Besides applied research, there is a small group of 20 scientists who conduct fundamental research, based on top management objectives. The cycle is: initial brainstorming, team gathering to staff the development programme, management submission and budgeting, periodical (36-month) reports to management to gain more resources, in 4-5 year projects. As to creativity skills and competencies, the company president has been the main source of ideas and research support. The company believes that there are no specially gifted scientists. Each researcher works concurrently on 2-3 projects and salary is less important than autonomy and productive working conditions.

There is no designation of extra time (for creative work), except in production. The company considers that the worst thing would be to restrict people to work only on their specialties and supports city sport and leisure clubs where all employees can meet. There are no closed offices and internal networks are preferred due to company product secrecy.

Unilever deals with nutrition, hygiene and personal care. Research staff conducts meetings to know "what Unilever is going to do 20 years from now?". First the idea has to be sold to the project manager and, if accepted, a complete document will be subjected to top decision. Creative individuals may negotiate their salary and each person is motivated to work in another project and to propose an original one. Meetings are held in a central bar, where other people are invited, and all employees are encouraged to participate in external conferences and meetings. There are co-operation agreements with external institutions, individual experts, consultants, and networks of specialists, under a confidentiality obligation.

Pfizer, in Belgium, adopted another method to think out of the box one year ago, after training with a steering committee. People are organized in training teams and everybody can propose new projects. Bad ideas are not punished, and people are encouraged to take risks. There is a pipeline of projects top-down, and an annual prize for the top company project, while individuals receive a symbolic award for every new idea. It is more about recognition than money.

Nanotechnology

Also four cases are described: Lund University, The Nanometer Structure Consortium – Lund Nano Lab; Department of Physical Electronics, School of EE, Faculty of Engineering, Tel-Aviv University; Faculty of Science and Engineering, Department of Chemistry, Waseda University, Japan; and the consultant Mark Raison, with experience on Japanese organizations, from YellowIdeas, Barcelona.

In Lund University, people seem less aware of creativity techniques. Projects are submitted, selected and funded like normal research projects. Five years ago it was declared a top priority for the university, to leverage newly acquired national funding to attract the best masters' students. They act by collaboration, meeting people at the university and competing for projects. There is no specific project structure. Projects are at risk as funds are drastically reduced due to the economic crisis.

In the Israeli case, the present economic crisis has also reduced the amount of funding available and a new policy shall be drafted for the future. As to creativity practices, if an individual proposes a good idea, he or she applies and can obtain money easily. The base is fundamental research and there is a selection committee every year to select projects, from several sectors in the society. The university cannot pay as much as private companies, but it attracts people by providing an interesting life and granting special contracts for 20-30% less pay than in an Israeli company. Organizations can come to the University, where there is a small number of start-ups and a venture capital system.

The only Japanese scientist interviewed at Waseda University reported that his university collaborates with industry in physical chemistry projects, and that industry also sends employees to work with university scientists. He admitted that it is very difficult to garner industrial projects or funding due to industry secrecy and confidentiality restrictions. He disclosed that Japanese managers have difficulty accepting creativity techniques, but when they agree, projects have great performance. Managers that have not been exposed to western culture, tend to focus on conventional solutions, making it difficult for employees to propose something different from the boss. One possible solution is to have them submit ideas anonymously (silent brainstorming). There is conflict avoidance and no debate and women's opinions are typically not sought out, so that diversity of thought is low. The lifelong contract between the company and the employee no longer applies and so risk-taking suffers. The current economic crisis portends the end of the Japanese era of creativity contribution.

ICT - Information and Communications Technology

From the ICT sector, two cases are reported: the Finnish Hermia Ltd, and the Portuguese YDreams.

Hermia Living Labs is a discussion forum involving users in every step of the project, and each year they propose a topic. One example – the objective of allowing elderly people to live in their homes later in their lives – they invited

the elderly, their families, nurses, technology organizations and researchers to a one day workshop. They generate ideas, prioritize and select a set of ideas that could be developed by organizations, using forecasting activities like Scenario Planning. They also act as start ups, organize events and foster open innovation, involving technology specialists in social networking activities to cooperatively generate ideas. Many organizations have lots of ideas never implemented, so they challenge university students to develop them. Once an idea is produced, the students own the project and are supported to commercialize it. Tekes Institute provides funds to implement these ideation projects. They also have an innovation mill where old ideas can be reanalysed and implemented.

YDreams' CEO mentioned that there are too many ideas in a company. He considered that the key is to recruit people who think "out of the box". Brazilians, for example, merge the ability to grasp mass culture with sophisticated culture. They have two groups of creative people: the ones in fundamental research, who have total freedom; and those in day-to-day projects. Both switch roles frequently. Teams include content and interface technicians. They conduct brainstorming sessions with participants from business, financial and intellectual property disciplines. The more productive sessions and contributors are rewarded. The salary range of participants is 5:1 and within the same category salary differentials do not exceed 1:2. The internal network is permanent, but employees complain there is too much information and communication suffers.

The Irish Case

Both reported initial cases belong to Enterprise Ireland, a state institution devoted to company development and support. It deals with indigenous SME's in Ireland. The strategy is to develop organizations and companies with the people they have and attract foreign investment. And so, the concept of "soft landing" is no longer in use. The focus is on entrepreneurship and programmes to help indigenous development and to support R&D, either within organizations, or in collaboration with universities, and to garner relationships with overseas advisors.

The second interview confirmed that the strategy is no longer attracting creative people to move to Ireland, but to improve existing organizations creativity and organizational innovation system. In the view of the interviewee, no country does this; it's entirely new. The thinking practices and tools must be at the highest level; the managing director of a company must believe that innovation is both necessary and useful, and that it is not just a moment of inspiration but rather the result of a structured approach to select the best opportunities and develop related products or services correctly. The applied innovation approach uses project-based learning to instill a creative culture in a company. This approach involves giving selected teams pieces of work to carry out and then having them make presentations, some weeks later, to explain their findings. The topics are deliberately chosen to raise debate and, of course, conflict will be evident and innovation will never be effective unless organizations have an ambitious culture and leadership.

The third case was Dromone Industries, which designs, manufactures and markets heavy machinery for construction and agriculture. They use idea production techniques of Brainstorming; Kepner Tregoe, Situation Appraisal, QFD - Quality Function Deployment, and Contextual Enquiry. Each project manager reports to the boss, who is in charge of integration. The emphasis is on incremental innovation. People have to see progression in the implementation of their ideas. Instead of bonuses, they give educational support and travel to exhibitions. The company experienced some conflict with operations managers at the beginning of the deployment of idea production techniques. The system can be improved by adding more value to products and processes, and moving beyond purely incremental innovations.

Eco-Innovation

One example of a technology which is pivotal for tackling climate change is the generation and transformation of energy: renewable energy, water and waste management, and motor vehicle abatement technologies. Two interviews were made: the Western Harbour of Malmö, and the city of Kamikatsu.

The first interview was related with the Bo01 Area, a residential area in Malmö, which will house 30,000 people by the completion of the project. Several instruments were used by the teams involved in developing Bo01. At least two seem to score as keys for the project's success: planning and organisation through a quality programme for building; uniform and consensual views of the goals and vision of the area, shared by all those involved in the project. The Quality Programme is a sophisticated document which deals with virtually all issues which are important in city planning. It also puts forward the spirit and the philosophy of Bo01. Most striking is a document signed by 18 people, which demonstrates a strong commitment to the project.

The second interview was made to the non-profit organization Zero Waste Academy Japan, at the town of Kamikatsu, which made a "Zero Waste" declaration with a time limit for reducing the amount of waste disposed of by incineration and landfill to near zero by 2020. The town has stopped using waste collection vehicles and has already achieved about an 80% recycling rate of waste, classified into 34 categories. Research is underway into development of new energy sources, and a Zero Waste Fund has been established, which will further promote the Zero Waste initiatives.

Other Industries and Cases

It was possible to obtain information from six other organizations, suggested by consultants because of their creativity best practices. All except two were industries based in the Netherlands.

The Bosh Innovation Unit, in Aveiro, Portugal, is helping the company to start developing an innovation process in the competency center. The vision is applied through three core activities/pillars: idea generation (internal network);

idea implementation (applied during project phase); and knowledge management (tailor-made activities). Employees are encouraged to submit ideas and there is an idea evaluation group that meets every month, under the coordination of the Innovation Manager. Once approved, the ideas follow a patent application process. The employees' rewards are linked with patent attribution and not only with the original idea. The approved idea proceeds to development, in which creative problem solving methodology is used. A network of contacts and experts on various technical subjects is assembled and made available to any individual in the organization who can use this network to solve a problem.

Rotor Company (segments for engines) produces a standard product, ranked highly in innovation business software. This product sells fine, so there is no need for product innovation. It has been the same over 50 years and the personnel have an advanced average age (more than 20 years of service). Thus, they do not have any formal system of idea generation, nor of project management. All work performed is based on hiring students to develop projects following managers' requirements for new processes. The system started three years ago and, since then, the incumbent employees face new ideas from the students who come and work in projects. Directors pressure middle management to come up with new ideas to be developed by students, and there is no material reward to the managers for their ideas.

At Wein Minerals Neetherlands, each day the production cell meets to come up with ideas. A problem is assigned to an interdisciplinary team that studies and proposes solutions, and is forced to think outside the box. Consultants were there at the beginning, and now the company maintains a team of five full time internal facilitators, used to support teams, especially the poorer performing teams and projects. There are lots of ideas but time does not allow for more than five ideas to be implemented per team. The A3 method (Lean Manufacturing Techniques) is used for idea selection, as well as root cause analysis and effectiveness solution checking measures. An average number of 10-15 problems are solved each month and they try to define small time range projects, presenting results every two to four weeks. There is no control for the smaller projects and more than 60% of the personnel are involved in some kind of research project. Management defines higher level objectives on safety, quality, and processes and, once a month, selects people to present the best solutions. There is no reward system but the best ideas are honoured and people feel proud of their work product. Two times a year they have a central meeting in which teams present the best ideas.

Sensata Technologies makes electronic centrals and idea generation starts with marketing people leading the projects. Market understanding needs improvement and more market evaluation is performed with engineering involvement.

The biggest company group in Portugal, SONAE, is the only service-based entity on our list. There are two facilitators and an innovation committee of 30 people, representing all areas in the company - Customer, Idea Management, Networking, Culture, and Governance. They develop workshops with customers, follow projects with direct impact on customers, and analyze suggestions and

complaints. There is an Idea Forum, where people are asked to submit ideas or solutions for concrete challenges. In promoting corporate awards, the company rewards the best implemented ideas and the most innovative projects.

At the biggest Portuguese road construction company, BRISA, ideas are brought from different sources: internal, universities, suppliers, and clients. Project management is done at the Project Support Office, including patents and models, foresight activities, innovation portal, potential evaluation and value creation. Management is highly involved in innovation connected to value creation, using the Strategic Planning Department, focalized on the organizational component. An innovation committee defines priorities and policies, and the Department of Innovation and Technology acts as a first line BRISA department. They have an integrated system of quality, innovation, research and development aimed at creating value through innovation.

These cases, compared only on idea generation, management and reward systems, are reported in Table 1 and, as can be seen, all cases suggested by the Chamber of Commerce have far less creativity practices than the rest of the sample. Nevertheless, it is interesting to note that only two cases seem to demonstrate best practices in creativity outside of the R&D department. Creativity best practices, or organizational innovation, are difficult to find in current companies outside of the research department, and “Everyday Innovation” is hard to find.

Table 1: Summary of characteristics of organizations in idea generation, selection and reward

Area	Case	Idea generation systems	Idea selection systems	Idea reward	Conditions
Bio-Technology and bio-medicine	North Carolina Biotechnology Center Bühler Factories Unilever R&D Pfizer	No Restricted to R&D Dep. Project management “Think out of the box” method in teams	No Project management Project management Top-down project pipeline	No No extra pay Best scientists negotiate salary Symbolic prize for top company project	Creative environment Creative environment Creative environment
Nanotechnology	Lund University Tel-Aviv University Waseda University	No No. Conventional	Project management Project management Project management	No Better conditions No	Funds are being reduced Interesting life University-Industry collaboration. End of the Japanese era of creative contributions

ITC	Hermia Living Labs	User integration. Scenario planning	Yes	Symbolic	Creative environment
	YDreams	Yes, when in "ideators" group	Yes	Yes. Can double the salary	Creative environment
The Irish case	"Soft Landing" policy (Entreprise Ireland)	Several. 40% employees involved	Short term projects	Educational support and travel	No longer applies. Replaced by "Workforce Development" Creative environment
	Dromone Industries				
Eco-Innovation	Bo01 Area in Malmo Zero Waste Academy (Japan)	Project development Project development	Quality Programme		State programme State programme
Other	Bosh Innovation Unit	Creative Problem Solving Middle managers	Project management	Patent reward	Creative environment
	Rotor Company	Production cells - facilitators and method. More than 60% employees involved	Interdisciplinary team	No	Students are hired to run projects Creative environment
	Wein Minerals			Symbolic	
	Sensata Technologies	Marketing dep. leads projects	Too many unmarketable projects	Corporate awards	
	SONAE	Idea Forum	2 facilitators and 1 innovation committee.		
	BRISA	R&D Dep.	Workshops with costumers Project Support Office and Strategic Planning Department		

5. Discussion and Conclusions

From the interviews and reports analysed, it is possible to conclude that the present crisis is having a deep effect on national policies concerning R&D and on high technology industries, and that these industries, more than the others, are having difficulty of finding alternatives ways to generate financing. The EU and countries like Israel are changing priorities and including services and other non

high technology activities and functions in innovation policies and financing. The US and Japan are losing much of their workforce capability due to cost reduction policies and a lack of organizational commitment and engagement of employees. This means, among other things, that the priority given to R&D in state institutions or big company research laboratories may be shared with innovation policies devoted to SMEs and service companies. If this new definition is accepted, innovation shall be understood as organizational, in addition to the traditional process and product-oriented types of innovation. Instead of trying to define organizational innovation as changes in the structure of the organization, which do not allow for quantitative return on investment analysis, the concept must be seen as the enactment of a dynamic system devoted to channelling individual and team creativity into profitable corporate innovation. Organizational or corporate innovation, and organizational or corporate creativity, must be seen as synonymous.

Besides R&D departments or laboratories, it is very difficult to find organizations with an institutionalized system of innovation, and from those who have innovation programmes, less than 20% of the employees are included in innovation-oriented project teams. Working within a whole workforce development system, although recommended by all types of theoretical and political sources, is rare and limited to specific industries and engineering departments. It was difficult to find recently-published literary references documenting systems of collaborative management, even though it originated in the XIX Century.

Even though future European innovation policies will favour the service sector and the SMEs, pragmatic application remains a challenge. We have found no cue as to the primary reasons why it seems difficult for companies to engage personnel in profitable innovation projects. The need for a relationship of trust between management and employees seems to be most relevant. Power struggles seem to be the main obstacle and it seems easier to see management spending millions in technology acquisitions than hundreds of dollars in organizational project development.

The project contractor does not take into consideration the effects of the recent crisis upon high technology sectors, and does not totally agree with the purpose of the investigation. It also considers as different, sectors that overlap (nanotechnology, biotechnology, biomedicine and ICT) in companies and research centres, making it difficult to separate its analysis. Also, the access to some of the cases was extremely difficult due to the sector's secrecy, confinement of the industry and culture of the country (e.g., Japan). Collecting data by telephone interviews, with people from non-English speaking countries, in order to draw complex analogies, is a difficult exercise. Nevertheless, from the interviews, relevant aspects of organizational innovation can be indicated: complementary team work in research projects, client intervention, fundamental research role, supportive environment (no punishment of errors and encouragement to take risks), social participation and intrinsic retribution system; learning opportunities, salary negotiation, open meetings; growing private participation and the

university as a place for venture capital companies and start ups; wider spectrum of project selection boards, to include companies, agencies and politicians.

We concluded that besides innovation projects and problem solving methodologies, all components of an organizational innovation system must be addressed, namely: creative management (leader selection, orientation and training in order to bring creative contributions out of teams and individuals); creative people management (general and specific orientations as to hiring, training and retaining creative employees); and creativity management (existent systems and conditions for team work and the transformation of individual and team creativity into profitable corporate innovation, together with HR management, especially salary systems). Also, to be effective, organizational innovation has to address power sharing, creating a climate of mutual trust between management and employees. This is not discussed in EU or national innovation strategy documentation, nor included in the literature concerning innovation.

We found that R&D is not the only method of innovating. Other methods include technology adoption, incremental changes, imitation, and combining existing knowledge in new ways. With the possible exception of technology adoption, all of these methods require creative effort on the part of the organization's employees and consequently will develop the organization's in-house innovative capabilities. These capabilities are likely to lead to productivity improvements, competitiveness, and to new or improved products and processes that could have wider impacts on the economy.

From the investigation it is possible, then, to draw the following remarks that can be used when building a system of corporate creativity in SMEs.

Key Factors

- From the literature and the case study analyses, it seems that organizational innovation relies on top management orientation to innovation and in project teams, supported by idea finding and problem solving methodologies, together with value and return on investment analysis. Client or market requirements seem to be the best inspiration for projects, and fluid decision making (flat hierarchy) the best guarantee that the system may work. To be effective, organizational innovation has to address power sharing and the creation of a climate of mutual trust between management and employees, together with supporting conditions. The environment (communication) provided by leadership is the key factor in corporate creativity, and collaborative management and collaborative tools, are possible solutions to overcome the present crisis. Companies that cannot evolve in the direction of a collaborative type of organization will suffer in today's innovation economy, as everything that is not creative will have a low cost orientation and can be outsourced. Inertia kills innovation and hope, but innovation needs optimism and employees need to feel that the company is worthy of their efforts to add value.

- For corporate creativity the real power is the unexpected, and the novelty of self-initiated projects far exceeds that of the projects initiated by management. Innovation cannot be predicted but just happens, somewhere between planning and improvisation. Therefore, the company must encourage unofficial activity and provide diverse stimuli. This can be achieved by identifying stimuli and providing it to employees, rotating jobs, arranging for outside interaction and creating opportunities for employees to take their own stimuli, asking them to run their business like their own may produce wonders. Great ideas, visionary leaders, core values, strategic planning, vision statements, and early entrepreneurial success are common myths for why companies succeed. Innovation is not for exceptional people, like the inventors; it is just discovering new ways of creating value, which once embraced by the employees, will become a way of life.
- Alignment is a key factor. The failure of large organizations to innovate is primarily the result of a communication gap, thus the company must provide opportunities for people to meet and the priority must be to make each employee responsible to requests for information or help from other employees. The connection between organizational boxes is one of the key factors; what you do inside each box is less important than how the boxes work together. Formal innovation systems must be validated by the informal organization, so that management policies and people's beliefs coincide. This means that all important decisions must be shared so that commitment is realized. There will always be continuous improvement as long as there is trust between management and employees.
- Innovation is made by people and for people, and the success comes from an uncompromising commitment to the organization and its people. Therefore, automation, routinization and mechanization are against innovation, as organizational creativity is more about commitment than about ideas, and it is not possible to be committed to a machine. A company is creative when its employees do something new and useful without being directly shown or taught.
- Symbolic rewards are more effective than material ones. Nevertheless, some compensation might be given to ideas that produce objective results, like patents. If there is prize money, it should not exceed 10% of salary. It is a mistake to believe that creativity can be motivated by offering rewards. Rewards have always been the main reason to stop suggestion systems, not to initiate them.

Idea Production and Selection Systems

- It is top management's responsibility to define innovation objectives, designate the teams, and provide time, resources, competencies, and leadership. The innovation system must be tailored to each company and not simply copied from external examples. The idea generation and

selection methods chosen are important aspects of innovation, but the organization should choose appropriate ones aligned with company goals and culture and develop expertise in their use. Even though there should be individuals or groups managing the innovation system, the moment the company needs a champion to promote ideas to top management, the company has already failed.

- If possible, idea generation and idea selection and development should correspond to different teams. For example, at Buhler, with a medicament required by the market, biologists may start the research and, after discovering how the virus might be destroyed, a team of chemists leads the making of the drug, which is then delivered to a team of medical doctors to conduct tests. Also, Buhler's cycle seems to be a guide: initial brainstorming - database search - hypothesis suggestion - team gathering to make the development programme - management submission and budgeting - periodical reports to management to free more resources
- Idea producing sessions must be open and a diverse set of people should be invited to participate. All forms of art should be considered in leadership training and ideation sessions. Open Innovation systems are welcomed, and the marketing sector can take control of contributions.
- Teams should be multidisciplinary and members related to finance, marketing, commercial areas and intellectual property management should be invited. Also, research and production roles should shift amongst employees. Students may be put in charge, under management orientation.
- Team composition should remain stable, at least during a project development, and project teams must be "visible" within the organization, together with their activities and achievements. Each project team must add this task to the project's list. Visibility is both an extra reason for the team members to comply with the planned requirements and a condition for the rest of the company to accept more easily the changes introduced by the team. Projects should have a short range (1-2 months, or 2-4 weeks), so that people may see the impact of changes or improvements.
- Some coordination must take place, so that the innovation system becomes embedded in the organization. Also, in accordance with the company's dimension, consultants should be available to help the project teams.
- Management control mechanisms must be a constant, giving continuous feedback on costs and impact to management and teams.
- Passive systems, from the simple suggestion boxes to sophisticated idea management software, generate only some of potential for the unexpected. Management should consider that each idea needs four hours to be transformed into a project. Thus, an active system could, at least, work side by side with a passive system.

6. Conclusions

The overall conclusion was that each company represents a specific case on innovation, as the interviews did not allow us to detect major similarities. Therefore, evidence indicates that innovation in companies does not align with standardized models of execution, but only with the attempts that the company makes to develop its organization. As these attempts become consistent and reliable, the company is likely to build its own innovation system, different from any other company. As a rule of thumb, everyone should ask which activities account for 80% of one's time but only for 20% of the accomplishments, and focus the creative energies toward how it might be reduced, delayed or even stopped.

Best practices can only be fully analysed through observation and participation, which should be considered for the future. The case of Ireland, eventually complemented with others from Denmark and Finland, deserves a deeper analysis, as suggestions for future research.

Acknowledgement

We would like to thank Maria Thompson, from Motorola Company, for her technical advice and the review of the manuscript. Also, we thank our colleagues from EACI, especially Hans Van Meer, and the managers we interviewed, especially Dr. Edward Commins, from Enterprise Ireland, without whose contribution this work would not have been possible.

References

- Atkinson, R. and Andes, S., 2009. *The Atlantic Century: Benchmarking EU & US innovation and competitiveness*, The Information and Innovation Technology Foundation, Washington.
- Bandow, R., 2009. *Balance scorecard and benchmarking*, Fraunhofer-Gesellschaft, Berlin.
- Collins, J. and Porras, J., 1994. *Build to last*. HarperCollins Publishers, New York.
- Edward J Commins, 2004. *The role of the Enterprise Ireland Technologist in facilitating Innovation Management in Irish SMEs*, Unpublished Master of Science Dissertation in Technology Management, University College Dublin.
- Florida, R. and Tinagli, I., 2004. *Europe in the creative age*, Demos, London.
- Hagardon, A., 1999. Group cognition and creativity in organizations, *Research on Managing Groups and Teams*, 2, 137-155.
- Hagardon, A., 2000. Building an innovation factory, *Harvard Business Review*, May-June.
- Hage, J., 1999. Organizational innovation and organizational change, *Annual Review of Sociology*, 25, 597-622.
- Kanter, R. M., 1983. *The change masters*. Routledge, London.

- Kao, J., 1989. *Entrepreneurship, creativity, & organization*, Prentice-Hall, New York.
- Lam, A., 2004. Organizational innovation, MPRA Paper No. 11539.
- McLean, L. D., 2005. Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development, *Advances in Developing Human Resources*, 7, 226-246.
- Monteiro, I. and Sousa, F., 2008. A liderança inovadora na hotelaria algarvia [Innovative leadership in the hotel industry in Algarve], *Revista Portuguesa e Brasileira de Gestão*, 7, 2, 68-78.
- Paulus, P., 2008. Fostering creativity in groups and teams, in: *Handbook of organizational creativity*, J. Zhou and C. Shalley. (Eds.), Lawrence Erlbaum Associates, New York
- Perry-Smith, J., 2008. When being social facilitates creativity, in: *Handbook of organizational creativity*, J. Zhou and C. Shalley. (Eds.), Lawrence Erlbaum Associates, New York
- Peters, T. and Waterman, R., 1982. *In Search of excellence: Lessons from America's best run companies*, Warner Books New York.
- Robinson, A. and Stern, S., 1998. *Corporate creativity: How innovation & improvement actually happen*. Berrett-Koehler Publishers, San Francisco.
- Sawyer, K., 2007. *Group genius: The creative power of collaboration*, Basic Books, New York.
- Shalley, C., 2008. Creating roles, in: *Handbook of organizational creativity*, J. Zhou and C. Shalley. (Eds.), Lawrence Erlbaum Associates, New York
- Shapiro, S. M., 2001. *24/7 Innovation: A blueprint for surviving and thriving in an age of change*, McGraw-Hill, New York.
- Schumpeter, J. A., 1934. *Invention and economic growth*, Harvard University Press, Cambridge.
- Sousa, F. and Andrade, C., 2007. Factores organizacionais e pessoais como determinantes da percepção do clima organizacional [Organizational and personal factors in organizational climate perception], *Inuaq-Studia*, 10, 219-235.
- Sousa, F., Pellissier, R. & Monteiro, I., 2012. Creativity, innovation and collaborative organizations. *The International Journal of Organizational Innovation*, 5, 1, 26-65
- Zhou, J. and Shalley, C. (Eds.), 2008. *Handbook of organizational creativity*, Lawrence Erlbaum Associates, New York.