The capability of being able to innovate is the most critical part in sustaining competitiveness. While big companies are already well equipped with instruments and experience in innovation management, small and medium sized enterprises (SMEs) in contrast usually only have basic access to these instruments. In addition, they are often faced with the problem that these instruments are incompatible with their particular needs. For the strategic and operative planning, for innovation processes and project realisation, most tools are yet completely insufficient. Furthermore, many of these tools and instruments are not even known to most SMEs.

The EC supported project »VIVA – European Virtual Centre for Innovation Excellence Assessment« has realized the need for action. Hence VIVA addresses these deficiencies by providing an Innovation Management toolbox and several case studies.

In this book you will find:

- A thorough description of the Innovation Management toolbox developed in the VIVA project. This toolbox comprises several tools supporting primarily small and medium sized enterprises in assessing their innovation excellence and enhancing innovation processes and strategies in order to develop an effective innovation culture.
- A comprehensive Innovation Management reference model to give the user a deeper understanding of the interrelations of different innovation activities.
- An outline of the latest and most important trends in Innovation Management.

Open Innovation for small and medium sized Enterprises

Anne Spitzley
Thorsten Rogowski
Francesco Garibaldo
(Eds.)

Open Innovation for small and medium sized Enterprises

Ways to develop Excellence

Innovation

ISBN 978-3-8167-7384-9

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Editors:

Anne Spitzley, Thorsten Rogowski and Francesco Garibaldo

Authors:

Andrea Bardi, Peter Butala, Francesca Di Lucchio, Paolo Franceschini, Sarah Fried, Francesco Garibaldo, Anna Giarandoni, Nadim Hamdan, Ilja Hauß, Javier Mendibil, Helmut Ortmeier, Thorsten Rogowski, Miriam Spangenberg, Claudia Speth, Willi Schweinfort, Anne Spitzley, and Kristina Wagner

Coverdesign:

Anette Grimmel and Petra Riesemann

ISBN 978-3-8167-7384-9

First published in June 2007

Printed in Germany

by Mediendienstleistungen des Fraunhofer-Informationszentrums Raum und Bau IRB, Stuttgart

Distribution:

Fraunhofer-Institute for Industrial Engineering
Nobelstraße 12, D-70569 Stuttgart,
Telephone: +49(0)711 970-2081,
Online-shop: http://www.iao.fraunhofer.de

Preface

Innovativeness is the most important lever to the increase of profitability and growth in any branch. Still the innovation processes of many small and medium sized companies are inefficient; they lack systematization and thus prevent the rapid and consequent implementation of innovative ideas in marketable products and services. The result is that the market chances stay unexplored and a holistic innovation strategy cannot be followed.

To support small and medium sized enterprises, an initiative to start and coordinate a European-wide exchange of results, approaches and ideas on innovation excellence assessment was set up: the VIVA web Portal. VIVA stands for the European Virtual Centre for Innovation Excellence Assessment[1] and is co-funded by the European Commission. This portal serves as a repository to aid SMEs developing innovation excellence that can replace the current ad-hoc methods.

The methods, tools and approaches are the results of the project VIVA. In this book you will find a thorough description of the Innovation Management toolbox to support small and medium-sized enterprises, a comprehensive innovation management reference model as well as good practice examples of the application of innovation management tools and methods.

We thank the European Commission for their support and especially our project officer, Mr. Jyrki Suominen, for his valuable feedback.

We also thank the members of the editorial staff, Julia Gutmann and Thomas Potinecke for their important work. Furthermore we are thankful for the important support of the Keiper GmbH to make this book possible.

[1] VIVA - NMP2-CT-2005-013800

Furthermore we thank the project partners for their excellent cooperation. Without their dedication this project would not have been possible. Partners of the VIVA project are:

- Fraunhofer Institute for Industrial Engineering (FhG IAO)
- Istituto per il Lavoro (IpL)
- invenio Engineering Services GmbH
- Communardo Software GmbH
- Centro Ricerche Fiat (CRF)
- Managing Innovation Strategies S.L.L. (Mainstrat)
- Fundacion para el Desarrollo de la ciencia y la Tecnologia en Extremadura (Fundecyt)
- Wirtschaftsförderung Region Stuttgart GmbH (WRS)
- KOGAST Grosuplje d.d. - GIZ VTG - Gospodarsko interesno zdruzenje, grozd proizvajalcev visoko tehnoloskih produktov
- Fundacion Labein - Tecnalia
- CRIT s.r.l.
- LAKOS - University of Ljubljana, Faculty of Mechanical Engineering, Department of Control and Manufacturing Systems
- Keiper GmbH
- ETH Zürich Zentrum für Produktentwicklung Forschungsgruppe Innovationsmanagement
- Clusterland Oberösterreich GmbH
- European Business and Innovation Centres Network (EBN)

Nowadays it gets more and more difficult to keep pace with the international markets. We hope that with this book we can give small and medium sized enterprises new ideas and suggestions for their daily work. Then we have reached one of our main goals: To transfer academic and spread industrial knowledge to the companies' everyday life and by this strengthen the European economy.

Stuttgart, June 2007

Anne Spitzley

Thorsten Rogowski

Francesco Garibaldo

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I With Innovation Management to organic growth and performance excellence

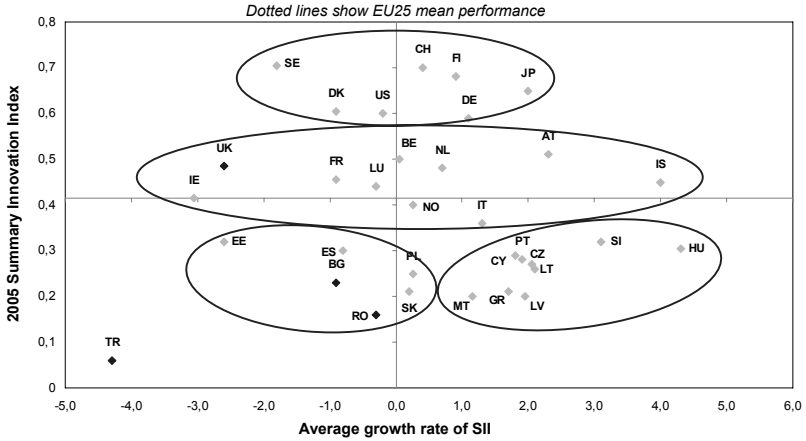
Kristina Wagner

1 Innovation Performance in Europe

The capability to innovate is the most critical element in sustaining competitiveness for advanced industrial nations which are no longer able to compete on cost. Innovation is thus on the top of the policy agenda in Europe. Based on the Lisbon Strategy[2] the strategic objective is to become the most competitive and dynamic knowledge-based economy in the world capable of sustained economic growth with more and better jobs and greater social cohesion.

However, as the recent European Innovation Progress Report[3] shows, only five of the EU-25 countries can be considered as innovation leaders (Switzerland, Finland, Sweden, Denmark and Germany). Seven out of the EU-25 even loose ground in their innovation performance.

Figure 1: Innovation Performance of EU-25



Notes: The circle identify the four main country groupings: Top = Leading countries, middle = average performers, bottom right = catching up, and bottom left = losing ground

[2] European Commission, 2005, Lisbon Strategy

[3] European Commission, 2006, European Innovation Progress Report 2006, Trendchart

This shows impressively that even when targets are set, their implementation across Europe differs widely and improved innovation performance especially on enterprise level does not always follow. To keep pace with the highly dynamic development in US and Asia it is essential to promote strongly and continuously innovation activities in Europe for European enterprises.

1.1 Innovation is key to achieve profitability and growth but SMEs show only little innovation activity

For enterprises professional Innovation Management is the key to achieve higher profitability and superior growth. It is proven that companies with sophisticated Innovation Management capabilities achieve profitability which is twice as high and grows 5 percent to 9 percent faster than less innovative competitors.[4]

This clearly shows that Innovation Management excellence is not an art but rather a craft – which can and has to be systematically and efficiently managed. Nevertheless several inquiries demonstrate that SMEs especially in traditional sectors are only little active in terms of innovation and its systematic management. This comprises about 70 percent of the SMEs.[5]

At the same time the SMEs in Europe count for 23 million enterprises which provide around 75 million jobs, generate more than two thirds of the EU's Gross Domestic Product (GDP) and account for up to 80 percent of employment in some industrial sectors.[6]

These figures show the immense potential lying in the increase of the Innovation Management performance of SMEs in Europe. For achieving this strategic aim a fundamental readiness for changes and overcoming of limits has to exist. Furthermore there have to be measures, tools and reference values which are contributing to the innovation development and the external innovation environment.

4 Bullinger, H.-J.; Engel, K., 2006, Best Innovator – Erfolgsstrategien von Innovationsführern; 2. Aufl.; München: FinanzBuch

5 Belz, J., and Warschat, J., 2005, Das Rückgrat der deutschen Wirtschaft – motivieren, bewegen, stärken: Zwischenbilanz eines Arbeitsjahres; Impulskreis Innovationskraft in KMU in der Initiative „Partner für Innovation", Fraunhofer IRB, Stuttgart

6 How to succeed as an SME in the internal market: Innovation strategies for cross-border business, European Monitoring Centre on Change (EMCC), 2006 (URL: http://www.eurofound.europa.eu/emcc/reports.htm)

1.2 SMEs unmet needs in Innovation Management

Whereas in most large enterprises innovation is on the top of the management agenda with significant investments in a professional, systematic management, Innovation Management is not the centre of attention at SMEs. Many SMEs are not even aware that they should enhance their Innovation Management capabilities.[7]

Many SMEs neglect the subject innovation because they lack of skilled personnel and there are shortfalls in capacity and financing. Market chances are not persecuted and often there is no innovation strategy available. In addition, the capability to transform promising ideas into products successfully introduced into the market is not very distinctive. At the same time the capabilities and readiness to link the innovation activities and to accommodate knowledge of other SMEs, institutions or research facilities are hardly developed. Aggravating is the fact that many SMEs have limited possibilities to finance innovation by themselves due to low equity ratio.

Although SMEs basically have access to instruments successfully used by large companies, they are faced with the fact that most of these instruments are not suitable for them. As a consequence, most new products and services are developed ad-hoc, without any systematic and methodical support. Support mechanisms for the improvement of innovation capability which is the requirement for efficient planning, development and market positioning for innovations are rather the exception than the rule.

Four major unmet needs of SMEs can be summarized:

- Understanding the business impact of Innovation Management: Enterprises show a lack of focus on business impact. This keeps SMEs from improving Innovation Management performance.
- Keeping the strategic positioning in mind while eliminating operational short comings: SMEs tend to focus on operational improvements first, before improving their strategic positioning. This is often neglected as resources are absorbed in the operational issues.
- Build cross-border networks: Due to the increasing globalisation, SMEs need to develop cross-border networks. This becomes difficult as often they lack of international expertise.

[7] Europe INNOVA paper No 2: European Innovation Management Landscape – Assessment of current practices in Innovation Management Consulting Approaches and Self-Assessment Tools in Europe to define the requirements for future „best practices“, November 2006

- Accelerate the commercialisation of ideas: Although SMEs often have excellent ideas for new products or services, it takes too long to commercialise these ideas. This is often due to limited support for developing and implementing business plans.

To fill this gap, not only the SMEs but all stakeholders involved in Innovation Management have to handle Innovation Management as a powerful means for sustainable business impact along the entire value chain: SMEs need to know what their needs and benefits are in terms of Innovation Management. Consequently, it is necessary to enhance and accelerate the generation not only of innovative products but also of processes and services at the SMEs.[8] Innovation Management consulting service providers and intermediaries have to provide adequate service offerings to SMEs including SME-tailored tools and they have to be able to generate demand for Innovation Management related services. Financial institutions have to extend their traditional evaluation criteria in which Innovation Management should play a prominent role. And policy makers have to detect the most effective policies and means to stimulate and continually promote Innovation Management capabilities at SMEs in the different European countries, legislatures and cultures.

Apart from raising awareness for Innovation Management on all stakeholder levels, a suitable, holistic approach to Innovation Management is needed, taking into account all innovation-relevant aspects.

2 A holistic approach to Innovation Management

To be innovative means to continuously implement new ideas and to place them successfully in the market. This is achieved by new products and services but also by innovative processes and organisational structures[9].

Innovation Management is as a result more than R&D, the entire company is in focus. Thus, a holistic approach covers all dimensions of Innovation Management including innovation management strategy, innovation management organisation and culture, innovation management processes and enabling factors for innovation management such as knowledge management, project management etc. and last but not least the business

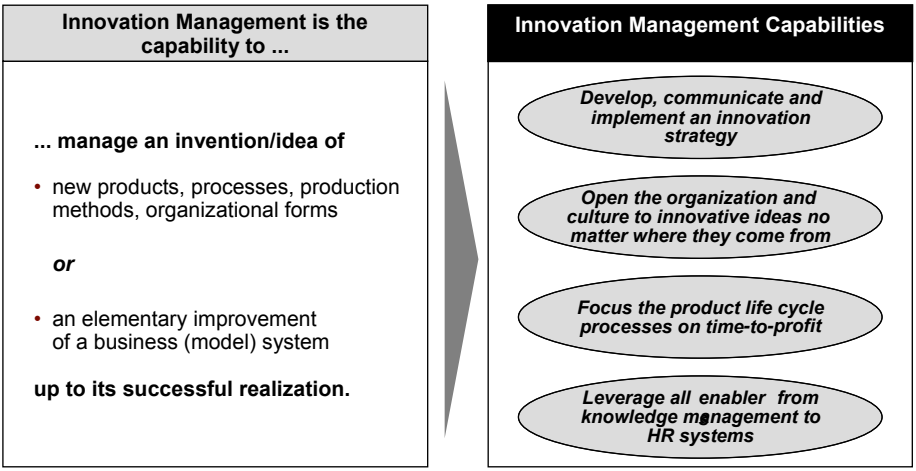
8 Spath, D., Wagner, K., Aslanidis, S., Banner, M., Rogowski, T., Paukert, M., and Ardilio, A., 2006, Auf dem Weg zu schnelleren Innovationsprojekten, in: Fokus Innovation, Kräfte bündeln – Prozesse beschleunigen, H.-J. Bullinger, ed., Carl Hanser Verlag, Munich, pp. 41-44

9 Wagner, K. et al, 2005: Die Innovationsfähigkeit des Unternehmens steigern – Analyse und Steuerung der innovationsrelevanten Einflußgrößen. In: Industrie Management (21), 2005.

impact of Innovation Management.[10] Therefore, SMEs have to leverage these innovation capabilities to drive the economies.

As current practice shows, the success of Innovation Management can only be sustainable if it is implemented as a continuous process in the enterprise. Enterprises which focus on a systematic management of innovation have significantly higher success rates in terms of the realisation of ideas into marketable products and their successful commercialisation.

Figure 2: Innovation Management Capabilites



Source: IMP³rove, 2007

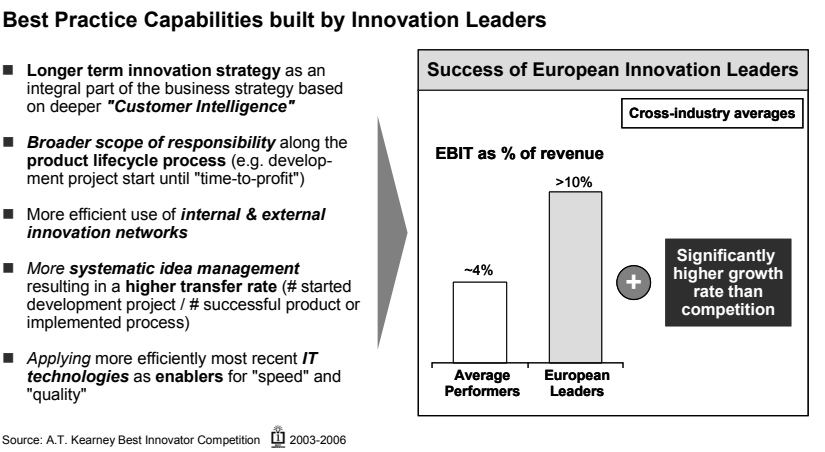
The commonalities among innovation leaders can be consolidated into the following set of critical success factors:

- All innovation leaders have implemented a long term innovation strategy as an integral part of the business strategy based on deep "Customer Intelligence"
- The culture of innovative enterprises is open for ideas and innovation and mistakes or failures are seen as learning opportunities.

10 Engel, K. et al, 2005, European Best Innovators – The New Frontiers, 2005

- The entire product lifecycle process of successful innovators is pro-actively managed. It is characterized by the systematic generation of ideas and realization of a high transfer rate from development projects into successful products with focus on "time-to-profit".
- Innovation leaders make use of internal and external collaboration and innovation networks efficiently, which is in line with the innovation strategy based on a clear view on capabilities along the value chain.
- As an enabler, the enterprises' controlling system reflects Innovation Management performance along targets laid out in the innovation strategy. The assessment of the subject innovation is integrated in capability management, performance management and reward systems.

Figure 3: Best Practice Capabilities built by Innovation Leaders



Many SMEs are aware that they have to evolve and modernise in order to compete in an increasingly global market. This requires more networking, increased flexibility, adapted structures, stronger links between research and innovation, increased added value in products, production and services, and decreased environmental impacts.

In order to boost European Innovation Management Excellence of SMEs European-wide however, it is necessary to coordinate the scientific and

industrial research as well as the initiatives, projects and activities on regional, national and European level.

3 VIVA – Innovation Management Excellence of SMEs in Europe

In order to enhance the Innovation Management Excellence of SMEs in Europe, the VIVA project was initiated by bringing relevant stakeholders of Innovation Management together such as SMEs, Innovation Management facilitators such as associations, intermediaries, clusters as well as policy makers and other Innovation Management related actors.

3.1 Objectives of VIVA

The strategic objective of this project funded by the European Commission[11] was to initiate and to coordinate a European-wide exchange of results, approaches and ideas on Innovation Management excellence. This was achieved by creating a self-sustaining community bringing together a critical mass of innovation competence in Europe.

VIVA was focused on the manufacturing industry being one of the major backbones of the European economy and playing an important role for the European competitiveness today as well as in the near future. The manufacturing industry contributes to a tenth to the value creation of the entire EU industry. The manufacturing industry consists European-wide of more than 24.500 enterprises, 2,6 million employees. In 2005, this industry produced machines and plants accounting to 420 Mrd. Euro[12].

VIVA built up a platform to link European stakeholders with their know-how, new technologies, methods and best practices concerning Innovation Management excellence of SMEs in the manufacturing industry, focussing especially on mechatronics and high-tech equipment.

The objectives of the work in VIVA have been:

The coordination of initiatives assesses and developes innovation excellence of SMEs's

The exchange and consolidation of studies and scientific results concerning the Innovation Management excellence as well as their distribution was

[11] VIVA NMP2-CT-2005-013800

[12] VDMA, 2007; URL: http://www.vdma.org/wps/portal/Home/de/

important within VIVA. VIVA brought together scientific experts and practitioners and initiated a dialogue on Innovation Management.

The knowledge exchange of different initiatives dealing with capability of innovation

VIVA aimed at analysing influencing factors on innovation and on the capability to innovate and addressed the following questions: What are critical success factors, which are the key drivers and what are the barriers for the innovation capability of SMEs in opposition to large companies? Are there any regional or national specialities which influence the Innovation Management capability? Are there sector specific differences which influence the innovation performance? Which methods are proper for increasing the innovation excellence of SME? Are there any cultural differences with regard to innovation?

The engagement of clusters' participants to enhance exchange of knowledge and experience

A European-wide, cluster-oriented networking and exchange of best practices and lessons learned has been established. VIVA focused on the linking of innovative companies acting in clusters such as the automotive cluster in Austria and the Slovenian cluster of manufacturers of high-tech equipment. It aimed to compare best practices of companies acting in the innovative environment of clusters.

The provision of a toolbox for innovation excellence

VIVA provided comprehensive access to methods and tools adapted respectively to the needs of SMEs for the assessment respectively improvement of innovation excellence. One major activity therefore comprised the collection and preparation of instruments, tools and methods developed by the VIVA partners and associated network partners. Company associations and innovation transfer centres linked to VIVA act as multiplier and help to spread and collect further methods and tools.

The identification of paths and trends in innovation excellence for the mechatronics and manufacturer of high-tech equipment

VIVA aimed at discussing future scenarios for innovation excellence with representatives of the manufacturing sectors involved. This comprises the discussion of a clear and long-term vision of a European manufacturing industry with regard to technologies, processes and services in the involved sectors.

3.2 Focus and results of VIVA

Four topics have been essential to build a holistic common ground for innovation excellence for SME in Europe. Those have been addressed and discussed in detail within Special Interest Groups (SIGs):

Management of Innovation

A systematic management of innovation supports the planning and controlling of the different influences on the innovation process in order to develop and build a marketable product. Within VIVA, the focus has been on the definition of an innovation strategy and on the initiation of targeted processes of innovation. This comprised the assessment and selection of innovation projects as well as the definition of selected measures for the realization of the innovation objectives. For these tasks there are several methods and tools, e.g. market analyses, determination of success factors etc.

Innovation Culture

Innovation Management comprises soft skills like creativity management and social innovation which are supported by additional methods and tools, too. Therefore it is necessary to select those which are most suitable for the company and to adapt them individually. Especially SMEs often have no capacity for this selection.

Assessment of Innovation Excellence

There is a bulk of **methods** for the assessment of innovations themselves. They can be roughly differentiated in technological, economical and psychological methods. The first category evaluates the potential of a new technology and the effort for the innovation, the economic assessment like 'cost-benefit analysis', 'scoring-models' or 'break-even analysis' leads to statements about the economical success of an innovation. The third category, i.e. the psychological assessment evaluates from the market's or customer's point of view. Mostly it is assumed that the decisions of the customers depend on several properties of the product. It is presumed that for a holistic and entire evaluation a combination of methods of all categories is necessary. Anyhow, these methods are applied to the innovation itself and not to the capability of an enterprise to make innovations. If an enterprise is repeatedly missing innovative success, its process of innovation assessment is improvable.

Innovation in Clusters

Firms and industries are normally inter-related in both direct and indirect ways. Given the interest in innovative economic development strategies by

both the public and private sectors, industry cluster policies have received significant attention in current initiatives. A cluster is a geographic concentration of competing and cooperating companies, suppliers, service providers and associated institutions. Local proximity to firms in all aspects of the production process, such as the suppliers, machine builders, assemblers, distributors and final customers allows the cooperating firms to adopt new technology and innovations rapidly, therefore increasing the overall efficiency of the production process. The firms collaborate to provide specialised services; through this collaboration, clusters develop. The social infrastructure within the cluster helps facilitate technology and knowledge transfer, which strengthens the cluster and promotes future growth. The importance of knowledge-intensive communities, in which people and organisations share and develop common knowledge, is growing. This has profound implications for research, innovation and governance. However, there are core open questions regarding what factors drive the development of an industry cluster and how to identify and measure the innovation in clusters.

By linking and coordinating innovation excellence initiatives, VIVA offers a comprehensive view on the topic. National and international research activities of the VIVA partners are linked which facilitate a European-wide knowledge exchange, also open to third parties.

Factors of influence on innovation, i.e. drivers and barriers, have been identified as well as regional, cultural or national peculiarities that have an impact on innovation capability. A comprehensive toolbox with SME-specific tools and methods to increase the innovation excellence will ease the implementation of Innovation Management at SMEs.

The identified future trends in innovation excellence and the development of a long-term vision of a European manufacturing regarding technology, processes and services have supported the development of a comprehensive framework for Innovation Management for SMEs in Europe.

In the following the VIVA framework will be presented:

In chapter II the dynamic and flexible expertise and skills of SMEs will be discussed in the context of learning organisation and knowledge management. The general VIVA framework will be described.

In chapter III the results of an empirical study on the current state of Innovation Management and innovation culture in Europe will be presented.

In chapter IV the VIVA toolbox will be comprehensively described. The toolbox aims at providing the SMEs with tools, methods and instruments

they can easily use in their daily work to improve their Innovation Management performance. The collected tools, methods and instruments are tailored to the needs of SMEs and are already proven tools.

Chapter V is focused on the impact of time drivers on the Innovation Management Performance. Success factors will be presented which show how to improve and advance innovations and how to enhance the innovation capability of companies. Furthermore, a framework for the analysis and evaluation of the innovation management capability will be presented and discussed.

Case studies elaborated in the VIVA context will be discussed within chapter VI. They will illustrate good practice examples of how to enhance Innovation Management capabilities by applying appropriate tools.

Chapter VII gives an outlook on how to go on with activities concerning Innovation Management for SMEs. The focus is a business model to perpetuate the VIVA activities.

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Spath, D., Wagner, K., Aslanidis, S., Banner, M., Rogowski, T., Paukert, M., and Ardilio, A., 2006, Auf dem Weg zu schnelleren Innovationsprojekten, in: Fokus Innovation, Kräfte bündeln - Prozesse beschleunigen, H.-J. Bullinger, ed., Carl Hanser Verlag, Munich, pp. 41-44.

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II A reference model for excellence in innovation management

Francesco Garibaldo, Ilja Hauß, Javier Mendibil

1 Part 1: Concept of innovation and definition of excellence in innovation

1.1 Concepts and definitions

1.1.1 Innovation is not a linear process

The first problem, which we must come to terms with, is the discussion of the "standard" concept of innovation in the national and international agencies. According to this concept, innovation is a linear process, based on the avant-garde results of scientific research and the so-called "high-tech" competences that functionally and temporally precede the industrial process. This linear concept has been submitted to a critical analysis, also using empirical material, in the PILOT Project[13], over the past three years.

Our critical reconsideration started with a straightforward observation: there are companies that are not "high-tech"—according to the formal definition of the OECD based on the Frascati manual[14]—which are highly successful on the economic level and capable of putting new, reliable and profitable products onto the market. In short, these are companies that have all the characteristics that Schumpeter attributed to an innovative company. Such companies are often, even if not always, SMEs and in the vast majority of cases they do not have a Research and Development centre, nor do they have any formal mechanisms intended for innovation. In any case it is difficult to argue that they are companies whose development mechanisms are "science-based", i.e. dependent upon the application of scientific discoveries mediated by sophisticated technologies. The number of companies in Europe that match this definition is rather large and they provide a significant contribution to the GDP and to employment. Are these exceptions that will gradually disappear or different mechanisms of innovation that teach us

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13 PILOT (Policy and Innovation in Low Tech, Knowledge Formation, Employment & Growth Contributions of the 'Old Economy' Industries in Europe). Research Project, funded by the European Commission (Contract No. HPSE-CT-2002-00112), Key Action "Improving the Human Research Potential and the Socio- Economic Knowledge Base" in the 5th Framework Programme.

14 http://www.oecd.org/document/6/0,2340,en_2649_34451_33828550_1_1_1_1,00.html and http://www.oecd.org/dataoecd/37/25/34964971.pdf

something about the complexity and the variety of the innovation mechanisms that actually exist?

If, as the Pilot project's empirical findings intend, the answer is positive, this is not a seldom exception of innovation, then it is a matter of trying to broaden the innovation concept that it will be congruent not just with the standard model but also with these alternative paths. The new broadened innovation concept will serve as a basis to develop far more realistic and flexible operative instruments and, something that is very important for us, viable for the SMEs. Furthermore, if it is possible to have innovations which are not "science-based" and "high-tech", what type of wealth of knowledge, competences and organisational and cognitive processes are mobilised in such cases? Are these artisan residues, useless in the upcoming scenarios, or vice versa fundamental mechanism for every type of innovation, even those that are not incremental, and if so, which are they? Finally, if such mechanisms exist, which are the socio-organisational and cultural conditions that foster their growth, their build-up and their development?

The last decade of organisational, psychological, economic and management studies has produced an important theoretical and cultural elaboration, as well as a significant collection of qualitative and quantitative case studies that will prove helpful for us to answer these questions.

Let's go back to the main point, that is, the critique of the linear and formal character of the innovation process. The main point described by Kaloudis et. al. 2005 is that:

"There is no evidence supporting the argument that the high-tech economies are also the high-growth economies. This suggests that different economies can follow different paths of economic growth. Countries play different roles in the differentiated international economic system with clear patterns of division of labour among the highly developed economies.

Based on these conclusions we would hypothesize that growth is primarily rooted not on the creation of new sectors but on the internal transformation of sectors which already exist and/or are growing, such as, the service sector. Overemphasizing the role of the high-tech sectors seen as isolated contributors to growth ignores this major dimension of change due to transformation in advanced economies.

Such oversimplifications are rooted in fundamental assumptions supporting modern research and innovation policies, which by overemphasising the role

of R&D in economic growth they often underestimate processes of change and needs in those sectors of the economy with low R&D-investments."[15]

1.1.2 Innovation is a multidimensional phenomenon

As we shall see later in detail, also on the grounds of the existing literature, it is not a question of a juxtaposition between knowledge-based innovation paths as opposed to those based on "making do", but an extension of the concept of knowledge. "Knowledge" does not exist but rather plural forms of knowledge and there is no standard content of different forms of knowledge, i.e. the scientific-technological form, but different possible contents. Therefore it is not a question of choosing one knowledge society, privileging a certain kind of industry as opposed to others, but of exploiting the unutilised knowledge potential in the whole of the existing sectors. Exploiting knowledge should not mean waiving the chance for creating new knowledge, both innovating them as such and exploiting the often unexplored functional relations between the different sectors and, among the actors themselves, between the companies that are "high-tech" and those that are not.

A first practical consequence is the multidimensional nature of innovation. This implies that in the processes for the evaluation of excellence we cannot only consider the R&D indicator but it is necessary to consider other factors as well; for example in the PILOT project at least five or even six were identified:

- R&D intensity;
- design intensity, which includes a broad design concept including parts of what hitherto has been included in the "D" of R&D;
- technological intensity;
- skills intensity (human capital orientation);
- innovation intensity;
- and organisational set-up.

This is not the right place to discuss them at length, as you may refer to the original essay[16], but the need for a multidimensional approach of innovation

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15 Kaloudis, A.; Sandven, T.; Smith, K., 2005, Structural change, growth and innovation: the roles of medium and low-tech industries 1980-2000. Paper for the Conference "Low-tech as Misnomer: The Role of Non-Research-Intensive Industries in the Knowledge Company", 29-30 June, Brussels.

should be recorded. This also implies that the degree of co-evolution of the different "dimensions" of the innovation becomes a fundamental key in evaluating the efficiency of the innovation paths, a key therefore to innovation excellence.

We are thus driven, by these critical analyses, in the direction of those studies that put the stress on the resources the companies have at their disposal: in the first place it is the individuals' knowledge, both tacit and formal, in order to achieve an innovative competitive advantage of a type and on companies' capacity to know how to use it appropriately and strategically, the latter being something that characterises excellence.

In short, we can isolate two aspects of excellence:

- The capacity to co-develop various dimensions, i.e. in practical terms, a certain number of corporate "policies";
- The capacity to know and be able to use all the resources, in the first place the unused individual and available knowledge, both tacit and formal, in a clear and well-articulated strategic design. We refer to the theory of dynamic capabilities

1.1.3 First conclusion

Innovation is:

- a non-,linear process;
- a multidimensional phenomenon;

Excellence in innovating largely depends:

- upon the degree of co-evolution of the different dimensions of innovation;
- on the availability of dynamic capabilities at corporate level.

1.2 The Dynamic Capabilities or the Dynamic and flexible expertise-skills

The title already indicates the multifarious approaches possible to the issue of individual capabilities – the "capabilities" of Zollo and Winter[17], the

16 Laestadius, S.; Pedersen, T.E.; Sandven, T., 2005, *Towards a new understanding of innovativeness – and of innovation based indicators*. Paper for the Conference "Low-tech as Misnomer: The Role of Non-Research-Intensive Industries in the Knowledge Company", 29-30 June, Brussels.

17 Zollo, M., Winter, S., 1999, *From Organizational Routines to Dynamic Capabilities*, WP 99-07, The Wharton School University of Pennsylvania.

"skills" of Le Boterf[18] , and a variety of contributions on the skills linked to expertise, such as those by Meghnagi[19] and Newell and Simon[20]. To these names we should add those of Dewey and Argyris.

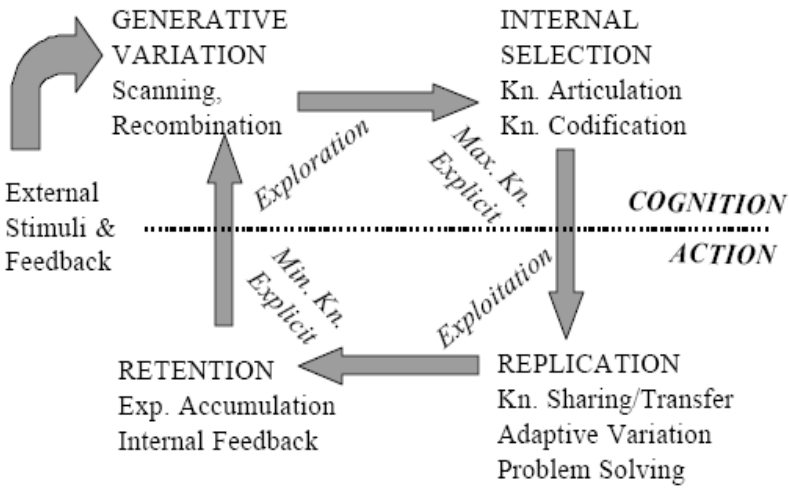
1.2.1 Knowledge evolution

From the practical point of view the problem can be delimited in the following way:

In a very turbulent ambience subject to very rapid changes, the innovative and excellent companies have, amongst the other possibilities, that of "science-based" innovations, the capacity to rapidly gasp the important and/or strategic external changes and to restructure their operative behaviours, besides their long-term choices. How does that happen, and what conditions foster such skills?

This Figure, taken from Zollo and Winter, is highly explicative:

Figure 4: Knowledge Evolution Mechanisms



The basic chart is a cycle that from a stage of generative variation, which is born from a combination of an impulse external to the company and some ideas, even in a tacit and/or embryonic form, with its consolidated routines,

18 Le Boterf G., 2002, *Développer la compétence des professionnels*, Edition d'organisation, Paris.

19 Meghnagi, S., 2005, *Il sapere professionale*, Feltrinelli, Milan.

20 Newell, A., Simon, H.A., 1972, *Human Problem Solving*, Englewood Cliffs, Prentice Hall.

moves from a stage of internal selection that explicitly evaluates their potential. These first two phases are exploration and explicit phases of the external stimuli and involve some cognitive processes in an important way. Two more phases follow: the replication and the retention, in which action typically prevails. The first action is the utilisation of what has previously been selected and leads to the reproduction of the routines, in the light of the context modifications – and is therefore an adaptive variation, and the second, of explicit, is an action of experience accumulation, in the new context, something that determines the new set of procedures, and thus, an action of recombination. Cognitively speaking, the cycle moves from right to left in the direction of explicit forms of knowledge, well-articulated and codified, while from left to right, the knowledge tends towards tacit forms "as it becomes highly embedded in the behaviour of the individuals involved in the multiple executions of the task".[21]

1.2.2 A definition

That having been said, what is a dynamic capability then? It is

"a learned pattern of collective activity through which the organisation systematically generates and modifies its operational routines in pursuit of improved effectiveness."[22]

Thus, for a company, to have that dynamic capability or not, it is not a "target hit or missed" with an isolated and singular act of creativity, but the availability, or non-availability, of stable structures and/or operational patterns. It is not even an individual mechanism in a strict sense even if it has been set off and conveyed by the people involved.

Zollo and Winter rigorously define the three mechanisms involved in this dynamic process: the organisational routines, the articulation and the codification of knowledge. Let us look at these in detail:

- The organisational routines are distinguished into operational and learning or search; for our discussion the latter are decisive.
- Knowledge articulation.

Knowledge articulation is essential to us because it consists of the implementation of a collective learning mechanism that spins off from the chance for the individuals to express their opinions and beliefs by means of a constructive dialectic discussion with others, even by contesting their points

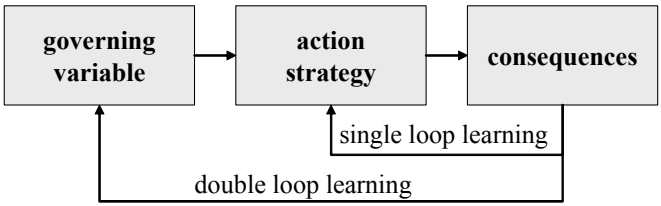
21 Zollo, Maurizio; Winter, Sidney, 1999, op. cit., p. 7.

22 ibidem, p. 10.

of views. These forms of learning enrich the capacity to elaborate organisational learning or search routines. This involves a specific organisational pattern which, in the first place, allows one to express oneself freely and, in the second place, to have time and place resources to allow this dialectical interchange: the possibility, in other words, to organise discussion groups, seminars, etc..

From this analysis, therefore, the minimum criteria for organisational specification accrue that allow for different organisational set-ups, respecting some criteria that can be defined as part of the conditions laid down for excellence in innovation. This part refers directly to the theory of Argyris on the double-loop learning process that is intuitively comprehensible from the following chart:

Figure 5: Double-loop learning process



Argyris saw the need to go from Model I, organizational features that inhibit double loop learning, to Model II, what he called theories-in-use, that is approximately to say the routines. In short, Model II can be summarised like this:

The significant features of Model II include the ability to call upon good quality data and to make inferences. It looks to include the views and experiences of participants rather than seeking to impose a view upon the situation. Theories should be made explicit and tested; positions should be reasoned and opened to exploration by others. In other words, Model II can be seen as dialogical – and more likely to be found in settings and organisations that look to shared leadership.

It looks to:

- Emphasize common goals and mutual influence.
- Encourage open communication, and to publicly test assumptions and beliefs.
- Combine advocacy with inquiry (Argyris and Schön 1996; Bolman and Deal 1997: 147-8).[23]

1.3 Learning organisations

A different but converging set of concepts comes from the concept of the learning organisation; it is an ideal towards which organisations have to evolve in order to be able to respond to the various pressures they face.[24] Peter Senge popularised the notion of the learning organisation in his best-seller The Fifth Discipline (1990):

Learning organisations are organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together.[25]

Peter Senge also places an emphasis on dialogue in organisations, especially with regard to the discipline of team learning. Dialogue is a basic concept in the learning process of learning organisations. The word dialogue comes from the Greek words *dia* (through) and *logos* (word, meaning). Hence dialogue means the clarification of thoughts and meanings, a shared flow of knowledge.[26] The purpose of dialogue is to go beyond one individual's understanding and try to understand each other's ways of thinking. As Peter Senge has argued, for example, team learning entails the capacity of members of a team to suspend assumptions and enter into a genuine "thinking together".[27]

It is certainly difficult to find real-life examples of learning organisations.[28] One good example is Team Academy, which was described by Peter Senge

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[23] Argyris, C. and Schön, D. (1996) Organizational learning II: Theory, method and practice, Reading, Mass: Addison Wesley. Bulman, L. G. and Deal, T. E. (1997) Reframing Organizations. Artistry, choice and leadership, San Francisco: Jossey-Bass.

[24] Finger and Brand 1999: 136

[25] Senge 1990: 3

[26] Senge 1990: 240

[27] Senge 1990: 10

[28] Kerka 1995

as the best real-life example of a learning organisation. Team Academy is an advanced learning organisation with a focus on preparing young entrepreneurs. Created 13 years ago in the Jyvaskyla Polytechnic in Finland by Johannes Partanen, it is now well established among the most effective educational systems in the areas of leadership, entrepreneurship and learning.

Teams as vehicles for learning

In Team Academy, a team is a group of students that study together, define their learning and performance goals, acquire shared learning experiences, they are responsible for their own and each others' learning, and help each other to find individual core competencies.[29]

In Team Academy there is no classic academic teaching and all the learning is driven by the student. But this learning takes place in action. The second point is that students are made conscious of their learning process. The understanding of what is a learning process is key to Team Academy, so that learning itself is one of the core disciplines "taught," like marketing or leadership.[30]

Johannes Partanen, developer of Team Academy and Head Coach, has adopted Peter Senge's theories of learning organisations and Nonaka's and Takeuchi's views of the nature of knowledge and the creation of new knowledge. These ideas have been put into practice and processed into a new model called *Brain-industrial Model,* which is described in the book "The Team Academy: A true story of a community that learns by doing". These theories are tested and developed continually by the Team Academy.

The processes of the *Brain-industrial Model* contain two essential methods for learning: dialogue and learning by doing. While implementing projects, the students use textbooks and other sources and previous experiences of their own, or those of other teams to find solutions to the challenges and problems they encounter.

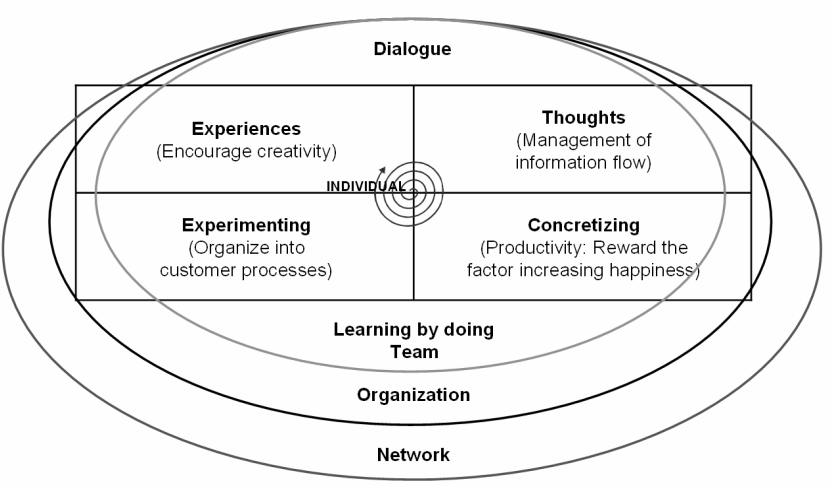
But in order to develop new knowledge and learn as a team, to go through the classic plan, do, evaluate and re-plan cycle is not enough. It is also necessary that the tacit knowledge the learners gain and posses is exchanged and shared at different levels. This takes place through dialogue.

[29] Collignon 2004: 2

[30] Collignon 2004: 3

The model can be also applied to the innovation process, as the following figure shows:

Figure 6: Innovation process in the Brain-industrial Model by Johannes Partanen 2000



At the Team Academy, innovations are based on experiments, on the ideas from the experiments, and on applying these ideas to new experiments. Various kinds of projects have increased the experience "portfolio" of the individual student, the team and the whole organisation. New knowledge and new innovations are not based on individual efforts but on the dialogue that takes place in the teams, in the organisation and in the network (customers, co-players...).

1.4 A highly conducive organisation

The specifics of the system thus become increasingly clear and well-defined. We can speak of a set of conditions about the organisation that in brief are contained in the definition of highly conducive organisations[31], meaning by conduciveness the structural capacity of an organisation to allow, for

[31] Garibaldo F. (1996), Workplace innovation: the making of a human-centred industrial culture, in Gill KS (ed), Human machine symbiosis: the foundation of a human-centred system design, Springer, Berlin Heidelberg New York, pp. 449-452; Garibaldo F., Rebecchi E., Some reflections on the epistemological fundaments of an Italian action-research experience, "AI & Soc" (2004) 18:44-67, SpringerVerlag, London, p. 53.

example, the activities indicated previously in Argyris' Model II, and specifically allowing the members of an organisation to share a "mental space"[32].

Moreover, the ManVis[33] study reaches similar conclusions. The study underlines, in line with what hitherto has been said:

"Knowledge-based manufacturing needs a learning organisation: the experts endorse a company's responsibilities for this issue, using own resources and developing individual organisation cultures. However, they do not see self-employed individuals as a realistic vision for manufacturing operations"[34]

But it also states that:

"There is a market tension between the low importance ratings on improving work-life balance conditions, on the one hand, and the positive views on long-term competence development, on the other hand: therefore, the often-seen prerequisites are rated lower than the preferred outcome of competence building. Further debate on this issue is needed as adequate education and qualification is seen as the most relevant barrier in this field."[35]

We consider prerequisites necessary for the realisation of such dynamic capabilities and capable of fuelling excellent innovation as well. These prerequisites include not just the existence of a highly conducive company or, if we prefer, capable of learning, but also of equilibrium conditions between life and work that allow for medium long-term investments, by some individual and some companies, in their working competences. This also implies a reduction in the degree of working instability. We shall be looking at this point in the next chapter.

A highly conducive organisation can be described very precisely. But there is still the problem of the compatibility of such an ideal-typical organisation with the possibilities of the SMEs. The greatest difficulty is the availability of sufficient resources to have the time and the spaces that allow for these dialogical activities. In actual fact, these difficulties lead us back to our project's general problem: how to allow the SMEs to access the excellent behaviours hitherto reserved to great companies.

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32 Ibidem.

33 **ManVis** is the acronym of the EU FP6 project entitled "Manufacturing Vision. Integrating Diverse Perspectives into Pan-European Foresight",commissioned by the European Commission and conducted by an international team of researchers; http://www.efmn.info/kb/efmn-brief53.pdf

34 ManVis Report 2 – p. 53.

35 ibidem, p. 53.

The problem can be partially solved, as far as this specific point is concerned, if we hypothesise forms of organised collaboration, within the scope of a cluster, a filière, a sub-supply network, a horizontal collaboration network between SMEs, etc.. Excellent examples are reported in the literature, for example Sweden[36] and in the more recent research, for instance in PILOT the case of BMS in Norway and Pontillo in Italy; as a matter of fact:

"BMS collaborates closely with one customer from concept to finished product. Again, in the case of the Italian firm Pontillo, the company is involved in constant product innovation, it is capable of modifying extremely high-tech equipment and is closely involved in the design phase and feasibility study along with its clients"[37].

ManVis considers an essential strategy for the future to be that of the enterprise networks:

"almost all experts believe that specialised SME networks which compete successfully in the global marketplace enhance Europe's competitiveness and employment rates"[38].

The Emilia-Romagna regional government at the beginning of this year created a specific innovation centre (Pi.M.I.NET) devoted to boost networking among SMEs.[39]

The aim of Pi.M.I.NET innovation centre is to overcome the fragmentation that typically characterizes local productive systems with a large presence of small and medium sized enterprises by supporting the creation of horizontal networks among complementary companies, instead of the traditional vertical integration processes. This strategy will allow the valorisation of existing synergies between companies while maintaining company flexibility. To this end, the Innovation Centre will support processes of organisational innovation[40].

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36 Lundberg, M.: Tell J., From Practice to Practice: On the Development of a Network of Small and Medium Sized Enterprises, "Concepts and Transformation" 2:1 1997.

37 IPL team in Pilot Project – WP4 final report – p. 9.

38 ibidem, p. 17.

39 http://www.piminet.org/docs/presentazione/brochure_en.pdf

40 See www.piminet.org

1.5 Knowledge codification

The third mechanism of the Zollo and Winter concept of dynamic capability is knowledge codification which is the production of written materials, of "tool boxes", of decision supporting systems, etc. It is one of the explicit objectives of our project. The model of Zollo and Winter underlines that the codification is a costly process in two senses. First, because it absorbs time and money resources (which are usually scarce in SMEs) and secondly, because it tends to produce a greater "organisational inertia". The point underlined by the two authors, which for us is of great importance, is that the latter cost does not automatically derive from the codification process but depends on a series of circumstances that can be controlled. A good case in point is the IMP^{3}rove project - which will deal with the today need for companies to have the capabilities to manage the process of innovation, from original idea to final product. Innovation management is not just a means in itself, but is about developing and organising endogenous capabilities within companies and translating them into competitive advantages and profits.

For small companies, which are often the most innovative, the challenge is two-fold. On the one hand, they must satisfy the demands of existing customers; on the other hand, they need to keep pushing the boundaries in the quest for new ideas and opportunities. Large corporations too have dilemmas related to innovation. In order to be successful, they concentrate on their best customers and their profits, trading in more sophisticated and expensive products and ignoring low-end product niches, which are less profitable. These niches can be exploited by small start-ups in order to take a share of the market from large companies. The recent success in internet phones is one such example.

Many SMEs and young innovative companies do not possess the entrepreneurial skills needed to exploit innovation successfully and survive in a competitive market. IMP³rove, Europe INNOVA's innovation management project, is specifically aimed at supporting innovative companies in overcoming these problems.

IMP³rove aims to provide innovation facilitators with new and better tools to consult enterprises on innovation management issues. The project activities will support innovative enterprises, innovation intermediaries and financial as well as political actors.

1.5.1 Capability building

Therefore, having seen the nature of the dynamic capabilities and some of their underlying mechanisms, how can they be constructed according to Zollo and Winter?

"Dynamic capabilities emerge from the co-evolution of tacit experience accumulation processes with explicit knowledge articulation and codification activities."[41]

Very concisely, this is a further reiteration of the need for systemic and stable structures and modalities.

What seems to be much more interesting for the VIVA project is the concept of Learning Investments Function, i.e. an estimate of the joint functioning of the three mechanisms described in A, B and C. It is obvious that a company has the lowest learning maturity when the company only relies upon consolidated routines. The maturity is growing in the case of articulation and reaching its maximum in the case of codification. By definition, the VIVA project reaches average and high levels of the indicated function.

What is interesting and not obvious, is calculating whether and when, specifically for the SMEs, such an investment is justified, whether the set of arguments laid down here and put forward to propose our project constitute a strong response or instead, when it is necessary to address our research and elaboration efforts.

Zollo and Winter provide a logical framework for dealing with the problem.

They take for granted what our project has assumed from the start, i.e. that there are the situations in which there are important changes and a strong acceleration – conditions that today characterise nearly all the European SMEs; furthermore, the situations in which the market positioning itself suggests and explorative orientation as concerns the products and the services provided. The essay will go back to the last point in greater detail in the next chapter. A last class of cases is that in which the variables are the frequency, the homogeneity/heterogeneity of the task experiences that the company must deal with and their greater or lesser causal ambiguity, i.e. the clarity for those who must carry out a task on what must or must not be done.

Zollo and Winter lay down three hypotheses on which we could work in the specific case of the SMEs. Here they are:

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41 Zollo, M.; Winter, S., 1999, op. cit., p. 17.

- H1: The lower the frequency of experiences, the higher the likelihood that there is explicit articulation
- H2: The higher the heterogeneity of task experiences, the higher the likelihood that explicit articulation and codification mechanisms will exhibit stronger effectiveness in developing dynamic capabilities, as compared to tacit accumulation.42
- H3: The higher the degree of causal ambiguity between the actions and the performance outcomes of the task, the higher the likelihood that explicit articulation and codification mechanisms will exhibit stronger effectiveness in developing dynamic capabilities, as compared with tacit accumulation of past experiences.[43]

These three hypotheses select broad classes of SMEs, i.e. those that have productive processes characterised by:

- Low frequency; i.e. short series
- High heterogeneity; i.e. high variances
- High ambiguity in the cause-effect relationship; i.e. scarce operational formalisation.

It is a matter of performing a careful reconnaissance as the project unfolds. The considerations of the SIG 3 find further supporting elements here.

42 ibidem p. 26.

43 ibidem p. 28.

1.5.2 Second conclusion

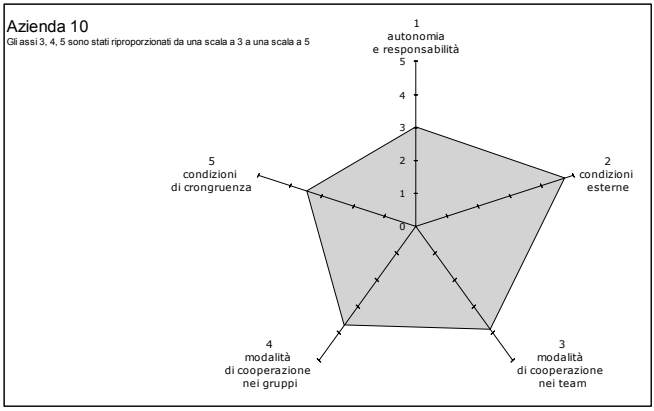
Dynamic capabilities depend upon:

- Stable structures and operational patterns;
- a model of work organisation allowing people: I) to participate in dialectical interchange (discussion groups; seminars; etc.); II) encouraging open communication and to publicly test assumptions and beliefs; III) to share a "mental space" in order to properly manage complex task and problems;
- an adequate education and qualification policy that can be measured through the Learning Investment Function;
- a process of optimisation of the Learning Investment Function moving towards Production Organisational models based on I) short series; II) high variances and III) scarce operational formalisation.

1.5.3 Measurement questions

Up till now 8 criteria and 6 subdivisions of some of the criteria have been listed. How can these issues be measured? A mere quantitative and parametrical analysis of these issues is not achievable; it seems effective to use the foot print analysis scheme. It means to represent each parameter with a conventional set of scores – for instance from 1 to 5 – on a chart; see Figure 7.

Figure 7: Footprint analysis example; measuring professional autonomy dimensions in a car factory



In this case quantitative and qualitative measures can be used at the same time for different dimensions

1.5.4 SMEs and innovation assessment

A simple SWOT analysis scheme can sum up what is specific for SMEs in pursuing innovation.

Table 1: SWOT-Analysis: What are the issues affecting innovation (management) in SMEs?

Strengths	Weaknesses
	Lack of willingness (change)
Fast access to information via intranet	Lack of resources, lack of delegation power
	Short term vision
flexible organisation	Lack of competencies and contact networks
	No existing innovation management
huge potential to be leveraged (regarding employment)	Too shy to contact research institutes
	Lack of interest by managers in innovation management
Awareness at some SMEs of the lack of and need for innovation management	Individual or family controlled SMEs may be afraid to change or to grow
Owner is truly interested in company (not only a “financial” shareholder)	Traditional management approach (non-flexibility)
	Low participation of SMEs to EC co-funded R&D and innovation programs
Many knowledgeable consultants	Difficulty for SMEs in exploiting the results of R&D and innovation programs
	Lack in knowledge protection by patents

Opportunities	Threats
	Globalization
Profits for innovators	Lack of money for innovation (Basel II)
Innovative companies can be bought by big companies	No evolution, but changes of environment -> death of company
Large companies realize the importance of clustering with innovative SMEs	Non innovative SMEs tend to disappear soon
	Innovation requires more and more expensive technologies
Anticipated market changes	Change in social structures, gap between rich (want to work in multinational company) and poor (is not able to run a SME) -> Where are the entrepreneurs?
Push innovation to OEMs	
Innovation as a resource for gaining competitive advantage	Competitive advantage obtained via innovation can be difficult to be sustained with internal resources (exposition to business riders)

1.6 Beyond Schumpeter: the nature of innovation

A third dimension, in addition to being holistic and multidimensional, is required; it is concerned with the nature of innovation. As was pinpointed in the concept of open innovation, and as it is stated in many definitions, for instance the definition by Rothwell[44] of the 5th generation kind of innovation, innovation will become more and more the outcome of cross-sectors fertilisation around broad "themes". These themes cannot be simply deduced by technology trends or sectional analysis, they result from new and old complex societal demands not satisfied at all or inadequately satisfied by the existing supply of goods and services; for instance the sustainable mobility of people, namely in strongly congested metropolitan areas in Europe. These themes are too complex to be satisfied by a single branch or sector of industry, and from a single discipline; they need interdisciplinary R&D and cross-sector innovation. Therefore two capabilities that are more specific should be developed. The first deals with the capacity to tune the internal

[44] Rothwell, R. (1977) "The Characteristics of Successful Innovators and Technically Progressive firms", *R & D Management*, 7: 191-206.

creativity, based on dynamic capabilities, with societal dynamics, it can be called **strategic thinking** capabilities, the second deals with the problem of operating in networks and can be called **networking** capabilities.

1.6.1 Strategic thinking

The arguments hitherto laid down come under the hypothesis that innovating consists of putting new, reliable and the products onto the market, i.e. Schumpeter's idea. Hence, there are no ecological considerations, strictly speaking nor so-called social sustainability, meaning with this the set of the issues classified by the international agencies as Corporate Social Responsibility (CSR). On the more specifically labour issues in this paper we have so far proceeded inductively under the entry: "organisational and systemic conditions that allow for and facilitate innovation". But as is obvious, this is not enough in respect to the European social model that presupposes the existence of a precise set of rules for the Industrial Relations (IR) and the presumption of achieving a high quality of work. Concerning both the Corporate Social Responsibility (CSR), on the side of labour quality, and the Industrial Relations, there is a copious amount of literature available, and in any case, the decisions already taken within the scope of the Union have laid down the constraints that every organisational reality must consider as a matter of fact. We are left with the task of laying down the foreseeable consequences of the different innovation models on the quality of work in the organisational, to set up models of excellence which, all other things being equal, exclude any processes that penalise work. As stressed by the experts of the ManVis[45] report, it is initially a question of bridging the discrepancy between the demand for competences and the disinvestment in the necessary conditions so that it can all be made possible.

The question is different if we introduce both the ecological constraint and the components of CSR concerning the macro-social issues.

[45] See note 14

Indeed, if we introduce considerations of a macro-economic as well as a social kind then it becomes necessary to pose a series of questions:

- Innovate what? The products, the processes, or both?
- Innovate to achieve what? To generically satisfy a client/consumer irrespective of the nature and the quality of the demand? Or vice versa establish the hierarchies of the objectives?
- Why innovate? Generically, as a condition to be competitive? Or more selectively for a specific configuration of competitiveness?
- Who is responsible and how are the unexpected social consequences of the innovative processes managed?

We can make some more analytical preliminary considerations on each of these questions, gleaning from them further criteria for a minimum specification of the requisites for innovative excellence.

We can, heuristically, consider two analytical segments: 1 and 2, and 3 and 4.

1.6.2 Innovation strategies - The need for product innovation

There is a broad consensus on the fact that in Europe, there is at the same time a need for the innovation of productive processes, for the reasons illustrated in Chapters 1 and 2 of this report, and of the products, for the deep transformations in progress of the international division of labour. And it is the opinion of this research team that the true mark of excellence consists in the capacity to tie together the two moments by developing specific synergies; today, such possible synergies are determined by the product innovation side. In short, it is not only a question of applying the latest formula of in vogue management techniques irrespective of any other consideration, but of supporting the product innovation elements with adequate and specific organisational innovations; this is a particularly relevant consideration for the SMEs. Underlining the idiosyncratic elements does not mean not considering a series of horizontal needs for organisational innovation, well-grounded in the two previous chapters. But it intends knowing that these horizontal innovations constitute a set of minimum specification criteria, or if we prefer, a generative matrix of solutions that are to be sought for *ad hoc* and balanced as a function of the product strategies being pursued.

The dominant topic of the situation is product innovation and this is motivated by the fact that Europe's market positioning and specifically that

of some European countries – such as Italy – is no longer sustainable, given the constraints of the European social model. Europe needs profound innovation in the relationship between domestic market and international market, and the products and service offered on both markets. Realignment between the domestic market and the outside market offers the opportunity to sustain, profitably, a process of product and service innovation that transcends the models hitherto pursued.

The previous statements can be better illustrated with a few examples. The case of the automobile is a very clear one. All of the international agencies agree on the fact that there is an excess productive capacity installed in the sectors both at the European and at the international level. In 2005, 54.559.023[1] passenger cars were produced worldwide, of which 17.772.480 (32,57 percent) were produced in European plants. The new registration of passenger cars in Europe was slightly less than 15 million; it means almost 3 million in surplus that should be sold outside Europe. If the worldwide production of European brands is taken into consideration, the challenge for European producers is even bigger; in 2005, for instance, the production of passenger cars made by German manufacturers abroad was up to almost 5 million, that is roughly half of the overall German production. In 2005, the worldwide demand for passenger cars was 53 million vehicles. This means that there is a strong unbalance among production and sales data while the pace of productive capacity building, by each historical brand, is increasing in the attempt to widen the market share and therefore increasing the plant's utilisation rate and rising profit margins. The capacity installed is 80 millions cars per year. On average, the worldwide utilisation rate of the plants is around 75 percent, which means an overprice for the consumers; the average rate is the outcome of very different rates depending on the producers and this is becoming a competitive factor in terms of costs or profits or both. In the meantime new brands, mainly in China, are increasing, mostly in joint ventures with western historical brands, new plants or expanding existing ones

Thus, if such disequilibrium could not be resolved in the medium term, what does an excellent process of innovation in the sector consist of? In the first place, of course, it consists of the technological search for engineering solutions that measure up to the energy crisis and the pollution problems. This is the answer of the most innovative companies and of the research policies of the European Union. Such a strategy, certainly a valid one, has an upper limit that is evident in the prices of the products on offer, rather than in the costs for the producers. These cars can only be acquired by a minority of the population, a substantially large minority in the rich countries, but

negligible in terms of percentage in the emerging countries. The percentage calculation does not take account of the possible sales volumes, given that the minimum percentages in the populous countries are translated into substantial volumes in respect to the existing productive capacity, at least in the short-term, but already in the mid-term this is a matter of opinion given the frenetic growth rate of the productive capacity. Therefore, it seems reasonable for Europe to utilise the opportunity of stabilisation and growth for European OEMs – and the relative profits – coming for the market growth in China, India and other countries to develop a long-term strategy based on:

- maintaining some strong specialisation such as the premium segment;
- moving the European sector in the direction of a sustainable mobility: a new generation of engines, new mobility patterns (vehicles and services) for metropolitan areas, developing an ecological dismantling cycle.

It is necessary to add that along this innovative line, there is also room for the SMEs, actually for the SMEs that are specially born to exploit these new technologies, such as the fuel cells, carving out niche markets for themselves[46].

Therefore, the pursuit of such innovation strategies and the possibility to identify positions of excellence in such a field is not underestimated at all. Instead, we want to identify a possible field of different innovations, as a case of illustration of the previously expressed concepts and to introduce some new ones. If, for example, we considered as a product of the car industry not the car itself, a private four-wheeled means of transport with an internal combustion engine, but the mobility of which the car would only be an instrument among the many possible, then many alternative possibilities would open up, not only the ones already mentioned for replacing the internal combustion engine with alternative systems of propulsion. Among these, the idea of mixed mobility platforms seems interesting, that is, not just based on the car and the traditional forms of public transport, and integrated for the metropolitan areas[47]. Europe is a case of world importance for its

46 Bardi, A.; Garibaldo, F., The automobile filière in Emilia- Romagna: strategic positioning and the consequences of the Fiat Auto crisis , in Garibaldo F., Bardi A., 2005, Company Strategies and Organisational Evolution in the Automotive Sector: A Worldwide Perspective, Peter Lang, Frankfurt am Main, pp.331 – 375.

47 See the materials of the congress organised by IPL, CERIS and CNEL in Turin on 25th Octoberl 2002 entitled: *Alternative Propulsions and the Car Sector*: *Possibile options, economic constraints and development potential*. In particolar, the paper delivered by Garibaldo F. "The means of

structure is based on high-density cities and metropolitan areas, and a population that is increasingly sensitised to the issues of mobility and pollution. The answer therefore to a public and private domestic demand, both individual and collective of this kind, is capable of building a supply of products and services on a global scale. Furthermore, it exemplifies another important innovation possibility deriving from the collaboration between different economic sectors, such as that of the motor-car and that of urban planning, between government systems and governance systems on a meso-territorial scale. Indeed, the concept of platform for mobility implies a task to be done not only on the means for mobility, but also on the architecture of the urban areas and on a synergy specifically designed between two action strands.

The previous example makes it easier to represent more abstract concepts such as the chance to have, around some great collective and/or individual demands of the internal European market the convergence of companies from different economic sectors capable of constructing *ad hoc* responses and wholly innovative in terms of products and services; products and services that, fuelled by the internal demand have the chance to present themselves competitively on the global market. As is demonstrated by the case of the motor-car, in some of these new scenarios there are not yet any size cut-offs to the entry of new actors. In any case, the SMEs networks that cooperate to organise complex responses are perfectly capable of entering these new markets. Furthermore, innovation is not necessarily based on high-tech; in some cases the innovating element is the original combination of existing technologies and easy access, to supply answers to a collective and/or individual demand that had not found, up to this moment, an acceptable response. Within such a perspective, above all for the SMEs, the idea of horizontal and vertical cooperation between companies with different productive specialisations is essential.

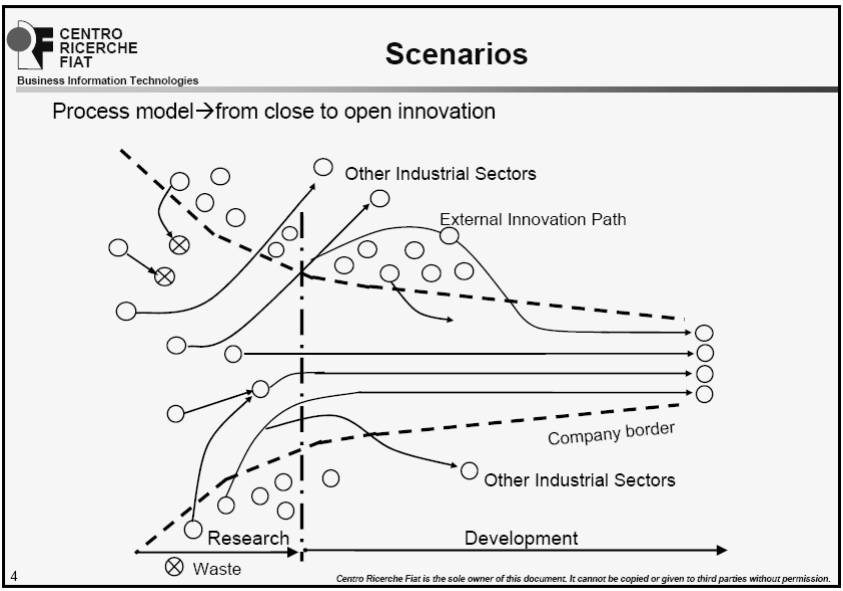
If we consider the analytical block of questions 3 and 4 there are further elements coming to mind. They reinforce what had been said with reference to questions 1 and 2. If indeed the global market is not read as a place for a homogenisation of the compartments, a reason why everyone would compete on everything, with the only difference being between those who have the control over the high-tech and those who don't, then we can identify segments in the world market. Additionally, the more such segments are referred to the demand for highly specialised and complex products and

transport and the flexible systems for mobility", by Cervellati P., University of Venice, "Impacts and implications for the cities" "; by Larrue, P. – INSTEAD, France – The role of the public decision-maker from the case of the State of California.

services, the more they offer opportunities, on the one hand coherently with the constraints of the European social model and on the other with the economic sustainability, for the reasons laid down in this Chapter, of productive models based on innovation as a structural fact and on the selection of a workforce and organisational models based on innovation strategies. The very same ecological norms, including the stricter ones, do not become a constraint, but constitute an opportunity in this scheme, given that the problems that find a solution through these norms are rapidly becoming more and more explosive all over.

This argument seems wholly coherent with the elaboration of the special interest group (SIG) 1 - Innovation Strategies and Processes - and namely with the scheme of the 4th Generation of R&D Management.

Figure 8: Process model, from close to open innovation



The open innovation scheme shows that innovation can come from the interplay of different knowledge and competencies, stored in different industrial sectors, and driven by an unfulfilled individual and/or collective demand.

1.6.3 Third conclusion

The excellence in innovation depends on the capacity to tie together process (it means also organisational) and product innovation by developing specific synergies; we label it as **strategic thinking**. The driver of this process is **product innovation**.

Product innovation should be linked to:

- a different mix of domestic and global market's demands;
- some big societal unfulfilled demands such as sustainable mobility;
- addressing specific market segments.
- Eventually the basic idea of interplay among different firms and sectors stress the relevance of public supported policies and strategies – that is industrial policies – to transform an accidental interplay in systematic co-operation. This is a critical point for SMEs.

1.7 Networking

We cannot go on, in particular as regards the SMEs, speaking of innovation by considering the companies irrespectively of their being "situated".[48]

This Table on innovation culture outlines the nature of the relations:

[48] Garibaldo, F.; Jacobson, D. 2005 : The role of company and social networks in low-tech industries. Paper delivered for the Conference "Low-tech as Misnomer: The Role of Non-Research-Intensive Industries in the Knowledge Company", 29-30 June, Brussels

Table 2: Approach of VIVA special interest group on innovation culture mix

SIG 2 approach – Innovation culture matrix

	Company level	*Transactional aspects*	*Contextual aspects*
Hard	Infrastructure	•Labs •Logistics •ICT	•Legislation •General infrastructure
Soft	•Organization •Managerial tools	•Services •Clustering •Supply chain	•Research system •Educational system •Industrial relations •Financial system (venture capital, private agency)
Intangible	•Values •Beliefs •Behaviours •Attitudes •Customs	•Knowledge system (Know why, how, when) •Industrial atmosphere	•Work culture •Intercultural dynamics

We thus have both the transactional aspects and the contextual ones that characterise the conditions of a company as a situated reality.

Concerning the transactional aspects, the processes undergoing change in the division of labour have pushed many authors to speak of a New Division of Labour (Eksted, 2004) in which a company becomes part of a "*wider system, such as networks, clusters, industrial districts, innovation systems, knowledge blocks, etc.]*[49]. Thus new forms of industrial organisation arise, amongst them project-based organisations, forms that are relevant to the SMEs. In these cases we have:

"The expansion and spread of project-based *organisations* challenge the traditional industrial structure. The activity of these *organisations* is in most cases related closer to its customers than it is the case in industrial *organisations*. As already mentioned, it is not unusual that the seller and the buyer work on the same project. The "exit" mechanism of the market is to a

49 Ekstedt, E. – **The New Division of Labour** – paper presented at the Japan Workshop on Corporate Social Responsibility & Changing Wage Systems – the Role of Trade Unions – Hitotsubashi University, Tokyo; Japan, November 26th 627 2004.

noticeable extent being replaced by "voice", and sometimes even by "loyalty", which is a third and more intimate category in *Hirshman's* model. Most transactions are preceded by negotiations. Some of the more successful companies have developed sophisticated negotiation methods to handle the "voices" of their customers. The multinational contractor *Skanska* performs most detailed contractual discussions with its subcontractors and customers. High negotiation costs in the early planning stages of a project will be reimbursed if it contributes to fewer mistakes when the whole production apparatus is involved later on (*Ekstedt* & *Wirdenius* 1995)."[50]

These considerations must be encompassed within the general project scheme; it is evident that this new division of labour is perfectly suitable to support a concept of open innovation and of strategic thinking also for SMEs.

SIG IV report indicates the innovation factors at the transactional environment level:

- Strong support on regional, national, European levels;
- Socio-economic policy supporting innovation (grants, subventions);
- Networking (clusters, supply networks, technological platforms);
- Innovation culture – public awareness, recognition;
- Strong support for joint ventures and collaborative efforts that develop and commercialise innovative solutions;
- Innovation awards.

For the contextual aspects, bearing in mind the previous analysis, we must underline some critical aspects that we ought to deal with:

- According to the PILOT project: "Another policy problem is the **circulation of knowledge**. Low and medium-tech firms are actually utilising high-tech knowledge in original and often informal ways. To facilitate these processes of knowledge exploitation, the presence of a dense network of institutions favouring knowledge circulation is critical. The policy problem is, therefore, to support **capacity-building** for low and medium-tech SMEs to access knowledge resources in a critical and selective way. Policies for the support of knowledge circulation

50 ibidem, p. 9.

and capacity building for low and medium-tech SMEs can also be implemented through networking techniques. In this case, the network is not a functional-operative scheme for the delivery of products and services, but a way to cooperate on specific goals. Shared facilities for product innovation or a policy coalition lobbying for particular policies, for instance specific vocational policies to strengthen the labour market, are examples of this kind of network." This argument also applies in general to the SMEs, the idea of innovation through the SME network. The SIG IV report stresses the advantages of networks and/or clusters for SMEs saying that "the manufacturing networks combine some good characteristics of large companies, such as critical mass, competencies, development potential, economy of scale, vast capital, etc. with advantages of SMEs, such as entrepreneurship, niche products and markets, flexibility, responsiveness, adaptiveness, etc**."** It is also arguing that" theoretically, clusters / networks are complex adaptive systems (since no mathematical models are available, we have to work with non-linear, stochastic, non stationary systems and with uncertainty)"**.** In the circulation of knowledge we should include the problem of training; from what has been said in this Chapter, there emerges the key role of training investments which, according to ManVis, can only be medium- and long-term. The duty must first of all be shouldered by the companies, within the scope of the calculation of the investment function, in order to avoid free-riding; despite public policies remaining essential, not so much for financial reasons but to determine the educational institutional picture that valorises the importance of this investment fostering new methods and approaches (forms of adult education, network support to training, including individual training, etc.). the ManVis project underlines some aspects relating to the corporate level and to process innovation: "The majority of the experts assume that education and qualification are the barriers for a realisation of the following statements:

- S015: Self-managing teams with a wide range of tasks, including planning and controlling, are widespread in the shop-floor organisation of production (80 percent of respondents).

- S053 Knowledge-based manufacturing leads to a share of less than 10 percent of unskilled labour in the workforce (80 percent of respondents).
- S021 Companies promote the sharing of knowledge amongst individuals through the establishment of a communication-friendly organisational culture and the provision of communication channels across formal structures (77 percent of respondents).

Two statements of the strategy, organisation and management section and one referring to the working conditions section are estimated as being difficult to realise because the level of employees' education and qualification is regarded as insufficient.

Interestingly enough, four statements of the section strategy, organisation, and management are among the top five ranks. Thus, in order to realise new organisational concepts comprising higher qualified and more diversified employees such as self-managing teams or knowledge companies, the qualification of the employees is apparently estimated as being not high enough."[51]

- Today's financial system is, on the eve of Basel II, an extremely critical element in the SME situation, above all in the hypothesis of a circuit of excellence for the SMEs; this presupposes easy access to credit even before highly innovative forms of medium-term investments.
- The local social and institutional context plays an essential role in sustaining innovative excellence. According to the results of the PILOT project, for example, for a balanced dynamic between global and local, **local policies** operating on all sets of "environments" to which a firm belongs, aiming at the creation of public goods, supporting the innovation process must be stressed. Clusters and fragmented economies need strong intermediate institutions and institutional infrastructure to provide local collective goods. To set up such institutions, the positive combination of the vision of the public bodies and the interests of the stakeholders (collective actors) are important factors. The crux of the argument is that technological evolution and innovative capacity evolve, among other things, as a result of the social context. Generally firms, and particularly small and

51 ManVis Report 2 . pp. 19-20.

medium Low Medium Tech firms, are highly sensitive to the solidity of the institutional set-up both of the national and the sub-national specific dimension. "Solidity" here means a mix of physically available infrastructures, and educational, vocational, knowledge creation, diffusion and brokerage facilities and institutions.

1.8 Summing up

Summing up the conclusion of the first part of this chapter on the "definition of innovation excellence in Europe", this is our understanding of the problem:

- Innovation is a non-linear, multidimensional and dynamic phenomenon;
- Excellence in innovation strongly depends upon two basic factors: a) the capacity to co-develop various dimensions, i.e. in practical terms, a certain number of corporate "policies"; b) the capacity to know and be able to use all the resources, in the first place the unused individual and available knowledge, both tacit and formal, in a clear and well-articulated strategic design. The key factor is an integrated and coherent set of policies and practices;
- These two factors are fully developed in organisations able to mobilize the dynamic capabilities of their people; this theme can be labelled as ***the conducive organisation*** theme;
- Excellence in innovation means also to go beyond the existing competitive path – to be more efficient in the existing set of products and services – and to create a brand new set of products and services able to fulfil existing ungratified societal demands;
- Organisations do not operate in a void and their performances are strongly influenced by transactional and contextual factors. As to the transactional factors, a key problem is how to manage the new division of labor in which a company becomes part of a "*wider system, such as networks, clusters, industrial districts, innovation systems, knowledge blocks, etc"*. As to the contextual factors, key elements are the existence of systems of i) circulation of knowledge, ii) of ***capacity-building*** for low and medium-tech SMEs to access knowledge resources in a critical and selective way, iii) policies for the support of knowledge circulation and capacity building for low- and medium-tech

SMEs can also be implemented through networking techniques, iv) financial managing capabilities support, v) local integrated policies.

1.9 Strategic thinking and scenario building

As it was already said in the first part of this chapter, it is quite clear now that future excellent innovation will take place mostly around "themes" and there will be continually changing blend of technologies of various vintages (Bender, 2006). The starting point of an innovative process therefore is the clear understanding of the cross-business potentiality and of the technologies available for it, from the perspective of a specific business. This can be done, both by an extrapolative approach and/or by a normative approach, depending on the degree of visibility of the possible interconnection of that specific business.

1.9.1 Scenario building and innovation management discipline

Scenario building is considered a technique, described in a specific scientific literature[52]. And a managerial technique often utilised by big corporations. Some of them developed its own method, for instance Royal Dutch/ Shell group[53] as Shell highlight it:

"The future is 'terra incognita': although we may be able to guess the outcome of events that lie close to us, as we project forward we enter an unmapped zone full of uncertainty. Paradoxically, the range of options this reveals can seem paralysing. No one can definitively map the future, but we can explore the possibilities. At Shell we use scenario building to help us anticipate what the future may hold and prepare ourselves more effectively. We also believe it can inspire individuals and organisations to play a more active role in shaping a better future—for themselves, or even on a global scale."

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[52] Kahn H., Wiener, A., J. - *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years*, - MacMillan Publishing Company (October 1967); Geus, A.d (1988): *Planning as learning*. Sage UK; Heijden, K. v.d. (1996): *Scenarios: The Art and Practice of the Learning Organisation.* John Wiley & Sons: Chichester, UK ; Rasmussen, L.B. (2003): Action Research Toolkit II: The Scenario Workshop. In: Gill, K.S. and Jain, A. (eds) Navigating Innovations – Indo-European Cross-Cultural Experiences. Vol. 1: Brandt D. (Ed.): Enterprises and Cooperation networks for regional development. India Research Express, India. P. 241-258.

[53] http://www.shell.com/home/Framework?siteId=royal-en&FC3=/royal-en/html/iwgen/our_strategy/scenarios/dir_scenarios_28022005.html&FC2=/royal-en/html/iwgen/leftnavs/zzz_lhn5_4_0.html),

Khan was very clear in highlighting that scenario building is a totally different business from forecasting; it is exactly what is needed to introduce complexity in a manageable way in business decision-making.

Scientifically speaking, scenario building is an exercise on a mid-long term future from 15 to 50 years; to be useful in business terms it is possible to adapt it to a mid term exercise 10-15 years. After having selected some scenarios – it is possible to treat them with classical planning techniques. The exercise is not futile at all as the Royal Dutch/ Shell group history makes clear; here the description of the case in point in the wording of Rasmussen (2005)[54]:

In addition, some of these enterprises established their own scenario planning groups, such as for instance the Royal Dutch / Shell Group in 1972. At that time the global demand for oil had increased from 6 percent to 8 percent per annum since 1945. But would it still be in the interest of the host governments of the oil producing countries to continue to increase production year by year? The scenario group at Shell approached this question as a mental drama, playing the roles of the major oil producing host governments. Thus, they created a scenario in which the oil producing countries reduce supply followed by a sharp price increase. Then it happened that the scenario suddenly became reality.

The Israeli-Arab conflict in 1973 had a dramatic effect on the oil prices: the oil supply was reduced, and the prices rose five-fold. Because Shell were prepared, they were able to take strategic action well ahead of their competitors.

So what happened was that (Heijden, 1996):

"While most of the refining industry needed years to decide that something really fundamental had happened in the industry, Shell moved immediately, switching investments from expansion of primary capacity to upgrading the output of the refineries…… due to Shell's early adaptation of alternative policies, they suffered much less from overcapacity and outperformed the industry by a long margin. This later was shown to have had a fundamental impact on the way the company as a whole came through the turbulent 1970s and the early 1980s"

These methodology and techniques are well established and effective. Can they be adapted to develop an innovation management discipline?

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54 Lauge Baungaard Rasmussen - *Participatory scenario methodologies -Paradigm, Process and Validity*- paper for a conference at the University of Bologna – 2005.

They can. Through scenario building techniques is possible to transform the phase of identifying new products and/or services from a serendipity concept to an organised process.

According to Kahn (1998)[55] in inquiring on the future, people should:

choose between the extrapolative approach and the goal-seeking (or goal-avoiding), normative approach. In the extrapolative technique one examines an existing situation, selects certain tendencies that seem important or relevant, and then extrapolates these tendencies in a more or less sophisticated fashion. Various policy measures that might affect these projections and change the trends or results can then be examined. The normative (or goal-oriented) approach, by contrast, involves first setting up some future context or scenario that is either desirable to achieve or avoid, and then asking what sequence of events might lead to the realization of this objective. In many cases, a relatively implausible goal is examined, such as the achievement of a world government or total arms control, and then this goal is compared with the current situation and its most likely extrapolation. To connect the present and the postulated goal, it may be necessary to modify the image of the current world and that of the future world, and perhaps to use relatively implausible scenarios. These distortions are justified because the aim is to focus attention or discussion on some unlikely but absolutely important event or educational dimension.

The scenario building is a heuristic tool with the power of regulating and organising our thinking; the outcomes are scenarios with an internal coherent structure and suitable for the usual techniques of measuring, accounting and planning. Therefore, it is possible, for instance to apply cost/opportunity assessment of these scenarios, to facilitate a decision.

1.9.2 Participative scenario building

It is also possible to go a step further. In case the innovation a firm is aiming at is strongly dependent on subjective preferences of customers or specific institutions and/or some kind of social aggregation (environmental groups, impaired people lobbies, old people representative organisations, etc) it is possible to use **participatory scenario methodologies** (Rasmussen, 2005), that is methodologies including stakeholders in the scenario building; these techniques have been already used to design brand new products in a process of "co-design" with potential customers (LEGO). The same kind of

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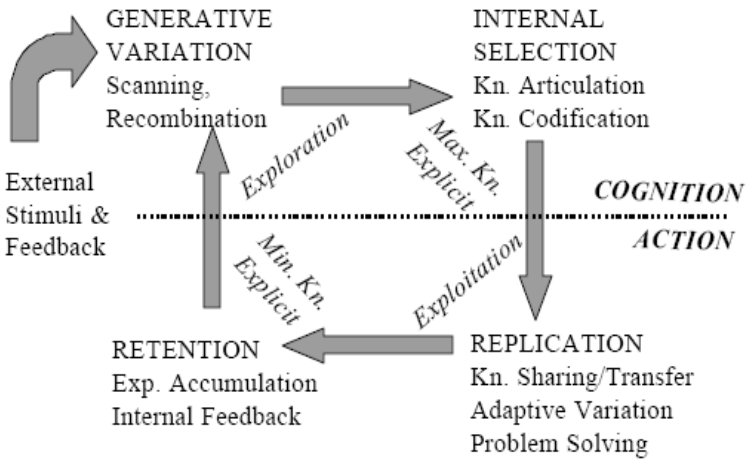
55 Kahn, H.- ***Choosing a Perspective on the Future.*** http://www.hudson.org/index.cfm?fuseaction=publication_details&id=1161

technique can be used in the value chain to start process of "co-design" of brand new products and/or services.

In this perspective innovation management and strategic thinking are connected in the scenario building activity, with two different roles; the roles can be highlighted also utilising the Zollo and Winter knowledge evolution mechanism, already illustrated in the first part of this report.

Figure 9: Knowledge Evolution Mechanisms



The former will introduce an assessment on the internal resources – technology, people, accumulated experiences – available for innovation to the scenario building; it will participate in the **internal selection**, i.e. the evaluation of the potential of the different scenarios basic ideas, and will, at the end of the selection process, reorganise the internal resources allowing the selected ideas to become reality – products and/or services – in a sustainable economic process, i.e. the **replication phase**. The latter will introduce the **generative variation** phase to the scenario building, i.e. scanning and elaborating external stimuli, evaluating, on the basis of the networking capacity, the external resources – technology, market potential, people demands - ; then it will participate in the **internal selection**, namely in participating to recombine the external inputs with the internal resources.

1.10 Innovation management: serendipity or discipline?

1.10.1 Innovation management capacity

The capacity to co-develop various dimensions, i.e. in practical terms, a certain number of corporate "policies" can be considered in different ways; for instance as a generic managerial capacity of coordination between the two opposite goals of organisation stability – routines, clear division of labour, etc., that is the closure instance – and the necessity of opening the organisation – searching for alternative ways, overlapping of competencies, etc. In this paper this capacity has seen as innovation oriented; it implies that the generic managerial capacity should become very specific and focused**: to develop and maintain an adequate and suitable innovative potential to be on the edge, in the specific field of the firm, of the competitive advantage**.

The first conceptual problem to be tackled is how to define the **creation** of innovation in a firm. On this topic there are many different schools; these different schools can be roughly divided into two main winds.

1.10.2 The triple helix model

The first one is convinced that "innovation itself remains unpredictable, non calculable, indistinct and fuzzy"[56]. The accent in this case is on the fact that there is not an assumed ideal model of innovation and so there is an endless transition from one state to another – in a way very alike to the triple helix model, and not a defined journey. In this approach the results of innovation are arbitrary while the process to produce it is considered stable and based on a specific set of rules that are more or less based on social systems based on "managerial belief systems" on which people must agree in order to have real effects. In the actual world there are many competing "belief systems", each one with its own specific rationality so the results, as the outcome of the intersection of these competing rationalities, are normally sub-optimal, unpredictable and leading to many unintended consequences. The overall argument leads to the side of the single firm, to something alike to what in VIVA is the concept of a conducive organisation, and in general to the social network theory of innovation, i.e. the impossibility to isolate the innovation process of a firm from its broader social context. In other words is it possible to design social systems that are supportive of innovation but the outcomes are unpredictable because of the structural interplay of different actors with

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56 Pohlmann, M.; Gebhardt, C. & Etzkowitz, H. – The development of innovation systems and the art of innovation management – Strategy, control and the culture of innovation- Technology Analysis & Strategica Management – VO. 17, No 1, 1-7, March 2005.

different strategies and rationalities simultaneously at play. A social system in itself is not a mere organisational blueprint, but the creation, development and maintenance of a specific culture supporting collective frames, which structure an accepted collective space for action. Summing up, in this perspective, innovation management is "the art of coping with indefinite system properties – of producing certainty and rituals in coping with uncertainties" or "an art of communication, co-operation and 'playing the system' and "a collective art of changing the rules by playing the system.".

What seems a very key and unquestionable argument in this approach is the structural relevance of the interplay of many different actors, with different rationalities and strategies trying to shape a common course of action; no single actor can control all elements of an innovation system; the triple helix model is a way to represent it. In cultural terms this approach stresses the complexity of the system and the impossibility to manage a corporate base innovation process as an independent process.

1.10.3 Innovation management as a discipline

On the other side there are the supporters of innovation management as a corporate discipline that is not based on a random or hit-and-miss approach but designed to reach a unique opportunity. In cultural terms this approach stresses the possibility to reduce complexity, not to dismiss it, selecting what is functional to the specific target – innovation – not only inside the firm but in the broader social context; all things considered the complexity of the system will introduce unintended consequences and these problems will be afforded through the traditional managerial practices. An example can illustrate the concept; in the medical sector, for instance, to have a good innovative idea is only a very small part of the product development strategy because, among other things, of the reimbursement models of the different National Health Systems; the model can be an incentive or disincentive to innovations depending on the kind of philosophy it is pursuing: cost reduction or effectiveness of the devices for patients? In this case to reduce the complexity of the interaction cannot be restricted to the firm but should consider the broader context; what cannot be easily managed is the uncertainty of the evolution in the mid term of the national health systems in Europe.

1.10.4 An integrated approach

These two approaches are not necessarily conflicting each other; this means that if innovation management is to become a realistic discipline, it should include complexity in some way. How? Designing alternative scenarios,

accurately gauging the degree of probability of each scenario, describing in a realistic way other actor's strategies affecting the final outcome, introducing feedback mechanisms in the governance system and setting up, to the extent that it is possible, inclusive strategies and decision making procedures to include, from the very beginning, demands and objections coming from other non-competing actors. This is a mix of social and technical steps, of qualitative and quantitative tools and indicators; in this perspective the technical and scientific rigour of a discipline lies in the method and tools.

We have collected many different tools and described in this paper a general method of identifying the main building blocks to attain to excellence in innovation and to build up a suitable innovation management system. We are also aware that other EU backed project, such as IMP^{3}rove are dealing with innovation management, namely for SMEs.

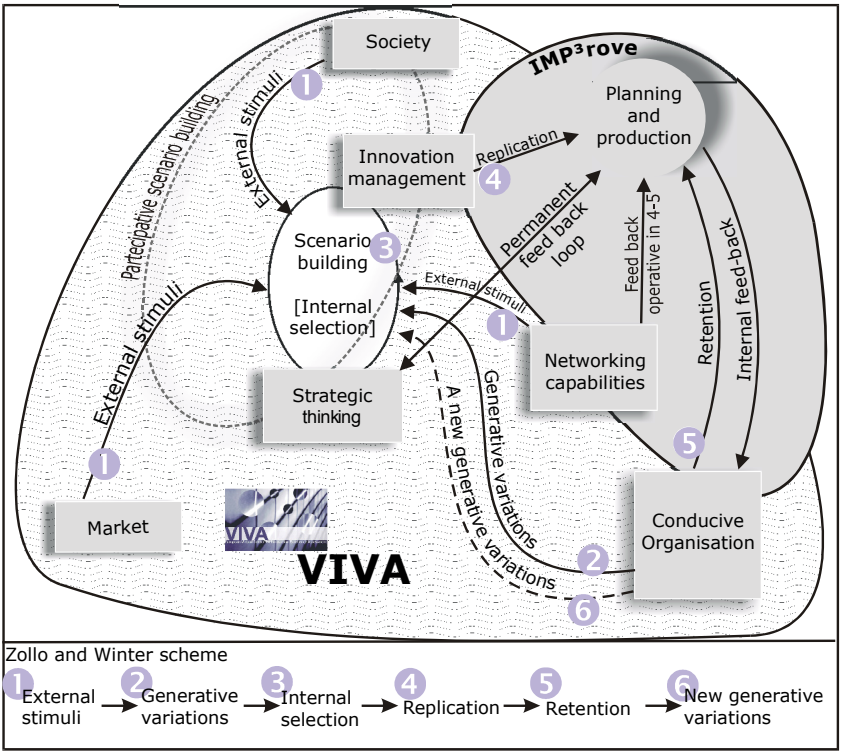
So what we are designing is the way to manage this complex system of interrelations.

1.11 A general framework

The following figure is summarising the general framework, there is a reference to the IMP^{3}rove project that is a project launched by the European Commission with the aim of effectively improving innovation and competitiveness in small and medium enterprises (SME) in Europe.[57]

[57] The main focus of IMP3rove is a new online platform, which can be used by companies from five to several hundred employees to review their innovation processes by means of a web-based questionnaire and compare themselves with the best in their industry in Europe. This is an important prerequisite for the reduction of development time for new products as well as the "time to profit". In the test phase, SMEs can receive a free consultation interview. The leading consortium members are A.T. Kearney and the Fraunhofer-Gesellschaft. The new platform is now available at: https://www.improve-innovation.eu/opencms/opencms/en/index.html.

Figure 10: Zollo and Winter Scheme



This can be also translated into steps.

The system of innovation management oriented to excellence in innovation should be based on methods to support strategic thinking based on the concept of open innovation; we are suggesting, among other possibilities, to utilise **scenario building** techniques, both in the simplified version of an internal exercise or in the sophisticated version of a participative scenario building, including consumers and/or clients and/or representatives of the civil society.

Strategic thinking should also include **methods to capture market stimuli** in a systematic way.

The system of innovation management oriented to excellence in innovation should be also able to transform the strategic visions into a realistic planning and production reality. This side of the innovation management is very critical for many SMEs, starting from the phase of a realistic assessment of

the economic viability of a perceived strategic innovation possibility. A reference model for this is under way in the IMP^{3}rove project and it is planned to be operative some months after the end of VIVA project, so we rely on it for this part.

A system of innovation management should also be able to guide SMEs through the structural transformation necessary to make the system sustainable on the medium and long run. The building blocks of **networking capabilities** and of the creation of a **conducive organisation –** including moreover very specific organisational issues, knowledge and competence management, human factor management, ergonomic factors – are the main contribution of VIVA to help mainly SMEs, but also bigger organisations, in a process of self assessment and identification of where to invest and to change.

Networking capabilities are very critical for the strategic phase, too. The concept of open innovation leads to the idea that innovation can be and in the future must be the results of a structured co-operation among different firms in a trans-sectional scheme crossing traditional industries borders.

This innovation management system is strongly dependent on a reliable and robust system of feedbacks.

1.12 SMEs

The general framework and each of the components are based on the existence of corporate functions that are easily available in medium and big firms but very difficult for SMEs and quite impossible to find in very small ones.

So the problem for these kinds of firms is how to reach excellence in innovation coping with severe limitations in creating new specific corporate functions. The problem can be split into two parts; on the one hand a specific change should be organised inside the firm; on the other publicly available institutions can support a part of the innovation process.

What can be done only inside is the part covered by IMP^{3}rove and the transformation of the organisation in a conducive kind of organisation; a role of innovation management consultancies (IMCs) such as the one devised in IMP^{3}rove.

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III The current state of innovation management and innovation culture in Europe - Evidence from the VIVA empirical study

Andrea Bardi, Peter Butala, Paolo Franceschini, Anna Giarandoni

1 Introduction

This contribution aims to assess the state of the art of innovation management and innovation culture in Europe. The VIVA partners worked out a set of check-lists that were submitted to a sample of 108 companies located in Europe. For the concept of innovation, in line with the VIVA theoretical framework, we decided to select a holistic perspective, as described in the figure below. On the one hand, we chose a broad spectrum of CSFs (Critical Success Factors) for innovations (hard, soft and intangible), and on the other, we considered a variety of levels at which innovations usually act/impact (company level, transactional level, and contextual level).

Figure 11: The holistic perspective of innovation

	Company level	**Transactional aspects**	**Contextual aspects**
Hard	Infrastructure	Labs Logistics Technology	Legislation General infrastructure
Soft	Organization Managerial tools	ICT Services Clustering Supply chain	Research system Educational system Industrial relation Financial system (venture capitalists, private equity)
Intangible	Values Beliefs Behaviours Attitudes Customers	Knowledge system (Know why, how, when) Industrial atmosphere	Work culture Intercultural dynamics

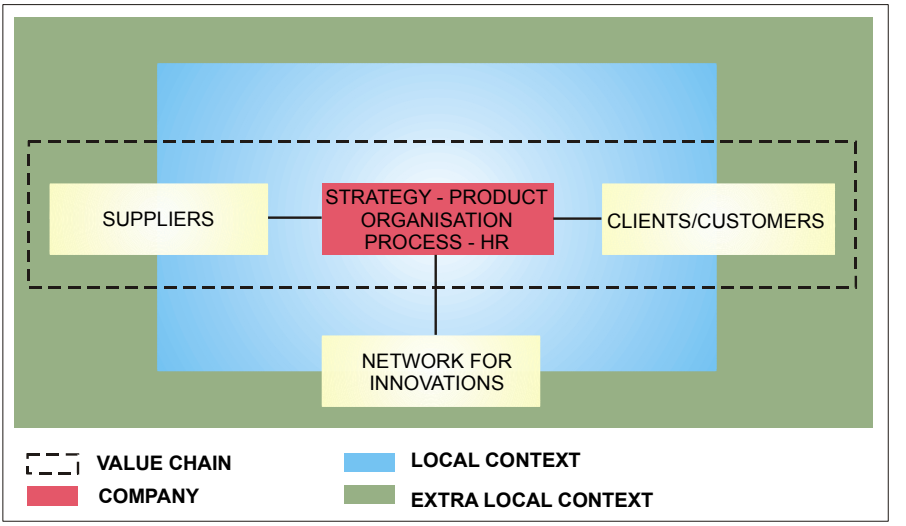
Furthermore, the theoretical approach was based on the idea of innovation as a non-linear process[58]. This implies understanding that innovation drivers and impacts have to be considered, as well as social issues.

[58] The *theoretical* basis of this argument is the linear model of innovation, the assumption that research and development is the starting point of any kind of innovation and that scientifically generated

From this perspective, we selected a qualitative method based on a set of check-lists, which were submitted to managers and researchers in industry.

The first check-list aims to assess the role of the context (geographical area) in which the interviewed company is located. The second is related to the company innovation system. It analyses the innovation approach both at the company level, evaluating strategy, product, organisation, process and human resources (HR), and at the value chain level (clients, suppliers). This method also surveys the contribution provided by the network for innovation that includes universities; institutions of applied research, scientific and technological parks, etc.; plus business associations, public institutions and public agencies devoted to promoting economic development (Chambers of Commerce, etc.).

Figure 12: Methodological Scheme



Finally the questionnaire aims to gather the data considered relevant to the goal of the present survey.

knowledge is a prerequisite for the development of new technologies. It is assumed that there is a clearly structured course of action, during which the knowledge of basic research is transferred, specified and utilised step-by-step via applied research, and is finally employed in the form of concrete technologies in a particular implementation context.

2 The mode of innovation

Through the VIVA research project, and thanks to the support provided by all the partners, 108 check-lists from 12 European countries were collected[59].

Because of the low number of completed check-lists from several countries, we were able to compare in detail only three out of twelve countries: Spain (28,7%), Italy (21,3%), and Germany (20,4%).

In this way, we analysed approximately 70% of the returned questionnaires, focusing mainly on the following:

- Internal coherence of innovation models,
- Role of external organisations for innovation,
- Correlation between models of innovation and context diversities (geographical area),
- Correlation between innovation capability and performance

Table 3: Number of returned questionnaires per country

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Spain	31	28,7	28,7	28,7
	Slovenia	11	10,2	10,2	38,9
	Italy	23	21,3	21,3	60,2
	Germany	22	20,4	20,4	80,6
	Austria	10	9,3	9,3	89,8
	UK	1	,9	,9	90,7
	Switzerland	5	4,6	4,6	95,4
	Czech Republic	1	,9	,9	96,3
	Hungary	1	,9	,9	97,2
	Portugal	1	,9	,9	98,1
	France	1	,9	,9	99,1
	Greece	1	,9	,9	100,0
	Total	108	100,0	100,0	

Regarding the industrial sectors, more than 70% of the companies were included in manufacturing and approximately 30% of the firms were service companies.

[59] Partners provided questionnaires not just from their own countries; for example EBN interviewed companies from the Czech Rep, Hungary, Portugal, Italy, France, and Greece.

In particular, in manufacturing the incidence of machinery and equipment was 20,4%, and for the service sector the category “other business activities”, with around 10%, was the most representative sub-sector.

In the three countries we selected, 67% of the Spanish companies questioned in the study were in the manufacturing sector, in particular more than 16% in the manufacturing of fabricated metal products except machinery, and the remaining 33% in the services sector, with other business activities at 13,3%. In Italy, 100% of the questioned companies were in the manufacturing sector, with more than 33% in the manufacturing of motor vehicles, trailers and semi trailers.

In Germany 73% of the questioned companies were in the manufacturing sector, with more than 47% in the manufacturing of machinery and equipment, and more than 21% in other business activities.

Table 4: Share of industrial sectors of the selected countries

	Country	**Spain**	**Italy**	**Germany**
		Sector	Sector	Sector
		Percentage	Percentage	Percentage
Manufacturing sectors	Manufacturing of rubber and plastic products	3,3	13,3	
	Manufacturing of other non-metallic mineral products			
	Manufacturing of basic metals and fabricated metal products	13,3	6,7	
	Manufacturing of fabricated metal products except machinery	16,7	20,0	10,5
	Manufacturing of machinery and equipment	13,3	26,7	47,4
	Manufacturing of office machinery and computers	3,3		
	Manufacturing of electrical machinery and apparatus n.e.c.	3,3		
	Manufacturing of radio, television	6,7		
	Manufacturing of medical, precision and optical instruments			5,3
	Manufacturing of motor vehicles, trailers and semi trailers		33,3	5,3
	Manufacturing of other transport equipment	3,3		
	Manufacturing n.e.c			
	Construction	3,3		5,3
Service sectors	Wholesale on a fee or contract basis			
	Wholesale and retail trade, repair of motor vehicles	3,3		
	Computer related activities	10,0		
	Research and development			5,3
	Other business activities	13,3		21,1
	Education	3,3		
	Health and social work			
	Recreational, cultural and sporting activities	3,3		
	Total	100,0	100,0	100,0

The 76 companies selected for the comparison in Italy, Spain and Germany were mainly single plant (51,5%), whereas 23,8% had a headquarter with several plants, and the remaining 24,8% were part of an alliance or group of companies.

To sum up the main points:

- The highest percentage of single plants was in Italy, followed by Spain.
- The highest percentage of headquarters with several plants was in Germany, followed by Spain and Italy.
- The highest percentage of part of an alliance or group of companies was located in Italy, followed by Germany and Spain.

The data on turnover in 2005 was provided by only a subgroup of companies: 93 companies out of 108.

Spanish companies had an average turnover of 30 Mil. Euros in 2005. The low value of the standard deviation indicator proves that the sample was homogeneous.

Italian companies had an average turnover of 84 Mil. Euros in 2005 with a high standard deviation indicator, though lower than German companies.

German companies had an average turnover in 2005 of 306 Mil. Euros with the highest standard deviation indicator, proving the lack of homogenity in the sample.

More than 64% of the companies were micro companies (15%) and small companies (48,9%).

Approximately 20% were big companies, and their turnover was over 100 Mil. Euros.

The remaining 16% were small-medium companies (8,7%), medium companies (4,3%) and medium-big companies (2,2%).

Table 5: Companies by size (class of turnover in millions of Euro) in 2005

		N°	Percentage	Valid percentage	Accumulated percentage
Valid	< 1 Mil micro company	14	13	15,2	15,2
	1-25 Mil small company	45	41,7	48,9	64,1
	25-50 Mil small-medium company	8	7,4	8,7	72,8
	50-75 Mil medium company	4	3,7	4,3	77,2
	75-100 Mil medium-big company	2	1,9	2,2	79,3
	> 100 Mil big company	19	17,6	20,7	100
	Total	92	85,2	100	
Miss	Miss	16	14,8		
Total		108	100		

For the number of employees taking the full sample into consideration, in 2003 more than 53% of the 108 interviewed companies (83 companies/102 companies) had less than 100 employees.

23% of the companies employed between 100 and 500 employees. Only 24% had more than 500 employees, and 14% were companies with more than 1000 employees.

In 2005, more than 57% of the companies (92 out of 102) had less than 100 employees.

23% of the companies interviewed employed between 100 and 500 employees. Only 18,5% had more than 500 employees and 12% were companies with more than 1000 employees.

More than 60% of the companies declared that the number of employees would increase in the next few years. More than 35% declared that the number would stay the same, and only 3,8% stated that the number of employees would decrease.

On the other hand, the trend between 2003 and 2005 confirmed that interviewed companies seem to be facing a process of fragmentation. This emerged most clearly in Spain.

The table below shows the companies in 2005 grouped according to turnover class and country.

- More than 74% of the Spanish companies were small companies with a turnover class of 1-25 Mil. Euros.
- Around 11 % were micro companies with a turnover lower than 1 Mil. Euros. The remaining 15% were small-medium companies (7,4%), medium-big companies (3,7%) and finally big companies (3,7%).
- The biggest group of Italian companies, approximately 30%, were small companies, 25% were small-medium and 20% were big. In this sense, the Italian sample was homogeneously distributed.
- For Germany, more than 70% of the companies were big, 17,6% were small, and the remaining 11,8% were equally divided into micro and medium companies.

Table 6: Companies by size (class of turnover in millions of Euro) for selected countries in 2005

	Spain		Italy		Germany	
	Turnover 2005		Turnover 2005		Turnover 2005	
	N°	%	N°	%	N°	%
< 1 Mil micro company	3	11,10	2	10,00	1	5,90
1-25Mil small Company	20	74,10	6	30,00	3	17,60
25-50 Mil small-medium company	2	7,40	5	25,00		
50-75Mil medium company			3	15,00	1	5,90
75-100 Mil medium-big company	1	3,70				
>100 Mil big company	1	3,70	4	20,00	12	70,60
Total	27	100	20	100	17	100

Analysing the share of the turnover for family products we can affirm that companies differentiated their production or their services. More than 44%

of companies had less than 50% of the turnover assigned to mainly family products.

Regarding the company products, most products of family I were custom-made products/services, most products of family II were products/services with variations like family III.

Table 7: Turnover for family products

	Turnover family I	Turnover family II	Turnover family III
	Percentage	Percentage	Percentage
0-25%	11,4	58,0	81,4
25-50%	34,1	36,4	16,3
50-75%	25,0	5,7	2,3
75-100%	29,5		
Total	100,0	100,0	100,0

Table 8 shows how often a product, process or organisational innovation occurs in the companies.

- More than 55% of companies declared they innovate their products annually, more than 20% declared they innovate their products every 2 years, and 14,6% declared they innovate their products every 3 to 10 years.
- More than 35% declared they innovate their process annually, more than 36% declared they innovate their process every 2 years, and 28,6% declared they innovate their products every 3 to 10 years.
- More than 33% declared they innovate their organisational structure annually, more than 27% declared they innovate their organisational structure every 2 years, 39,1% declared they innovate their organisational structure every 3 to 10 years.

Table 8: Frequency of innovation

	Product	Process	Organisational
	Percentage	Percentage	Percentage
Annually	58,9	35,2	33,3
Every 2 years	24,4	36,3	27,6
From 3 to 5 years	12,2	24,2	29,9
From 5 to 10 years	4,4	4,4	9,2
Total	100,0	100,0	100,0

The main conclusion that emerged was that organisational innovation is definitely not a priority for the interviewed companies. Furthermore, some interesting findings emerged quite clearly analysing annual investment in terms of percentage for functional area from 2003 to 2005.

The questionnaire asked for the distribution of overall investments in terms of percentage according to the functional area indicated (R&D, I&C technologies, machinery/equipment, training, logistics, other)

To analyse the trend of investments, we calculated the growth rate of investment for functional area, for country and for turnover class.

- In Spain, investment in R&D decreased in the medium-big companies and increased in the small companies, and to a lesser extent in the micro companies. Investment in I&C technologies remained at the same level for the micro and small companies, but there was an increase in investment in medium-big companies. A big increase in investment in machinery/ equipment for the micro companies can be seen, whereas this was substantially unchanged for small and medium-big companies. An increase can also be seen for investment in logistics in the micro companies; however there was a decrease for small companies.
- In Italy, there was a big increase of investments in R&D in the small companies, to a lesser extend in big companies, as well as a decrease in the small to medium companies. Generally, investment in I&C technologies decreased in the small and medium-small companies, but remained unchanged in the big companies. Moreover, there was a big increase of investments in machinery/equipment in the medium-small companies and a decrease in both small and big companies, as well as a big

increase of investment in logistics in the micro companies and a significant decrease in the small companies.

- In Germany, there was an increase of investments in R&D in the small companies and to a lesser extend in big companies, but unchanged investment in the medium big companies. Investment in I&C technologies decreased in small companies, remained unchanged in the medium-big companies, and increased in the big companies. A big increase of investments in machinery/equipment in the small companies and a decrease in the big companies, as well as unchanged investments in the medium-big companies, can be seen. On the whole there was an unchanged level of investments in training for the small and medium-big companies, and an increase in the big companies, as well as a decrease of investment in logistics in big companies.

Table 9: Growth rate of investment for functional area (2003-2005)

Country	Turnover 2003	R&D	I&C techno-logies	Machinery/ equipment	Training	Logistics	Other
Spain	< 1 Mil	,05	,00	,22	-,26	,25	-1,00
	1-25Mil	,11	,00	,04	-,04	-,16	-
	75-100 Mil	-,14	,11	,00	,33	-	-
Italy	1-25Mil	1,33	-,06	-,39			-,70
	25-50 Mil	-,17	-,16	1,10	-,25		
	> 100 Mil	,11	,00	-,09		,66	,05
Germany	1-25Mil	,40	-,75	2,00	,00		
	75-100 Mil	,00	,00	,00	,00		
	> 100 Mil	,25	,25	-,18	,29	-,26	
Total	< 1 Mil	,01	,00	,09	-,16	,21	-,50
	1-25Mil	,28	-,07	,12	,04	,23	-,24
	25-50 Mil	,13	,17	,38	-,16	,50	-,02
	75-100 Mil	-,07	,05	,00	,16		
	> 100 Mil	,12	,16	-,24	,19	,30	,05
	Total	,18	-,00	,09	,00	,26	-,19

To sum up the main findings:

- There were quite evident similarities in the investment trend for Germany and Italy
- There was an increase in investments in R&D due to an increase of investment in small and big companies
- There was an unchanged level of investment in ICT though investment decreased in the small and medium-small companies.
- There was increased investment in machinery/equipment due to a noticeable increase of investment of the medium and small companies. The level of investments in training appeared stable: but there was a decrease for the smallest companies and an increase for the biggest companies.

The main conclusion seems to confirm that the equation small size equals less attention to R&D investment is mistaken.

3 Environmental factors for the success of the company

It was assumed that environmental factors are key factors for the competitiveness of companies.

We thus evaluated 6 “external” factors which we consider relevant for companies competitiveness.

These factors were:

- The competitiveness of local industry
- The quality of labour market
- The quality of the educational system[60]
- The quality of the governance system[61]
- The strength of the community[62]
- The effectiveness and efficiency of the infrastructure

Each thematic area included a variable number of qualitative indicators (max-7-min-3) to assess the context in which the companies were located. The self-assessment answers were ranked from 1 to 5.

Because of the low number of questionnaires per country, only comparison between Italy, Spain and Germany made sense.

[60] Excellence of educational system implies: high rate of education; presence of vocational training centres; presence of management or qualified business schools; presence of research centres and universities of national and international importance.

[61] Excellence of governance system implies: presence of entrepreneurial associations who represent the production networks; strong tradition of industrial relations; presence of banking and financial services oriented to SMEs' development; on-going relationship between local government and private companies; presence of local government oriented towards the economic development of the region; strong public and private institutional systems providing concrete support to industrial innovation as a central feature of company competences.

[62] Excellence of the local community implies: presence of network of public and private services for the community nursery schools, etc…); firmly established structures, activities and initiatives of a cultural kind (associations, theatres, etc.); presence of support services to foster integration of immigrant communities into the local society, etc.

Taking into account the average value for each thematic area:

- No country showed an "excellence" position in any thematic area (assessment >4)
- Germany and Spain occupied a leading position in 3 thematic areas (yellow)
- Italy occupied the worst position in 3 thematic areas (infrastructure, community and education)
- For "Industry" Germany led, followed by Spain.
- For "Workforce" Germany led, followed by Italy. Spain came last, with a "critical" assessment.
- For "Education" Spain led, followed by Germany.
- For "Governance" Spain came first.
- For "Community" Germany led followed by Spain.
- For "Infrastructure" Spain led, followed by Germany. Italy was given a "critical" assessment.

Table 10: External factor assessment

Country	Total Industry	Total Work-force	Total Education	Total Gover-nance	Total Commu-nity	Total Infra-structure
Spain	3,22	2,71	3,94	3,95	3,44	3,79
Slovenia	2,95	2,71	2,82	2,64	3,06	3,36
Italy	3,47	3,46	3,41	3,40	3,28	2,57
Germany	3,89	3,60	3,76	3,38	3,53	3,45
Austria	3,29	3,06	3,48	4,47	2,33	3,50
UK	3,43	3,80	5,00	2,83	3,33	2,00
Switzer-land	3,97	4,56	4,85	3,37	3,73	5,00
Czech Republic	3,00	2,80	4,25	3,50	4,00	3,50
Hungary	3,57	3,00	2,75	2,33	2,00	3,00
Portugal	3,14	3,00	2,50	2,50	2,67	4,00
France	2,86	4,20	4,25	4,33	3,33	5,00
Greece	2,43	2,20	4,25	2,17	3,67	2,50
Total	3,41	3,19	3,67	3,55	3,28	3,42

From the table above, the three countries seem to present significant differences in terms of the role played by context.

Table 11: Analysing the internal positioning of the various countries:

Environmental strong thematic area for country	Environmental weakness thematic area for country
Spain: Governance, Education	Spain: Workforce
Italy: Industry, Workforce	Italy: Infrastructure.
Germany: Industry, Workforce	Germany: Governance

The six environmental factors are grouped into two new macro thematic areas:

- Solidity (hardness) of industrial system (Industry + Workforce),
- Institutional and infrastructural system (Education+ Governance+ Community+ Infrastructure)

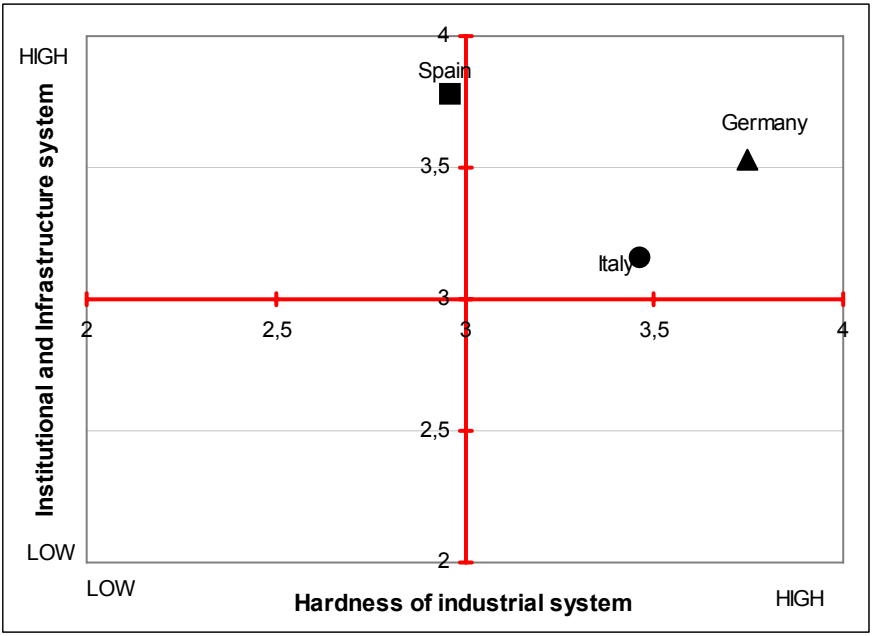
The pattern below shows the following scenario, dividing the countries into two groups:

Germany and Italy, although with lower values, base their environmental factors for the success of companies on the robustness of their industrial system.

- The Mechanical sector in Emilia-Romagna Region (Italy) is a clear example of these factors.
- Industry: most large companies play a pivotal role in driving the competitiveness evolution of their subcontractors. In this sector, inter-enterprise relationships are nowadays a *defacto* standard: competing through the right network then becomes a strategic asset.
- Workforce: in the presence of companies with long tradition the mechanics sector also draws strength from the existence in the territory of a **network of technical schools**, often working in close contact with businesses, which have contributed to improving skills and technological updating through the training of young qualified technicians.

Spain bases its environmental factors for the success of companies on its institutional system and infrastructure.

Figure 13: Industry-infrastructure Matrix



4 Companies innovation patterns

The company checklists defined 8 thematic areas of primary importance for the innovation strategies of each company:

- Strategy of innovation
- Organisational structure for innovation[63],
- Innovation process,
- Product innovation,
- Value chain,
- Network for innovation,
- Human resources & competence for innovation
- Competition[64]

[63] The thematic area of organisational structure for innovation describes four organisational models to manage innovation in the organisational structure of the company, so in the analysis that follows we will be considering it as a descriptive variable.

The questionnaire asked for an assessment of the importance of each item for the company (on a scale from 1 to 5), as well as a self-assessment.

By analysing the level of importance of the thematic areas for each country we can affirm that:

SPAIN

- Spanish companies consider strategy to be of the highest importance, higher than the average of the 12 countries; this is followed by human resources and innovation process.
- Medium importance is attached to value chain and network for innovation
- Product innovation comes last, though a little bit higher than the average result of the 12 countries.

ITALY

- Italian companies consider innovation process the most important issue for innovation at company level, followed by strategy.
- Medium importance is given to value chain, followed by human resources.
- Product innovation comes last, is the furthest from the average of the 12 countries.

GERMANY

- German companies consider strategy to be of the highest importance.
- Medium importance given to the innovation process, followed by value chain, human Resources and network for innovation. There are very slight differences between the innovation process, value chain and human research, which means that companies have no clear priorities here.
- Product innovation is given the lowest priority.

[64] We have inserted the thematic area Competition in Product innovation as they are so closely related .

Table 12: Thematic area importance

Country	Strategy Importance	Innovation process importance	Product Innovation importance	Value chain Importance	Network importance	Human resources importance
Spain	4,20	4,13	3,55	3,6	3,83	4,18
Italy	3,81	3,83	2,91	3,5	2,95	3,45
Germany	4,17	3,86	3,28	3,84	3,45	3,81
Total	4,19	4,0	3,42	3,77	3,54	3,89

The total concerns 12 countries

By analysing the level of importance for each thematic area among the three countries we have reclassified the results in terms of levels: high, medium and low:

- 2 out of 3 countries attached great importance to strategy, in line with the total average of the 12 countries; the other country attached medium importance to it.
- One country attached great importance to the innovation process, in line with the total average of 12 countries, and 2 out of 3 countries attached medium importance to it.
- 2 out of 3 countries attached medium importance to product innovation, in line with the total average of 12 countries, and one attached low importance to it.
- All of the countries attached medium importance to the value chain in line with the total average of 12 countries.
- 2 out of 3 countries gave medium importance to network for innovation, in line with the total average of 12 countries, and one gave low importance to it.
- 2 out of 3 countries attached medium importance to network for innovation, in line with the total average of 12 countries, and one attached great importance to it.

Table 13: Thematic area importance

Country	Strategy impor-tance	Inno-vation process impor-tance	Product inno-vation Impor-tance	Value chain Impor-tance	Network impor-tance	Human resources impor-tance
Spain	High	High	Medium	Medium	Medium	High
Italy	Medium	Medium	Low	Medium	Low	Medium
Germany	High	Medium	Medium	Medium	Medium	Medium
Total	High	High	Medium	Medium	Medium	Medium

The total concerns 12 countries

By analysing the level of self-assessment for countries we can affirm that:

- Spain has the highest level of self-assessment on strategy. Medium assessment is allotted by the companies to the value chain, followed by human resources, innovation process and network for innovation.
- Spain has the lowest self-assessment on product innovation furthest distance from the average of 12 countries. Italy has the highest level of self-assessment on strategy. Medium assessment is allotted by the companies to the innovation process.
- Spain has the lowest self-assessment on product innovation. Value chain, human resources and network for innovation are given a lower assessment than the other countries.
- Germany has the highest level of self-assessment on strategy. Medium assessment is given by the companies to: innovation process, value chain, network for innovation and human resources.
- Germany has the lowest self-assessment on product innovation but this result is higher than the average of the 12 countries

Table 14: Thematic area self-assessment

Country	Strategy claim.	Inno-vation process claim	Product innovation claim	Value chain claim	Network claim	Human resources claim
Spain	3,08	2,87	2,36	3,07	2,63	2,98
Italy	3,23	3,12	2,51	2,98	2,34	2,77
Germany	3,62	3,05	3,00	3,39	3,16	3,13
Total	3,43	3,05	2,84	3,77	3,54	3,07

The total concerns 12 countries

By analysing the level of self-assessment for each thematic area among the three countries we have reclassified the results in terms of levels: high, medium and low:

- None of the countries earned an "excellence" assessment in any thematic area.
- All the countries had a medium assessment in strategy.
- 2 out of 3 countries revealed a medium level of self-assessment in the innovation process, in line with the average result of 12 countries, and one country had a low self-assessment.
- 2 out of 3 countries revealed a low level of self-assessment in product innovation, in line with the average result of 12 countries, and one had a medium self-assessment.
- 2 out of 3 countries revealed a medium level of self-assessment for the value chain thematic area, in line with the average result of 12 countries, and one had a low self-assessment.
- 2 out of 3 countries revealed a low level of self-assessment in network for innovation, below the average result of 12 countries, and one had a medium self-assessment.
- 2 out of 3 countries revealed a low level of self-assessment in human resources, below the average result of 12 countries, and one had a medium self-assessment.

Table 15: Thematic area, self-assessment

Country	Strategy claim	Innovation process claim	Product innovation claim	Value chain claim	Network claim	Human resources claim
Spain	Medium	Low	Low	Medium	Low	Low
Italy	Medium	Medium	Low	Low	Low	Low
Germany	Medium	Medium	Medium	Medium	Medium	Medium
Total	Medium	Medium	Low	Medium	Medium	Medium

The total concerns 12 countries

By analysing the gap between assessment of importance and companies' self-assessment we can hypothesize where companies could invest their resources to boost innovation.

We evaluated the gap according to the following scheme:

Importance	Self assessment	Gap
High	Medium	Improvable
High	Low	Priority
Medium	Low	Not strategic
Medium/Low	High	Over-investment
High	High	Coherence- Excellence in Innovation
Medium	Medium	Coherence- Intermediate position in innovation
Low	Low	Coherence-in Critical position

Description

Importance	Self assessment	Gap
High	Medium	High importance and gap not too big to be closed
High	Low	High importance should be a priority but the gap seems too big.
Medium	Low	Not such a strategic area to invest in.
Medium/Low	High	Not so important as an item, but very good positioning in terms of assessment. It is an area in which the companies spend too much time and money! (over investment)
High	High	Coherent and excellent positioning in innovation (no need to move from this situation)
Medium	Medium	Coherent and intermediate positioning in innovation (need to move from this position but low chance to change)
Low	Low	Coherent but critical positioning in innovation (urgent change needed, but low real chance for it.)

None of the countries revealed a thematic area corresponding to "excellence in innovation"

- None of the countries revealed a thematic area "over investment in innovation"
- Spain revealed three priorities: innovation process and human resources and competence for innovation. However, the great size of the gap would suggest that companies could need additional resources (internal and external) to help them to define their innovation policy investments.
- Italy and Germany do not attach priority to their investments in innovation.
- Spain and Germany do not revealed a critical position in innovation, whereas Italy revealed two critical positions in thematic areas not considered very important.
- The scheme shows the difficulty of German companies to differentiate their innovation strategy.
- Italy looked very static, with no thematic area where the gap may narrow in the near future. Specific investments should mobilise resources to define priority (an important thematic area) but at the same time mobilising internal and external resources to boost innovation.

Table 16: Gap Analysis – Thematic area and selected countries

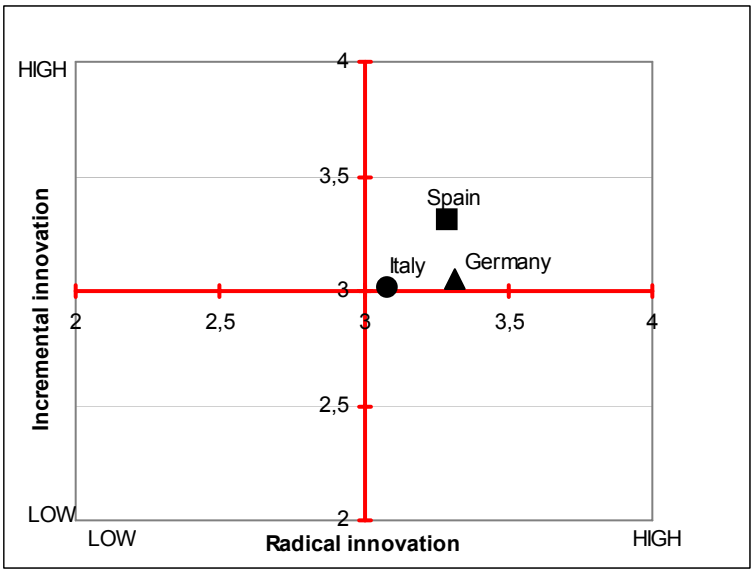
Country	Strategy gap	Innovation process gap	Product innovation gap	Value chain gap	Network for innovation gap	Human Resources and competence for innovation gap
Spain	Improv-able	Priority	Not strategic	Coherence Interme-diate position in innovation	Not strategic	Priority
Italy	Coherence Interme-diate position in innovation	Coherence Interme-diate position in innovation	Coherence in a critical position	Not strategic	Coherence in critical position	Not strategic
Germany	Improv-able	Coherence Interme-diate position in innovation	Coherence Interme-diate position in innovation	Coherence Interme-diate position in innovation	Coherence Interme-diate position in innovation	Coherence Interme-diate position in innovation

We have selected some qualitative indicators from a cross the various thematic areas and grouped them together to underline additional information about companies' innovation profile.

As for the innovation mode, countries seems to diverge in terms of the intensity of radical innovation and incremental innovation

- Germany shows the greatest propensity towards radical innovation, with a medium position towards incremental innovation.
- Spain shows the greatest propensity towards incremental innovation, with a medium position, almost like Germany's, towards radical innovation
- Italy shows the least propensity towards radical innovation and with a medium propensity to incremental innovation.

Figure 14: Incremental-Radical Innovation Matrix

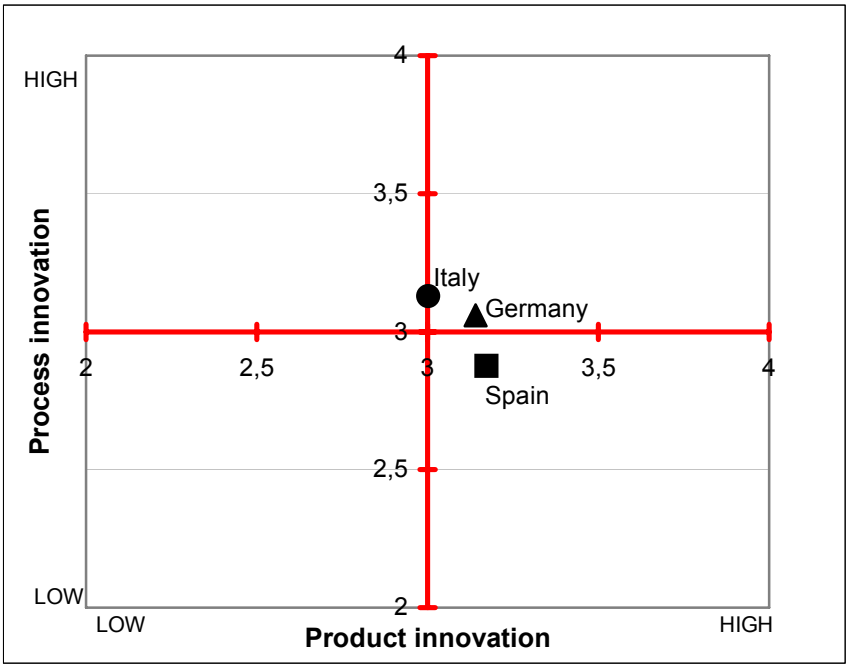


Concerning the kind of innovation, the three countries seem to be not so distant from each other.

Spain comes first in product innovation and last in process innovation. Italy is in exactly the opposite situation.

Germany is in the middle for both.

Figure 15: Product-Process innovation Matrix



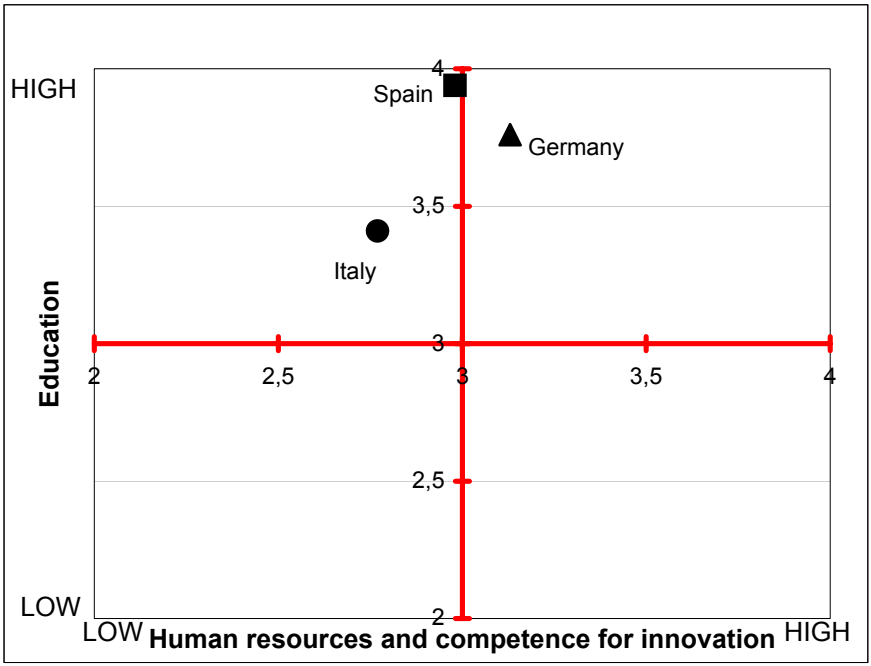
We have connected an environmental factor (education) to qualitative indicators for human resources and competence for innovation.

The scheme shows that Spain comes first in human resources, with a medium level in education.

Germany shows a medium-high level in education but comes first in human resources and competence for innovation.

Italy comes last in both.

Figure 16: Education System-Competence for innovation Matrix

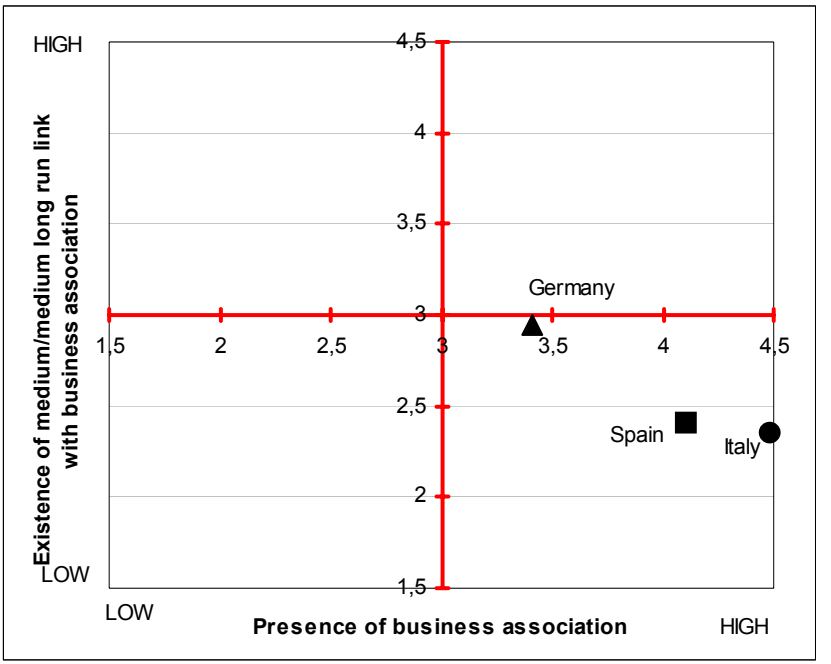


We have connected the environmental factor of the governance (e.g. presence of entrepreneurial associations) with qualitative indicators for network of innovation (e.g. the existence of medium or medium-long term links with associations).

The scheme shows that Italy has the highest level of entrepreneurial associations but the lowest level of medium or medium-long term links with associations. Even though industrial associations are widespread all over the country, only *vertical* associations can be identified as strategic actors (in terms of innovation initiators) for associated companies.

The same trend is confirmed in Spain but to a different extent. Germany shows a medium presence of associations, but the highest level of medium or medium long-terms links with associations.

Figure 17: Presence-link with business association Matrix

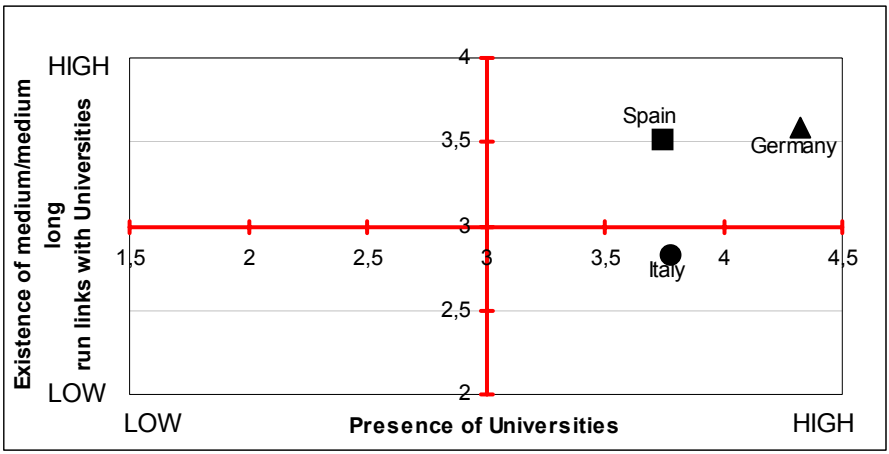


We have also connected the environmental factor of the education the presence of universities, with qualitative indicators of the network for innovation, and the existence of medium or medium-long term links with universities.

The scheme shows that Germany has the highest level of presence of universities with highest level of medium or medium-long term links with Universities. Spain has a high level of presence of Universities and a high level of medium or medium-long term links with Universities.

Italy has a similar level to Spain in the presence of universities, but the lowest level of existence of medium or medium-long term links with universities. This factor determines an endemic weakness of research-industry strategy in Italy. The causes can be identified in difficulties over building lasting and reliable partnerships between companies and universities.

Figure 18: Presence-link with Universities Matrix

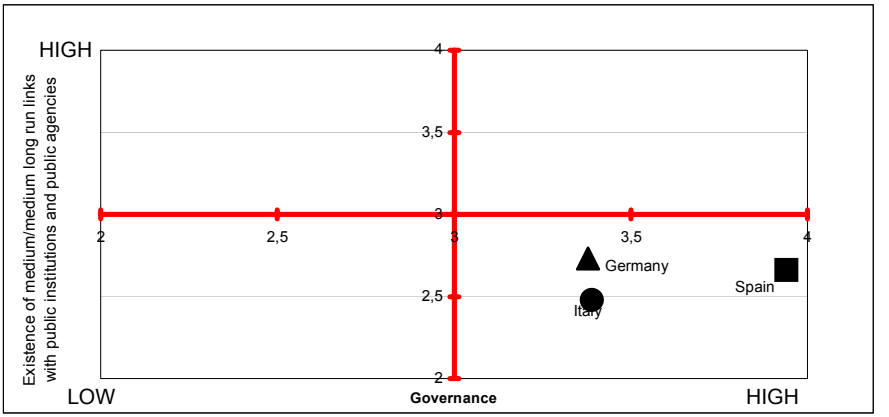


We have finally connected an environmental factor (governance), with qualitative indicators of network for innovation, the existence of medium or medium-long term links with institutions and public agencies.

The scheme shows that Spain has the highest level of governance but only a medium-low level of the qualitative indicator of network for innovation. Germany has the highest level of presence of public institutions and public agencies but it is a medium-low level, and in addition it has a medium-high level of governance.

Italy has the same medium-low level as Germany in the presence of public institutions and public agencies, but the lowest level of governance. However, local governance can act as a strong innovation enabler when focusing on specific themes. The Innovation Programme of Emilia Romagna region helped reach excellent results in terms of the creation of new collaboration and partnership opportunities at local level (i.e. NetLabs, networked laboratories).

Figure 19: Governance system-link with public institution and public agencies for innovation



5 Evidence from case studies

Additional research carried out by the VIVA partners was based on the case study method.

Each VIVA partner constructed a case study based on the story telling approach, focusing on **four Special Interest Groups** (SIGs) in relation to innovation issues (SIG 1: Management of Innovation; SIG 2: Innovation Culture; SIG 3: Assessment of Innovation excellence; SIG 4: Innovation in Clusters).

All cases were selected by the VIVA partners on the basis that the cases represented best practices or at least positive experiences over introducing innovation at company as well as cluster or sector level.

Obviously there is no single recipe for innovation, but a variety of positive ingredients, as well as some features that should be considered to boost innovation at company/cluster/sector level emerges quite clearly.

The analyses of the case studies confirm that:

- Innovation is a non-linear process
- Innovation is a multidimensional issue as well as a dynamic phenomena
- Innovation is not necessarily a science-based R&D related process
- There isn't a one best way to introduce innovation
- The sector doesn't explain innovation capability at company level
- SMEs may be able to innovate business models as well as work organisation
- New forms of work organisation may stimulate workers to actively contribute to introducing innovation at the workplace
- A positive correlation between autonomy-responsibility and performance at company level emerges.
- An effective network for innovation requires synergies among institutions
- Cooperation with universities is not enough: the right interface, the right content, and clear objectives are required
- Being an SME doesn't necessarily mean being unable to absorb IT opportunities.
- Methods and tools implementation is not enough. Working groups, work-place lay-outs as well as IT platforms, should be designed according to company strategy having with clear aims and proper resources.
- New methods of work (collaborative innovation) should be explored early on. This is, perhaps, the most important issue for increasing the innovation rate and excellence.

6 Relationship between the VIVA survey findings and the European innovation scoreboard

European Commission (EC) started to consider the importance of innovation for the European economy with the Green Paper on Innovation in 1995 [Green Paper, 1995]. Under the Lisbon Strategy (2000) EC introduced a set of political instruments not only to boost scientific and technology

development and innovation but also to measure and assess effects of these instruments.

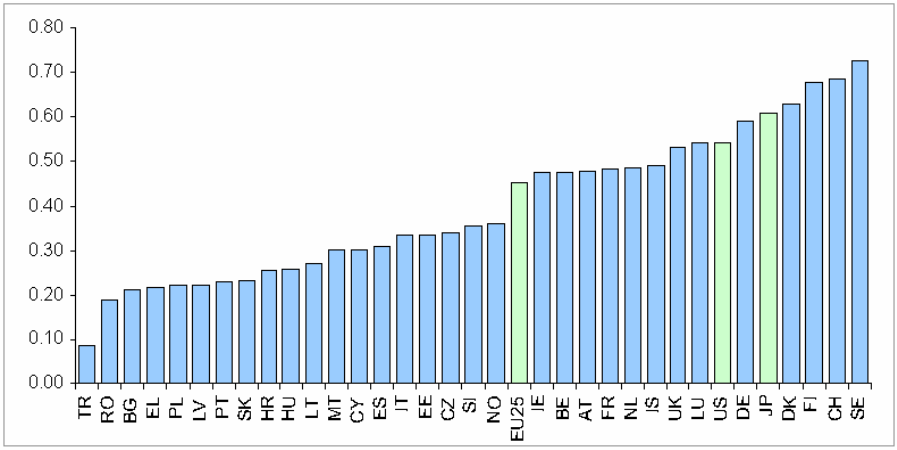
One of the well-known assessment instrument is the European Innovation Scoreboard (EIS), which aims to evaluate and compare the innovation performance of the EU Member States, as well as some other reference states.

Six EIS reports have been published till now. The EIS methodology and indicators are being permanently developed. The data are mainly collected by the EC statistical office EUROSTAT and corresponding EU national statistical offices, by the Community Innovation Survey performed in each EU country, as well as by some other sources of statistical data (OECD, etc.). The EIS 2006 indicators [EIS, 2006] are grouped in five main categories, three of them related to innovation inputs (innovation drivers, knowledge creation, innovation & entrepreneurship) and two to innovation outputs (applications, intellectual property). Each category is formed by four up to six individual indicators. Several interesting views on data and correlations among them are elaborated with the special emphasis to draw a clear picture of the gap between the EU25 performance and the main global competitors, i.e. the US and Japan. Two main conclusions can be drawn from the EIS 2006 study: (1) the countries forming the EU15 group are somehow stagnating while the new EU10 countries are dynamically catching-up, and (2) the performance gaps between the EU25 and the US as well as EU25 and Japan are decreasing.

Fig. 10 shows a ranking of the EU25 national economies, the EU25 average, the main global competitors US and Japan and some other national economies according to the overall Summary Innovation Index (SII) showing the composite innovation performance. Let us now look how the three selected countries are positioned on this ranking. Germany (DE) is in the upper category, just in between the US and Japan. Italy (IT) and Spain (ES) have neighbour positions and similar performance but are quite below the EU25 average and also behind some of the new EU10 countries, i.e. Slovenia (SI) and Czech Republic (CZ).

From the point of view of the average growth rate of SII, all three countries (all of them are from the old EU15) have slightly negative growth of innovation performance. Anyway, the EIS 2006 positions Germany among innovation leaders while Italy and Spain are in the trailing group.

Figure 20: The 2006 Summary Innovation Index (SII) [EIS, 2006]



The EIS observations give a clear factual picture about innovation performance of national economies and the aggregated EU25 economy based on the actual statistical data.

Now, how can the VIVA survey results be related to the EIS results and do they bring any new value?

Data analyses of the VIVA survey show similar patterns of innovation performance of the three selected countries, i.e. Germany, Italy and Spain, as the EIS 2006 survey but perhaps with not so evident distances. It is clear that Germany is catching the group with the outstanding innovation performance, where three Scandinavian countries are dominating (Sweden, Finland and Denmark). But Italy and Spain are far from the top performance.

It has to be mentioned that the objective of the VIVA survey is clearly related to some specific questions associated with the innovation management and innovation culture in Europe from two perspectives: (1) innovation excellence and (2) SMEs. From this point of view the VIVA survey certainly brings some interesting new evidences and thus new value. This is especially applicable for the identified gaps between the assessed importance and actual situation in companies regarding the thematic areas related to innovation (e.g. innovation strategy, product innovation). In strive for innovation excellence companies from the selected countries may recognize where to put their efforts in order to develop a coherent innovation system, which is the most important prerequisite for the innovation

excellence. And the innovation excellence should be a vision of majority of companies, also SMEs.

7 Conclusion

According to the empirical evidence all the countries involved were on average quite far from being "excellent" in innovation.

On the other hand the report questions the belief that the SMEs are not capable of investing in R&D because of structural constraints. Given the results of the survey the equation small size = less attention to R&D investment is mistaken.

As expected, companies pay more attention to product innovation. In fact more than 55% declared they innovated their products annually. On the other hand, organisational innovation appears to be less relevant for the companies. More than 33% declared they innovated their organisational structure annually, more than 27% declare they innovated their organisational structure every 2 years, and finally 39,1% declared they innovated their organisational structure every 3 to 10 years.

Even if in the self-assessment Spain and Italy turn out to be the weakest countries in innovation, Spain is able to select its priority in innovation (innovation strategy and innovation process).

This is not the same for Germany and Italy. The latter in particular turns out to be in a very risky position with both product innovation and network being critical for innovation.

Finally, Italy, with a very fragmented productive structure, is not going to profit from the potential benefit deriving from the qualification of the relationship system with both clients and supplies (value chain). Human resources and competence for innovation also highlight the differences between Spain and Italy. It is not by chance that Spain considers the qualification of human resources as a key issue for future innovation, whereas Italy does not seem to perceive investment in human resources as strategic for boosting innovation processes.

Each country seems to combine its own resources to boost innovation in its own peculiar and unique way. No "best way" for Europe emerged clearly, or in other words, there was no standardised recipe to be repeated throughout Europe to find the proper conditions to mobilise resources for innovation.

The results seem to show three different focuses on innovation in each country. Spain is mainly based on an "incremental innovation" oriented

model, Italy seems to be increasingly focused on process innovation and Germany seems to be launched on mobilising radical innovation related resources.

Main focus on innovation

	Spain	Italy	Germany
Main Focus	Incremental innovation	Process innovation	Radical innovation

In terms of the external driver for innovation, i.e. the system related resources able to sustain an effective innovation process, a much diversified approach seems to emerge quite clearly.

Spain appears able to identify both its weaknesses and strong points, being able to organise all its national resources (stakeholders, public actors, etc.) in a consistent way in accordance with selected priorities.

Germany is able to establish better effective long term cooperation with knowledge based and science based institutions e.g. Universities.

Even if Italy seems to offer Italian companies an extensive network of relations for innovation (i.e. high presence of both business associations and Universities), there are worrying limitations in terms of long-term cooperation between universities and industry. For this reason clustering is still considered the most important external driver for innovation. From this point of view, process innovation becomes improvements (and investment in them) in collaboration processes. Clustering is then a key competitive strategic factor, and competing through the right network has to be considered a key strategic factor.

External driver on innovation

	Spain	Italy	Germany
External driver	Consistent strategy promoted by stakeholder (effective governance)	Entrepreneurship and high skilled workers (cluster)	Long run link with Universities

For the case studies analysis, quite evident limitation in term of organisational innovation seems to emerge, whereas on the other hand the direct correlation between the kind of work organisation and performance in innovation is clear.

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IV Methods and tools to support the innovation framework – Tools of the VIVA toolbox

Thorsten Rogowski, Nadim Hamdan, Sarah Fried

1 Why do we need special IM methods and tools?

Today's market is changing rapidly. Advancing technologies, changing environment, changing industrial structures and strategies, evolving society, unique customer desires, competitors improving their products, processes and services, etc. lead to the necessity that companies recognise and react to these changing conditions. New methods, processes and a different and innovative way of thinking have to be learned and adapted to always be on the threshold of the future and therefore secure the competitive position.

The competitive pressure and the talk of cost reduction overshadow another possibility to stay competitive and to skim the economic potential. In the last years many companies focussed on rationalising which on the one hand improved the productivity but on the other hand led to a cutback of many jobs. Yet, innovations and managing of innovation processes are a better possibility, socially and economically, to optimise costs and to acquire new business and to secure and, more importantly, to create new jobs. 99,8 percent of European companies are small and middle-sized. 66 percent of all jobs are positioned in the companies and a 65 percent of the entire turnover in the EU is generated there (Hanke, 1996a and 1996b). This emphasises that SMEs are the cradle of securing the competitive position of Europe. Inadequate innovation efficiency would have negative economic results. Therefore companies require an organised innovation management.

Today, the success of companies depends on innovation management. Innovation management is part of the value-added process and is the foundation of generating an innovative atmosphere, innovative methods, new processes, and finally innovative products and services. Without managing the roots of innovations, improvement and development are not possible.

Innovation management is about developing and organising innovation capabilities within the company and turning them into competitive advantages and profits. The management of innovation processes helps to structure innovative ideas that lead to innovative results. Companies have to manage the process of innovation, from the idea to the final product and services.

Still managing innovation processes is a challenging task. OEMs are already equipped with instruments, experience, human and financial resources in innovation management. In contrast, SMEs only have basic access to those instruments and resources and are often faced with incompatibility of innovation management tools. For the strategic and operative planning and project realisation, these tools are lacking. Customer demands are often lost along the way because tools regarding customer processes and communication are often not tailored to SME needs. Furthermore, many tools and instruments are not even known to most SMEs. A new awareness has to be established how, when and why tools should be implemented.

The realisation of innovations in companies requires an interaction between different components such as innovation atmosphere, innovation methods and innovation resources (Wieselhuber & Partner, 2006). Innovation management tools can be applied to these fields. Numerous tools are concentrated on www.viva-eu.net. These support mechanisms that improve the innovation capability should become the rule rather than the exception. The tools aim to replace ad-hoc products, processes and services. Companies can find helpful methods to develop and improve their innovation processes. Especially for SMEs the VIVA Toolbox gives practical and easy innovation management support. Management culture, internal and external communication, clustering, generating ideas and failure management culture are just a few examples where these tools can be deployed. The freely available VIVA Toolbox on www.viva-eu.net supports new ideas, but more important helps support and dominate the entire innovation process.

2 Benefits for SMEs using the toolbox

The company's ability to innovate is the ability to develop new products and market them successfully. According to several studies innovativeness is the most important lever the increase profitability and growth in any branch.

Some people say that innovation is related to R&D only and that innovation is happening by accident and being some kind of "unmanageable" is widely spread among SMEs. However, studies have shown that innovation is not only based on the excellence in R&D but depends on an enabling configuration of an innovation system in which the whole company is included.

It is the result of a goal-oriented and systematic allocation of resources and outcome of well-planned tasks, activities and processes. Companies need to manage the innovation process systematically to establish the organisation

and structure for generating a continuous flow of innovation. A systematic approach on innovation management addressing all dimensions of the corporate-wide innovation system is not yet well understood and implemented among SMEs.

Innovation processes of companies are often inefficient and lack systematisation. These processes need to be improved continuously. That is why the VIVA-Toolbox was developed. The tools collected in the Toolbox give SMEs the opportunity to analyse and evaluate the innovation capability and to develop and implement measures to improve their innovation excellence. The tools are mainly research results, instruments or developed methods collected by the VIVA-partners or associated partners. An easy access via the VIVA portal is defined and implemented, offering a knowledge and competence-based network so that support for the SMEs is not only provided by the toolbox but also by competent experts.

The toolbox provides several tools which can especially help small and medium-sized enterprises to assess their innovation excellence and enhance their innovation processes and strategies develop an effective innovation culture participate in or build up new clusters. Consequently, tools to all relevant fields of innovation as well as to all process steps are provided. SMEs can easily find methods and instruments to solve existing problems and on the other hand they have the chance to break new grounds by implementing tools and instruments not known to them before to enhance their innovation excellence (Bullinger, 2006).

3 Systematisation of the Toolbox

The Toolbox is an accumulation of various methods, procedures and tools to help enable, implement and improve innovative activities within and outside the enterprise. Provided and gathered by the VIVA consortium this data base offers an excellent support on innovation projects and activities. The available state-of-the-art tools and methods give an impulse on how to confront and handle evolving innovation aspects. The goal is to skim the innovation potential as best as possible. Giving you new approaches to deal with innovative activity, the methods and tools provided help your enterprise to identify problems and see chances from a different angle. Absorbing the given information and tools, your enterprise is bound to reach a higher competitive level.

The tools are broken down into four content areas to simplify the search for your particular request.

3.1 Innovation Strategy and Process:

In this content area you can find tools which support and help develop innovation management and planning of projects as well as tools supporting different phases of an innovation project, like creativity techniques.

3.2 Assessment of Innovation Excellence:

With tools provided in this content area your company is able to analyse its actual competitive position and strategy. Furthermore the tools help controlling innovation activities. Portfolio tools support your company in exploiting opportunities and sharpen the positioning of unique products and services while keeping an eye on potential risks. Also included are tools that help to achieve a maximum use of human capital available in the organisation.

3.3 Innovation Culture:

Innovation Culture is practiced on the employee level as well as on the corporate level. Particular tools can be found in both areas. These tools support the management of social responsibility, launching new business contacts and relationships. Moreover, leadership competences, management of life-long learning and facilitation of communication can be improved when implementing specific tools. Creating an innovative atmosphere for everyone in the organisation is also supported with the available innovation culture tools.

3.4 Innovation in Clusters:

These tools improve cooperation with companies in your network, focusing on clusters. They help recognising key innovator players and simplify the process of knowledge transfer. Among these tools are methods describing how to externalise and analyse problems in an innovative network.

4 Navigation in the Toolbox

There are two paths which lead you to tools which are suitable for specific aspects regarding particular innovation activities and methods:

Navigation by Content Area:

If your given request is already able to be classified into one of the four contents above such as Innovation Strategy and Process, Assessment of Innovation Excellence, Innovation Culture and Innovation in Clusters, then

you will find an intuitive navigation following this link. Within these content areas various tools regarding innovation activities can be found.

Navigation by Problem:

If you are not sure in which content area answers and tools to your request can be found, the navigation by problem is the path that leads you to an adequate tool. Numerous frequently asked questions are listed and there is a great chance that they are related to your request. Behind each question several tools are recommended.

5 Case Study "FlowX"

In the following a virtual case study is given to present some interesting tools applied to an imaginary scenario leaned on a real company. Short problem descriptions as well as summaries of important tools and methods of the VIVA-toolbox are presented.

5.1 Company "FlowX" in troubles

The company FlowX provides a diverse set of customers such as retail markets and OEMs with applied engineered fluidic and mechanical solutions. FlowX has a reputation as an innovative manufacturer of high-quality fluidic systems, air-moving systems, reliable micro pumps, combustion control, and various industrial solutions. FlowX stands for innovativeness and has a significant share of the European control systems market. Its technologies and patents made FlowX a well-known brand name as an innovative designer. The historically grown family business employs about 300 people and operates in six different European countries. FlowX turns over 15 Mio $ a year which makes it one of the leading control systems manufacturers in Europe. More than 40 different products are designed and developed in the company-owned R&D department and many subcontractors supply FlowX with electronic or mechanical components.

In recent years the market has changed. Decreasing market potential, wider product ranges, fewer contracts per enterprise, changing order behaviour, strong and permanent innovation pressure and at the same time cost pressure from new entrants to the market make it difficult for FlowX to increase its turnover and sustain a dominant role in the control systems market. Technologically advanced products are being developed to counteract this trend but many are not as successful as anticipated. Other businesses are gaining on market share with better technologies or similar technologies to lower prices.

Always being up-to-date, FlowX decides to act against evolving problems and circumstances by bringing in external help to analyse the existing business situation. Suggestions include examining the innovation strategy, the innovation structure/organisation and the innovation culture by leading the company FlowX through an Innovation Audit. The results of the Innovation Audit will show existing problems and weak points of FlowX. Certain tools of the VIVA Toolbox are then recommended to improve the innovation process.

5.2 Analysis of the current situation of the FlowX

5.2.1 First Analysis: Innovation Audit (Fraunhofer IAO)

The Innovation Audit comprises 4 distinctive steps which are usually completed within 4 to 6 weeks.

In the **first step** the company and the auditor conjointly define the objectives of the analysis.

Depending on the objectives and the organisational characteristics both the scope and the duration of the audit are defined. In parallel, both parties decide upon the participants and agree upon the timing of the audit process. Here, it is important to address all hierarchy levels, functions and divisions within the innovation system of the company to integrate different perspectives within the innovation system.

In addition, performance indicators (such as financial data on sales and profit, invest in R&D etc.) and additional information related to innovation management are collected.

In the **second step** interviews with selected interviewees are conducted based on a structured interview guideline. It builds upon a holistic company model. Both strengths and weaknesses are identified. If required, interviews are complemented by moderated workshops or specific data and "system analysis", such as for example the analysis of the implemented idea management. The interview guideline is semi-structured and for each area specific audit criteria are assigned that are investigated with one open "key question". For each key question there are additional detailing questions to enhance the value of the analysis with regards to the objectives and the content of the assessment. To validate the answers additional "validating questions" are asked.

In the **third step** data is evaluated and key findings are analysed based on the Innovation Audit Scorecard und Fraunhofer benchmarks of good practices in innovation management. The Innovation Audit Scorecard as an

effective means to measure the gaps between the current practice and the targeted "good" practices and performances. For each audit criterion there is scorecard with two main functions: On the one hand, it helps to assign a value to the answers on a range between 1 and 4, to identify good-practice criteria and priority areas for improvement. On the other hand, the Innovation Audit Scorecard provides the base for the definition of high-level actions as there is a list of valuable actions and measures assigned to each criterion. An excerpt of the Innovation Audit Scorecard is presented in the appendices (appendix 2). Based on the analysis of the identified areas for improvement customised concepts can be developed (see design phase). In this phase the expertise of the auditor, good-practice benchmarks as well as the characteristics of the company play an important role. The most important result is the identification of key areas for improvement.

In the **fourth step** the Innovation Audit is completed with presenting the results to the client. Based on the Innovation Audit Scorecard the results are visualised and presented in a consolidated way. In addition, key strengths and important areas for improvement are presented and first recommendations and high-level measures are provided. If required, recommendations for improvement are evaluated and prioritized. The final result is a first high-level roadmap which serves as a base for the second design phase explained in the following paragraph

5.2.2 Design Phase of the Innovation Audit

The aim of the design phase is to develop detailed concepts for the priority areas identified in order to improve the innovation capability of SMEs. It further elaborates the results of the Innovation Audit. Therefore, the conception focuses on those priority areas and recommendations for improvement that were defined in the Innovation Audit. The development of detailed concepts and measures takes into account the customers' needs and the organisational context. Indeed, the scope and the duration of the design phase highly vary among different enterprises as it is realised in a customised way.

The design phase comprises the following high-level phases:

- Definition of objectives and key performance indicators of the design phase
- Detailed analysis and definition of requirements
- Development of detailed concepts and configuration of indicators (For selected areas indicators are defined to measure and control the sustainability of innovation capability. Based on

the detailed analysis key performance indicators are identified and targeted values defined. If required, for the remaining areas of the Fraunhofer Innovation Management model a configuration of indicators also takes place. This helps to adapt the indicators of each area towards the company's needs. This configuration provides the base for an implementation of the Innovation Card)

- Development of a plan to implement detailed design concepts (detailed roadmap) and selected indicators (Bullinger et.al, (in print)).

5.2.3 Implementation of the Innovation Audit at FlowX

In the very first meeting the aims of FlowX are defined and different interviewees are selected. An external, independent assessment is granted and potential for development can be examined.

Before beginning with the interviews, a company specific catalogue with critical success factors needs to be developed and additional information about the company and the economic environment is collected.

The interviews are based on a detailed guideline which includes all important areas such as innovation strategy, innovation process, innovation structure and innovation culture. The interview guideline is semi-structured and for each area specific audit criteria are assigned that are investigated with an open "key question". For each key question there are additional detailing questions to enhance the value of the analysis with regards to the objectives and the content of the assessment.

Representatives of the executive management, the managerial accounting, research and development and marketing are interviewed and strengths and weaknesses are identified.

5.2.4 Outcomes of the Innovation Audit at FlowX

Within the evaluation the collected data is set in a relation to the general economic situation and additional information and experiences of competitors are added.

As a general outcome eight problems specific to FlowX are identified and need to be solved.

New employees need too long to adapt

- Lack of experience and time in accompanying new employees
- No structured process in inducting new employees

Knowledge management and transfer of technologies and processes are not adequate

- A concise and unified ERP-System is not established
- Data and processes are not integrated into a unified system
- Information is not centrally collected
- Poor evaluation of innovation processes

Management leadership is insufficient and company culture is not well established

- Inconsistent teamwork
- Lacking responsibility
- Unprecise assignment of tasks and goals
- Lacking steepening incentives
- Blurry corporate identity

Project management is unorganised

- Deadlines are not met
- Ad-hoc application of resources, human capital and knowledge
- Overlapping of human resources

Competencies are not always present to follow innovation projects and new ideas

- Lacking financial resources for R&D projects
- Too long duration of R&D processes
- New ideas are sometimes abandoned due to poor resources
- Company does not know to which potential partner it can turn to for certain projects

The development and improvement of products is neither efficient nor creative

- Lack of brainstorm techniques
- Few new ideas for new features
- Poor integration of customer needs and their feedback in product development

Poor identification of potential competitors

- Competitive advantages of the competitors are not known
- Own strengths are not well assessed
- The company's technology portfolio and marketing strategy does not distinguish itself from the competitors' strategy

Product portfolio is not well adjusted to market needs

- Little overview over own products/strengths
- Product portfolio does not take future market growth rates into account
- Decision-making process in which products money should be invested lacks systemisation

5.3 The VIVA-Toolbox offers many methods and tools to overcome the typical problems of companies like FlowX

5.3.1 Problem: New employees need too long to adapt

In the context of Innovation culture FlowX has the problem that new employees do not efficiently take part in the innovation process. The company needs too long to introduce new employees and new ideas are lost due to an insufficient integration of the staff in the innovation process. The integration of new employees in general takes too long and a corporate culture is not transmitted. This means that time is wasted and good ideas of new employees are barely followed. A new approach needs to be implemented.

Method: Guidelines to introduce a new employee (innovation culture on employee level) by invenio GmbH – Claudia Speth

This method supports the introduction of a new employee in his first few days. In this critical phase, the understanding of the business culture and the working atmosphere is given to the new employee. Every company has a different way of thinking and aims at different goals. It is very decisive to communicate the corporate identity in the first few days, so that the new employee can find his place in the new environment and act as a part of the corporation. Creativity and teamwork is cultivated and corporate behaviour is easily adopted. The efficient integration of new employees is one of the success factors in companies. Mostly, SMEs do not have the time and capacity to install departments to solve this problem. invenio supports SMEs by accompanying new employees personally and with written information

on their first few days in their new surrounding. Contents of the invenio introduction seminar are:

- Basic introduction
- Introduction to the company's philosophy
- Describing the new working space and environment
- Rules of the company
- Tour through the company

By using these guidelines FlowX achieved a faster adjustment to the new jobs of employees. The involvement of new employees in the innovation process rose steadily and a stronger identification with the company took place.

5.3.2 Problem: Knowledge management and transfer of technologies and processes are not adequate

One outcome of the Innovation Audit is that FlowX has indeed implemented a knowledge management system but that it lacks systematisation and structure. Moreover, it is poorly supported by a unified ERP-System.

The knowledge or skills generated in a company are the key element of new ideas and their transformation in innovations. Therefore a common process, in which knowledge can be identified, created, represented, and distributed for reuse is one major element in the innovation process. The implementation of this process can also help to evaluate the company's innovation excellence by collecting data in central database.

A structured process needs to be implemented and supported by new technologies. The VIVA-Toolbox comprises several methods to solve this problem.

Tool: Knowledge management analysis by LABEIN-Tecnalia

The aim of this tool is to improve the knowledge flow in a company. It creates a better adjustment and connection between social-organisational and technological processes. With this tool companies are able to reflect on how they have implemented processes and activities to manage knowledge internally and how to transfer technological and process knowledge with adequate systems. Applied computer systems allow a continuous information flow within an organisation. They facilitate company processes and visualise relationships with customers, suppliers and employees. Functions such as suppliance, manufacture, controlling, finances, accountancy and sales management allow a more efficient monitoring of processes.

- Implementation of new e-systems to increase productivity such as working flow system, e-business and e-commerce systems, documentary management systems and Electronic Document Interchange, marketing integrated information systems, knowledge teams operations supporting systems, ERP, CRM, PDM, SCM
- Adjustment in social-organisational processes
- Training of staff getting acquainted with new systems

Tool: Innovation Controlling supported with ERP-Systems by FhG/IAO

The Innovation process cannot be reduced to particular sectors of a company. Therefore an innovation specific indicator system similar to the Balanced Scorecard can be implemented to control the innovation activities of the company. This company-tailored indicator system provides information about the influencing factors to innovation. The use of existing ERP-Systems, like e.g. SAP, can support and facilitate the sometimes tedious data gathering process. This approach allows a practical and continual evaluation of innovation excellence in a company.

Several data sets can be controlled separately. The achievement of targets can be monitored so that further actions can be taken. Thereby the innovation ability becomes tangible and more controllable. The ability to check the input factors continually without great effort, leads to a planning of the innovation abilities instead of the widespread implementation of ad hoc actions.

At FlowX by the analysis of their knowledge management status and the support of a unified ERP-System a noticeable reduction of time and costs in the innovation process is realised. So information does not get lost and processes become more efficient.

5.3.3 Problem: Leadership is insufficient and company culture is not well established

By assessing the company culture it was obvious that FlowX has a deficit in establishing some kind of a corporate identity within its staff. This results in inconsistent teamwork, imprecise assignment of tasks and goals and a lack of willingness to accept responsibility. In order to strengthen the managerial leadership the management style has to be carefully adjusted. Furthermore a strong corporate identity needs to be developed.

Tool: Management Style Analysis by LABEIN-Tecnalia

A leader is an executive who is capable of achieving a degree of influence over his collaborators which is higher than that to be expected of the position he holds. To become a leader, the manager has to surpass his managing and administrating abilities and must constantly strive to transform and improve the organisation.

The best way to achieve this ability is by:

- Adopting a considerate, direct, individualising and differentiating attitude towards collaborators, in the endeavour to achieve maximum personal development
- Employing methods intended to stimulate the collaborators' intellectual and creative ability
- A motivation which, in addition to recognising a job well done and providing fair and gratifying retribution, creates expectation and gives meaning to the work being done
- Behaving in an upright, consistent and exemplary manner, in the personal and professional fields alike.

The questionnaire on Management Style assessment helps to detect and visualise areas in which leaders can improve delegation, communication, teamwork, being upright, being creative and managing a pleasant working atmosphere. These are preconditions for change improvement and corporate identity.

Tool: Culture Assessment by LABEIN-Tecnalia

Company culture is the result of how the company thinks, acts and relates. These values indicate what ways of doing things, of behaving etc. are appreciated, considered as positive, and those which, on the other hand, are not. The culture of a company, like the culture of other social groups, takes shape over time, as a result, among other, of experience and of the good or bad results of actions taken because of this experience. Another influential factor is the way employees and managers behave and act inside the network.

The questionnaire on Company Culture assessment helps managers to get to know the company better, to underline aspects responsible for either hindering or accelerating change or improvement.

By implementing these tools, the current situation within the company was made transparent to the upper management of FlowX and supported it to

establish a company wide corporate identity, so that all employees could identify with the innovative strategy of the company. Moreover an incentive system was introduced.

5.3.4 Problem: FlowX's project management is unorganised

The company's organisational structure is the basis of the successful implementation of an innovation strategy. The FlowX has an insufficient project management and therefore time schedules and deadlines are not met.

The use of resources is not well planned and therefore resources overlap and the employees are burdened with unnecessary work. Another problem is that different projects are not synchronised so that outcomes which might be helpful for others are not exchanged.

The implemented currently project management at FlowX is only poorly structured and does not include all processes of the company. Therefore it is only adequate for small and easily manageable projects but it is absolutely insufficient for the amount of new projects FlowX has to deal with in order to stay competitive.

The VIVA-Toolbox offers a tool to overcome these problems by implementing a new project management or to enhance the existing one.

Tool: Project Management Guidelines by Fiat Research Centre

Well implemented project management processes can help to manage all the relevant information. It is important to visualise information or communicate and collaborate with the team, to present complex information in an organised, easy-to-understand visual format and to be aware of connections, obstacles, and pathways so you can quickly choose the best course of action.

Project management must support every phase and process of the project. The guidelines defined rely in wide parts on PMBOK, the "Project Management Body of Knowledge" which is published by the "Project Management Institute" and serves as one of the main industry standards.

Initiation Process:

One of the key deliverables of the project initiation process is the project charter. The project charter identifies business needs, as well as the results or products that will satisfy those needs. A MindManager tool supports creating a project charter beginning with brainstorming and ending in placing the ideas into a map. Ideas can be linked with processes, phases and knowledge management areas of project management that the PMBOK defines. A mind map helps visualising and communicating the project to everyone involved.

Planning Process:

The PMBOK includes a scope statement which defines in more detail than the charter what, exactly, a project must accomplish. As with the charter, the scope statement often emerges from a brainstorming effort, this time by the planning group under the supervision of a project manager. With a mind map, you can follow the brainstorming process detailed above and, once again, by visualising connections you have a more efficient, higher quality process. Risk assessment, initial budgets, human resources, communication plans and schedule can also be included into the charter.

Project Execution, Monitoring and Control Processes:

The execution process includes the primary processes of creating the product, whereas the secondary monitoring and control processes track project progress against the project plan and implements corrective or preventive actions to improve project performance. The status of projects is collected and shown on the dashboard

Project Closure Process:

Project closure is the process of finalising all activities completed across all project process groups and formally closing the project. Typically this is where the project manager wraps up all appropriate paperwork.

Though this is important work, for most project managers it is also tedious because it involves a host of administrative details, including gathering and archiving all the information. A mind map can support the project manager to concentrate on further strategic work.

As a result of the implementation of the project management guidelines, FlowX achieved large scale time savings due to an improved workflow.

5.3.5 Problem: Competencies are not always present to follow innovation projects and new ideas

FlowX has a very innovative R&D department with deep expertise in their strongest areas. But in certain areas the company should have the possibility to outsource research projects in order to focus stronger on their key competencies. Instead of extending the R&D sector to an unmanageable scale, external experts need to be contacted to reduce costs and save time. The risk that new ideas are not pursued because the resources are overloaded can be reduced.

FlowX needs support because it is not well integrated in a company network and has only little experience with partnerships in R&D.

Tool: Experts Database provided by Wirtschaftsförderung Region Stuttgart

The Experts Database which is available in English and German is a web based internet platform which can be reached via http://exdb.region-stuttgart.de/ with standard browsers. The main aims are the set-up of different thematic knowledge-bases as well as collection and distribution of real-time information concerning new projects, meetings, events, general news, press releases etc. This is an effective way for exchanging know-how on a large database with several search functions. The database offers an easy access to interregional cooperation projects and research and development projects.

Main objectives and positive effects for the involved SMEs using the database are:

- attaining anonymous contacts to possible innovation partners in the field of research (service providers), selling or distribution
- innovate tools for knowledge transfer in specific topics
- if partnership makes sense, personal contact data and company information can be exposed
- circumventing an early fixation and information of partnerships, SMEs often realise in an advanced state, that the partner is unsuitable for further cooperation but the contacts are so tight that non target-oriented cooperation will be proceeded
- stepwise approach to new cooperations

For FlowX using this kind of external database and support helped them to find a company with complementary expertise in a short time. FlowX was able to develop its idea of a new multidisciplinary product, which would only have been possible alone at much higher costs.

5.3.6 Problem: The development and improvement of products is neither efficient nor creative

There are large potentials in the improvement of products and product features. FlowX already has many different products in the microsystem field. New ideas are sometimes pursued but many ideas are abandoned due to insufficient technically matured ideas and features. However, there still is a large potential in developing optimised fabricating processes and improving existing products to reduce costs and to gain on market share. Until now, FlowX has not been using a structured creativity method besides the well known brainstorming sessions. With the SCAMPER-Creativity tool, the hidden knowledge in the company can be unfolded and developed so that

the product innovation potential can be skimmed. Customer needs and demands are also able to be integrated into this tool.

Method: SCAMPER

SCAMPER is essentially a checklist that helps companies to think of changes it can make to an existing product in order to create a new product. These changes can either serve as direct suggestions or as starting points for lateral thinking. SCAMPER stands for Substitute, Combine, Adapt, Modify, Put-to-another-use, Eliminate and Reverse.

The SCAMPER techniques use a set of directed questions about the company's probability and opportunity to come up with new ideas. The stimulus comes from forcing oneself to answer questions one would not normally pose. An extract of some questions of SCAMPER are listed here:

- Substitute – Can a different material be used? Can a technical function be substituted? Are there other ways of fabrication and processing?
- Combine – Can functions of a product be unified? Can production processes be combined?
- Adapt – Can technologies from other product lines be adopted?
- Modify – Are there different assembly possibilities?
- Put to another use – Can for example micropumps be developed not only for fluids, but also for gases?
- Eliminate – Does the product have superfluous elements? Can connections between elements be reduced? Can fabrication processes be reduced?
- Reverse – Can elements be reversed?

Using SCAMPER helps defining possible new products or restructuring and optimising existing products. Many of the ideas may be impractical or may not suit the used machines and equipments. However, some of these ideas and questions could be good starting points for generating new products and for the maturing and development of undeveloped ideas.

By using this method, FlowX now develops smaller high-pressure valves, actuators based on electrostatic effects instead of electromagnetic forces, and micropumps transporting not only fluids but also gases. Some of the new products that are generated with SCAMPER helped FlowX to enter a new market and acquire new customers.

5.3.7 Problem: Poor identification of potential competitors

The Innovation Audit showed that FlowX is aware of other companies in the market. Yet FlowX's technology portfolio and competitive strategy is isolated from the strategies of the other competitors. Improvement can be done by analysing how the competitors serve the market, what their competitive advantages are and how they perform and react to customer needs. These aspects need to be regarded and integrated into FlowX's strategies. Having adequate knowledge about other competitors, FlowX would be able to distinguish itself from them. Potential competitors, such as late followers adapting innovations implemented by FlowX, must be observed more carefully.

The Competitive Analysis method serves as an analytical examination for FlowX. Finally, FlowX has an opportunity to intensely deal with its competitors.

Method: Competitive Analysis

Understanding the market is one of the key criteria for economic success. Yet knowledge of existing and potential clients and their current and future needs is not enough. Knowledge of current and potential competitors, their competitive advantages, position and market strategy should be of key concern.

This method helps to identify

- Current competitors
- Potential new competitors
- The competitive advantages of these companies

This method identifies who the competitors are, their strategy, their advantages, customers and portfolio. The results of the examination offer helpful guidelines how improvement can be made and what strategic decisions should be made on how to relate to competitors. Information is given on how the company can stay in front of its competitors, how to react to new strategic directions of competitors and how to secure a head-start by hindering followers when implementing a new technology on the market.

FlowX now applies this method regularly so that competitors' actions and strategies can be kept in mind when developing and optimising own competitive strategies. FlowX uses the results of this tool as a part of the input for the 'Analysing Service- and Product Portfolios' tool.

5.3.8 Problem: Product Portfolio is not well adjusted to market needs

FlowX has a large product portfolio. The competences, skills and valuable experience are integrated in over more than 40 products. On the basis of experience and efficient controlling, FlowX does have a sense of knowing which products report high profits. But the results of the Innovation Audit show that financial resources are sometimes reinvested in the 'wrong' products. Some markets where the products are distributed show a diminishing growth rate. Other markets are shared by lots of microsystem manufacturers and the market share of FlowX is diminutive. A few products produced by FlowX show little profit and are not worth investing in. In other product lines a lot of resources are invested although the market potential is marginal and the market growth rate is diminishing.

The VIVA Toolbox offers several standard tools that develop an overview of FlowX's products. The matrix developed by the Boston-Consulting-Group, the McKinsey Matrix and the Products/Services and Markets Matrix show where market growth and market share are the largest and how present competitive strengths can be implemented in products serving these markets.

Tool: Analysing Service- and Product Portfolios

For SMEs it is very important to have a portfolio that fits the company's strengths and helps exploit the most attractive opportunities. Therefore a constant analysis of the current business portfolio is needed to decide which businesses should receive more or less investment.

The best known and accepted portfolio planning methods are the Growth-Share Matrix developed by the Boston-Consulting-Group and the McKinsey Matrix.

The Growth-Share Matrix is based upon two dimensions, the market growth and the relative market share. So market growth serves as a proxy for industry attractiveness, and relative market share serves as a proxy for competitive advantage. Every product line can be placed in the matrix and results in 4 different categories:

stars (=high growth, high market share)

Stars nearly always show reported profits, but it may or may not generate all of its own cash. If it stays a leader, however, it will become a large cash generator when growth slows and its reinvestment requirements diminish. The star eventually becomes the cash cow, providing high volume, high

margin, high stability, security and cash throw-off for reinvestment elsewhere.

cash cows (=low growth, high market share)

Characteristically, cash cows generate large amounts of cash, in excess of the reinvestment required to maintain share. This excess needs not, and should not, be reinvested in those products. In fact, if the rate of return exceeds the growth rate, the cash cannot be reinvested indefinitely, except by depressing returns.

dogs (=low growth, low market share)

Dogs may show an accounting profit, but the profit must be reinvested to maintain share, leaving no cash throw-off. The product is essentially worthless, except in liquidation.

question marks (=high growth, low market share)

Question Marks almost always require far more cash than they can generate. If cash is not supplied, they fall behind and die. Even when the cash is supplied, if they only hold their share, they are still pets when the growth stops. The question marks require large added cash investment for market share to be purchased. The low market share, high growth product is a liability unless it becomes a leader. It requires very large cash inputs that it cannot generate itself.

Only a diversified company with a balanced portfolio can use its strengths to truly capitalize on its growth opportunities. The balanced portfolio has:

- stars whose high share and high growth assure the future;
- cash cows that supply funds for that future growth; and
- question marks to be converted into stars with the added funds.

The McKinsey Matrix is a later and more advanced form of the Growth-Share- Matrix. The dimensions used in the McKinsey Matrix are market attractiveness and competitive strength, which include a broader range of factors.

The key factor market attractiveness can be defined as a combination of the following indicators: market growth rate, market size, demand variability, industry profitability, industry rivalry, global opportunities, and macro environmental factors. Competitive Strength can be defined as a combination of: market share, growth in market share, brand equity, distribution channel access, production capacity and profit margins relative to competitors.

Tool: Products/ Services and Markets Matrix

The products/services/markets matrix helps to assess business opportunities for innovation in products and services. Innovation in products/services and markets is important because satisfying customer needs and demands is essential. They demand special products and services that are custom-made. Less and less products are sold as "standard off the shelves". Design, service, functionality and the uniqueness of products and services are in the focus of customers. The challenge of innovation lies in the capability of the company to invent, create and innovate special products, unique services or brilliant concepts that enable companies to win new orders.

In the analysis phase the matrix of products/ markets is a tool that will help to:

- Define existing markets, existing customer groups and their correlation
- Indicate importance of each segment (in terms of estimated share of the turnover, estimated rate of profitability, area of growth, potential for innovation, etc.)
- Identify the most important products/services offered to the most important markets/client groups
- Identify profitable and non-profitable segments/markets
- Indicate the potential for innovation in each segment

In the planning & strategy phase the matrix is a tool that will help to:

- Decide whether a product should be reinvested in, strengthen the position of a product in the market, remove the product etc.
- Identify new products and new markets/customers
- Plan the future mix of products/services/markets
- Indicate the desired strength in each segment

The output is structured in four fields:

- Matrix of existing products/services/markets
- Identification of growth areas for the company and segments of particular innovation possibilities
- Evaluation of the quality of the matrix
- Ideas generated for improvement or innovation

Having applied these tools to FlowX, market and customer demands are now clearly structured. The product mix is optimised, meaning that several

products were identified as ‘dogs’ and hereupon abandoned. Financial resources now are correctly invested into the ‘Question Marks’, aiming to develop them into ‘Star’ products. Markets were identified that show a large growth potential, but where FlowX was not that active and present, such as the biomedicine market and the household field demanding products for domestic appliances. These markets were accurately examined and potential customers are now involved in the innovative product development.

5.4 FlowX’s success

FlowX succeeded to change their processes and to implement some of the tools of the VIVA toolbox. As some changes show their benefits not immediately after implementing them but over time in everyday work FlowX is curious about the success of the measures taken. First results are very promising to FlowX.

6 Available tools

6.1 Introduction

In the following the available tools are listed to give a short overview of the width and depth of the toolbox. Aim was to collect tools to support the most important areas of innovation management.

6.2 INNOVATION STRATEGY AND PROCESS

- Creativity Management: Tools for Creating new Products & Services
- Protection of Intellectual Property
- Creativity Techniques
- Knowledge Management Tool
- Creativity Management: SCAMPER
- Integrated Idea Generation
- Embedded Microcontroller development system 'µrRD2'
- MELIOR's Company System
- Customers and Buyers Criteria
- Competence Management
- Virtual Machine Tool
- CRIT-Research
- InnoClub Innovation Process (IIP)
- Problem Constellations
- Guidelines for New Technology Based Firms management
- Systemic Coaching
- Project Management Tool
- LabVIEW Development System
- Innovation Process Implementation

6.3 ASSESSMENT OF INNOVATION EXCELLENCE

- Small and Medium Firms Networking for Excellence in Production and Labour
- Innovation Card
- RPA - Rapid Plant Assessment
- BIP: Best Innovation Practice
- Knowledge Management Analysis
- Intellectual Capital Reporting
- TIP - Top Down Innovation Planning
- The Diamond of Innovation Management
- Innovation Self-Assessment
- Competitive Analysis
- Innovation Controlling with ERP-Systems
- Analyzing Service- and Product Portfolios
- Technology Evaluation
- Value Net Analysis
- Products/Services and Markets Matrix
- Talent Management Self Assessment Tool (TALISMAN)

6.4 INNOVATION CULTURE

- Personal Education Program
- Career model
- Appraisal Interview
- Analysis of Management Style and Company Culture
- Developing Good Leadership Skills
- Induction of a New Employee
- Assisting Newcomers
- Xertatu:adi - Corporate Social Responsibility
- Organisation of Brokerage Events

6.5 INNOVATION IN CLUSTERS

- Collaborative Demand and Supply Networks (CODESNET)
- Innovation Indicators for Performance Measurement of Cluster Partners
- Experts Database
- Innovation Process in High Tech Cluster
- Regional Intellectual Capital Reporting
- LIMES - The Web-Based Manufacturing Execution System for Networked Manufacturing
- Innovations in the VTG Cluster
- Conceptual Model of the Dynamic Production Cluster Structure
- DETECT-it

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V Better and faster - Innovation as success story

Anne Spitzley, Willi Schweinfort

1 The innovation capability of SMEs

To ensure market success today and in the future enterprises have to reach goals faster than their competitors. Accordingly, enterprises must bring products and services rapidly and effectively to the market. Best possible conditions throughout the innovation process have to be created so that the enterprises are able to break new grounds and be highly innovative. The key to success is managing and controlling the fields that have an impact on the innovation process. For instance, the management and promotion of the competence and knowledge development of employees is a source for generating new ideas. The fundamental innovation strategy, which gives the direction of ideas that should be pursued, is also a field affecting the innovation process.[65]

According to a study by Arthur D. Little (2004) the innovation capability of enterprises is intersectoral the most important lever to increase the profitability and economic growth. Companies participating in this study estimate that excellent innovation management could yield an average of 13.5 percent turnover increase. In Germany as well as in Europe small and medium-sized enterprises show the largest potential in development.[66] Enterprises' main focus should be on developing an effective innovation structure to eventually reach an outstanding innovation capability level to ensure market success.[67]

Though merely a third of small and middle-sized enterprises (SMEs) are exceedingly active in implementing innovations (BMWA), not many enterprises can describe themselves as 'innovatively active'. The term "innovatively active" embraces more than the development of new products or the efforts in research and development of an enterprise. A significant coherency between research and development expenses and attained growth potential exists.[68] It is mentionable that for example innovative forms of organisation or new production processes also contribute to the success of an

[65] Wagner et al., 2007
[66] Maufuture, 2003
[67] Spath et al., 2006
[68] Kinkel et al., 2004

enterprise and help achieve a competitive advantage.[69] Today, enterprises face up to the individualisation of demands, an increasing diversity in variants as well as the acceleration of technical and scientific development. Enterprises have to meet demands evolving from these turbulences in their environment by being versatile.[70] Consequently, the development and marketing of new products is a considerable precondition for the success of an enterprise. Correspondingly, the ability of enterprises to successfully organise innovation processes and implement innovation projects increases in importance. [71]

In the following chapter enterprises are encouraged to rethink their present strategies and innovation processes. An impulse is given to restructure fragmentary approaches regarding innovation capability. To support enterprises on their way to improve their innovation capability the Fraunhofer-Gesellschaft has developed an Innovation Excellence Model. This model examines an enterprise in nine fields along the innovation process. These nine fields contain important success factors which can be implemented in every value creation level. To achieve a better competitive position which can simultaneously be defended the nine fields of design also allow an analysis of aspects that help improve workflow and innovation activities. Additionally, the most important time drivers are listed and explained in the following chapter. To be successful today and in the future enterprises should be aware of time drivers that retard innovation projects or encourage and accelerate innovation projects. For example, lacking motivation of employees or ambiguous strategic objectives are blockades that constrain market success. Therefore it is important to know what the critical success factors are and what deriving aspects are implemented or lacking and need to be improved. Step by step, the factors that improve innovation capability give an understanding of how important innovation capability is and how each enterprise can improve their individual innovation capability to drastically gain and secure their competitive position. A new approach is given to SMEs to assist to effectively skim the innovation potential. The results of this approach assist enterprises in improving the implementation of innovative projects, management of innovation activities and innovation controlling. Achieving this, enterprises are bound to break new grounds and a slightly different view of things gives

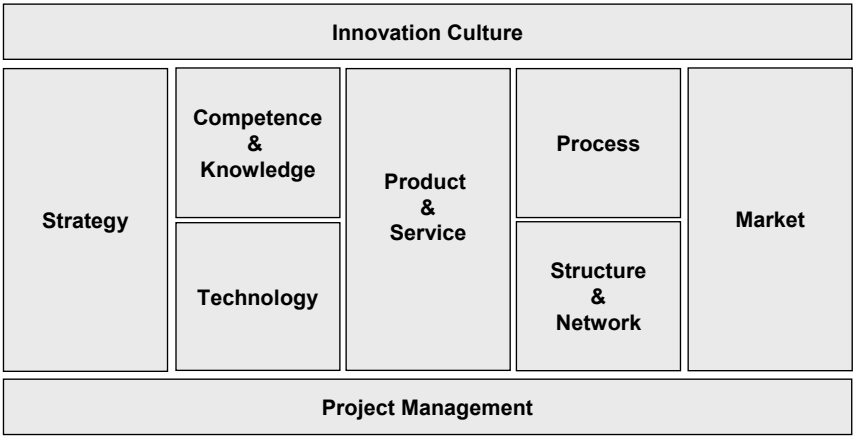
[69] Spath et al., 2006
[70] Hartmann, 1996
[71] Spath et al.., 2006

an understanding of the key competitive factors evolving today and which are bound to dominate the future.

2 The Fraunhofer Excellence Model and the related Nine Fields of Design

The Nine Fields of Design for valuation and augmentation are the basis of the Fraunhofer Innovation Excellence Model. Although the model is all-embracing, it offers a relatively high degree of details to enable the individual measurement of an enterprise's innovation capability. Along the innovation process nine relevant fields of design exist. These enable enterprises to measure, valuate and systematically increase the innovation capability. On the basis of the value in each Field of Design innovative enterprises can be distinguished from less innovative enterprises. The model of the Nine Fields of Design is shown in Figure 21.

Figure 21: Nine Fields of Design along the innovation process



Innovation Culture

The Innovation Culture embraces elements of the business culture that are considered important for innovation activities. It describes the existing values, norms and business behaviour as well as the resulting business atmosphere. These can have a positive or a negative impact on the innovation activities. The Innovation Culture of an enterprise affects the competence of employees and the readiness to develop and implement new ideas.

Strategy

The Innovation Strategy particularly contains the intermediate- and long-term objectives of an enterprise as well as the formulation of measures how these goals can be reached. At the same time the actions of other people involved in the field have to be considered.[72] By anchoring the strategy a joint understanding of innovations in the enterprise can be generated.

[72] Hagenhoff, 2003

Competence and Knowledge

Knowledge describes the understanding and the abilities that are adopted when problems are to be solved.[73] Furthermore, data and information are also described as knowledge. In what manner knowledge is implemented within activities is referred to as 'competence'. The skills and abilities of employees in an enterprise mark a considerable potential to generate new ideas which are put into practice in form of innovation projects. Therefore the further development of the enterprise and its employees is essential for the innovation capability of an enterprise.

Technology

According to Sommerlatte and Deschamps (1986) the term Technology means „[...] the practical application of scientific or technical possibilities for the realisation of performance features of products and resources, [...]". In order to be innovative it is necessary to implement and have a good grasp of the adequate technology. Additionally, an enterprise must continuously be on top of the newest technologies and technology trends. This is the only way to decide whether or not a technology is promising for the success of an enterprise.

Product and Service

Four product categories can be distinguished, whereas combinations of the categories are also possible: Services, software, hardware and procedural products. Service is therefore a specific product, mostly immaterial, or the result of at least one activity performed where subcontractors and clients meet. The development of products should be consistent with the existing technological competences, practicable production processes and available resources. Whether or not a product results in a success depends on if customer demands can be satisfied. Moreover, a product or service must offer a minimum life-span to reduce amortisation time.

Process

According to DIN EN ISO 9000 a process is a „set of interacting or correlating activities which transforms inputs into results". When directing and controlling the innovation capability in an enterprise the question arises in how far the implemented processes are suitable to bear innovations. Therefore it is necessary to check if all the required processes are implemented and if they have the according features.

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[73] Probst et al., 1998

Structure and Network

The term ‚Structure and Network' in the broadest sense describes the organisation of an enterprise. The external organisation such as partners and subcontractors and the internal system are also to be considered. It is also important to select the adequate project partners who have the required competence, flexibility and innovativity. Furthermore it is necessary to cultivate formal and informal networks with other enterprises and research establishments.

Market

Supply and demand meet at the market in form of customers and competitors. Especially the client is known to be „the best source and adequate touchstone".[74] To be successful today, an enterprise must not only detect the demands of buyers but also keep an eye on the competitors. Enterprises should keep track on which ideas competitors are working on and what competitors might come into question when considering a research and development cooperation with a competitor.

Project Management

Project management is the leadership of a project. In particular leadership includes controlling, planning and supervising the project, as well as leading institutions, as shown by Rinza (1994). Further components of the innovation project management are the operational and organisational structures of research and development projects, as well as methods, procedures and instruments, which support the direction and organisation. Many innovation projects fail due to lacking project management. Therefore it is important that failures are prevented by efficient project management.

3 Time drivers

Increasing growth and profitability are the reasons why enterprises plan to acquire new markets. In spite of several successful improvements within the enterprise, it remains a difficult challenge to defend a leading role at the market having many competitors breathing down one's neck. Sometimes rivals even copy products and produce them more effectively than before. For this reason, effective protective mechanisms are necessary in order to establish innovations and to stay competitive.[75]

[74] Spath, 2001

[75] Slama et al., 2006

According to the BMBF study[76], the opportunity of having a temporal head start is used most by SMEs, far before working with secrecies, patents, complex design or brands.

Furthermore, during a telephone survey by the "Fraunhofer-Institut für System- und Innovationsforschung"[77], SMEs were asked to evaluate their estimation of the importance of the product development time. About 80 percent consider this aspect as very important. Being asked if the planned time schedule for projects is sticked to, over 60 percent of enterprises admit that they generally need more time than expected. Only few enterprises mentioned projects that were finished in less time than expected.

Regarding the enterprise's experiences, it is obviously very important to be aware of the factors that retard projects.

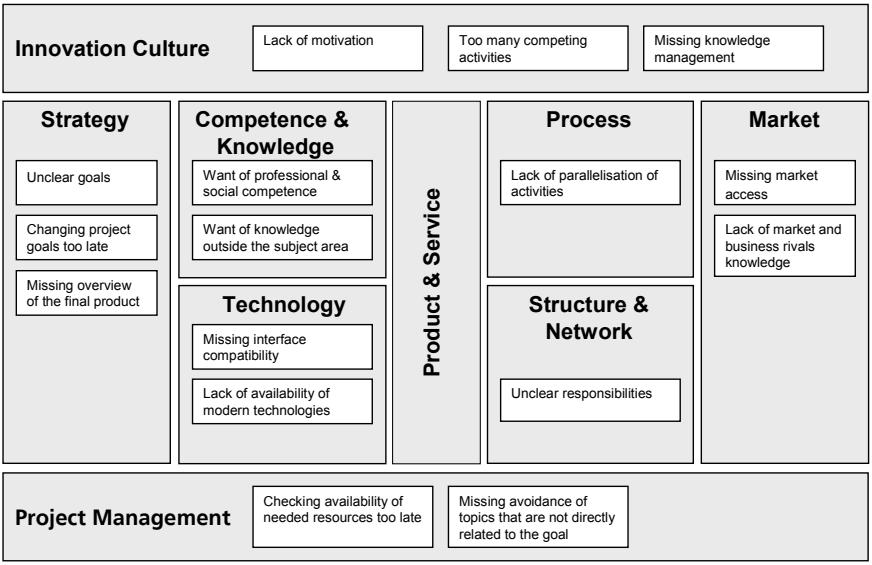
Being able to identify and understand time drivers gives enterprises the chance to accelerate innovation projects. Analysing 17 internal projects of the Fraunhofer-Gesellschaft, 40 different time drivers are identified and grouped according to the "Fraunhofer innovation excellence model".[78]

[76] "Germany's technological performance", 2003, also see Grupp et al., 2003

[77] ISI 2005

[78] Slama et al., 2006

Figure 22: Time drivers dedicated to the "Fraunhofer excellence model"



Based on experience, the three categories Project Management, Innovation Culture and Strategy are the main enablers for the reduction of development time. The product or service itself as the centre of all cannot be assigned to any time drivers and is as well not a part of the initiation and development, where normally time is lost. Time drivers are furthermore defined as factors that extend innovation projects and let them differ from the optimum.[79] In the following some of the most important time drivers are explained according to Slama[80] to give a feeling of how apparently small issues can affect an entire project.

Innovation Culture

A person involved in the innovation project and not completely motivated certainly could not be able to deliver results in the best and fastest way possible. As per Wildemann (2004) a lack of motivation could have both intrinsic and extrinsic reasons. Additionally people do not work full-time on one project. There are always tasks at everyday business that have to be done

[79] Slama et al., 2006
[80] Slama et al., 2006

or other projects are waiting. Thus, time for the "main" project is scarce and this leads to a delay of results.

Another way of saving a lot of time during product development is a systematic knowledge management, e.g. knowledge of reliable suppliers and partners. According to Spath et al. (2005), transferring specific project know-how to other projects is the main aspect of knowledge management.

Strategy

Lacking a clear strategy from the beginning on, or not communicating it to everyone involved in projects, nobody is able to see the main goal. The lack of knowledge makes it difficult to develop ways to reach the specific goals and hinder focused and optimised work. Additionally, unspecific goals lead to the necessity of adjusting goals during the project. This in turn forces the staff to redo already "finished" work and leads to surplus work and time.[81] In addition, a missing picture of the ensemble could let problems arise during the integration of different sub-projects. With the lack of understanding coherences, employees lose motivation not knowing what objectives and goals they are spending their time on.

Competence & Knowledge

Lack of knowledge is one of the main time wasters and, in the worst case, could even kill the project. People missing professional competence are not able to get their work done in the demanded quality and, far more important, in the demanded time. Professional competence describes the "ability to think in technical and organisational systems, analyse problems, to develop solutions and to help design jobs and processes".[82] This time driver can be noticed very often when people join a team later on, or when they are assigned to a new project. Besides, it is also important to provide sufficient knowledge outside the subject area. This phenomenon can be seen very often at interdisciplinary interfaces, for example people having problems to communicate due to different terminologies. The understanding's impairment therefore delays the task fulfilment.

Technology

Tools like programs with different interfaces used in different project stages are normally not compatible to each other and therefore absorb a lot of time reconstructing compatibility. It is a phenomenon often seen during the integration of particular projects. Along that issue, it can also be the

[81] Wildemann, 2004

[82] Wildemann, 1993

technology's performance that retards work and thus the entire project. Acquisitions are often denied due to financial reasons, but missing the fact that an extended project time creates the higher costs.

Product and Service

For this Field of Design no time drivers can be found, because the product is the outcome of the innovation process.

Process

Another problem seen very often in innovation projects is the missing parallelisation of activities that are not related to each other.[83] Getting the work done one after another can in that way clearly retard your project. However, a too wide parallelisation could also extend the project's duration, as the effort of coordination rises enormously.[84]

Structure & Network

Without a clear definition and distribution of responsibilities, particular tasks are handled not at all or just insufficiently, resulting in two possible scenarios. First, no one could feel responsible leaving the task undone. Second, several employees could feel responsible ending in a competence conflict not conducive at all. Both scenarios end with the same result: The task remains undone or is handled far too late.

Market

To successfully establish products at new markets, enterprises first of all have to enter them. This "first-time market opening" is directly linked with a very high time effort, for example building up sales structures and customer contacts. Just as well, enterprises can get problems by starting to develop a new product without early information about the product's market. This mistake can lead to a delayed market launch, or even, in worst case, to the project's defeat.[85] According to Wildemann (1993), market knowledge is even the main success factor for innovative products. Starting to look for a potential market for the products at a later date, gaining market and competitor information as well as getting entrance to the market could be very difficult and highly time-consuming.[86]

Project Management

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[83] Stanke/Berndes, 1997

[84] Wildemann, 2004

[85] Schmelzer, 1990

[86] Slama et al., 2006

Required resources e.g. machines or materials are needed to be checked on availability as soon as possible. If not, production and delivery delays are inevitable and must be considered. In addition, during a project, staff can usually be found coping with topics not really linked to the project and furthermore not scheduled. The processing of these topics implies a very high expenditure of time and ought to be avoided.

4 Success factors to enhance the innovation capability

Focusing the actual debate about securing the competitiveness for European countries the innovation capability of SMEs is always one of the most important issues. As shown by Belz and Warschat (2005) SMEs in Germany employ 70.2 percent of the jobholders in the private economy and earn 41.2 percent of the whole turnover. Thus SMEs play an important role concerning the economic power and employment.[87] Because of that the relevance of supporting SMEs by optimising their innovation process and increase their ability of being innovative will rise in the near future.

For the improvement of the innovation ability of an SME the knowledge about the so-called success factors of innovation capability is essential. In 2006 the "Fraunhofer-Institut für Arbeitswirtschaft und Organisation (IAO)" in cooperation with the "Fraunhofer-Institut für System- und Innovationsforschung (ISI)" has conducted a study among 151 highly innovative enterprises to identify the most important success factors for innovation capability.

4.1 Preliminary work, base data, and study procedure

The preliminary work for the following study was the implementation of case studies with eminently innovative SMEs. In several workshops success factors for innovation capability were identified and indicators to measure these success factors were carefully worded.[88] For example in several workshops this success factor was named: "Free space or so called play areas need to be created for employees". This success factor is not measurable in a direct way. Because of that the success factor has to be operationalised to be a directly measurable assertion, like: "Existence of a preliminary work budget, which is independent of customers' orders". Altogether 23 success factors with adequate indicators to measure the innovation capability of SMEs were found.

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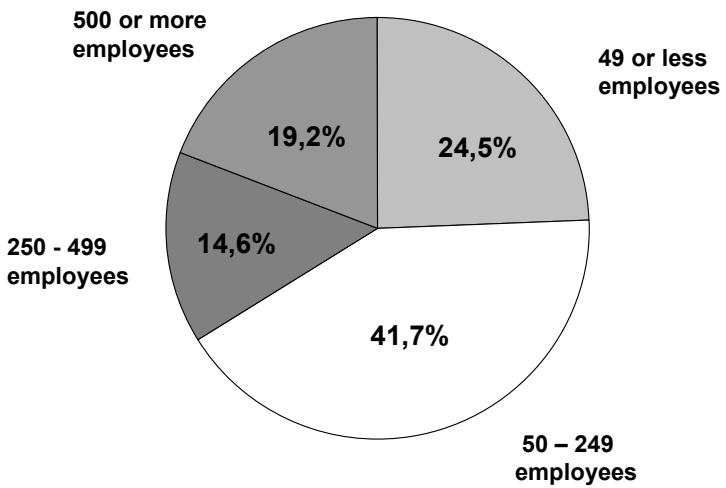
[87] Kirner et al., 2006

[88] for further information see Wagner et al., 2007

Based on Wagner's et al. (2006) results a study with 151 companies is conducted. The interviewed enterprises belong to the engineering or to the electro technology sector. They were all members of their sector association and appraised to be highly innovative by their association. The interviews were conducted by telephone. The enterprises had to evaluate themselves on all 23 indicators. In addition they had to evaluate the relevance of the indicators for their own innovation success.

A closer look on the number of employees of the interviewed enterprises shows that most of them are SMEs (see Figure 23). Focussing the structural characteristics of the interviewed enterprises, the group with 50 to 249 is the biggest with 41,7 percent of the sample. Followed by the group of 49 or less employees with 24,5 percent. These two groups accord contently the definition of SMEs of the European Union (Recommendation of the European Commission 2003/361/EG, valid since 01.01.2005). Together they make nearly 67 percent of all interviewed enterprises. The group with 250 to 499 employees is with 14,6 percent not that big. By the definition of the German Institute for SMEs Research – Deutsches Institut für Mittelstandsforschung IFM – in Germany these groups belong to the SMEs, too. Altogether the due of SMEs in the sample is nearly 80 percent.

Figure 23: Distribution of number of employees



The rest – 19,2 percent – of the enterprises have 500 or more employees. As only SMEs are the article's interest only the groups with up to 499 employees are the content of the following.

4.2 Results – Top 5 success factors for innovation capability

As described above the enterprises were asked to evaluate the relevance of the indicators for innovation success. Four answers were possible: "Highly important", "important", "less important", "unimportant".

On the whole all success factors found by Wagner et al. (2007) were evaluated as highly important or important by minimum 50 percent in average by 86,2 percent of the SMEs. Focusing only on the highest answer possibility – highly important – we can identify the Top 5 success factors for innovation capability. The most relevant success factor for innovation capability for SMEs is the "Courage of the companies' management for new ventures". More than 80 percent of all interviewed SMEs rated this factor as highly important. For more than 60 percent it is also important that "Employees can bring in new ideas and proposals at every time", that their employees have a superior engagement and an "Excellent knowledge of the competitive environment" and "a short decision making process". The factors with the percentage of the enterprises, which consider the success factor as highly important, are shown below in Table 17.

Table 17: Top 5 Success factors for Innovation Capability

rang	Success factor	Percentage of the SMEs, which consider the success factor as highly important
1.	Courage of the companies management for new ventures	83,6
2.	Employees can bring in new ideas and proposals at every time	68,0
3.	Superior employees' engagement	66,4
4.	Excellent knowledge of the competitive environment	65,6
5.	A short decision making process	63,1

These success factors approve of the advantages which are generally assumed for SMEs. For example there is a closer relationship of the employees in SMEs because of less hierarchies as well as better possibilities for an informal exchange. As we can see the courage of the companies management for new ventures is highly important for nearly all SMEs. Because of this more risks for new things and innovations should be taken.

5 An approach to analyse and evaluate innovation capability of SMEs

The world gets connected – the globalisation of the world economy is rising every day. European enterprises work in close cooperation with enterprises from all over the globe. The own innovativeness and the innovation capabilities of business partners and suppliers will play an even more important role then it plays today. For that reason a standardised approach is needed to analyse and evaluate the innovation capability of your own company and that of others. By using this standardised approach it will be possible to compare the innovation capability of enterprises. Moreover, the rating of the innovative ability can be implemented in auditing subcontractors. It can be used to valuate the actions for innovation today and it provides an outlook on how the company will develop in the future. This may help to decide whether or not to cooperate with a subcontractor according to his innovation capability. Besides using the approach to compare enterprises the approach can be used to improve one's own innovativeness by improving the identified weaknesses.

The Fraunhofer IAO has developed an approach to analyse and evaluate the innovation capability of SMEs. This approach points out the fields showing strengths of the company, and it points out those fields where weak points can be transformed into strengths. The analysis is done by 58 questions which deal with following topics:

- The summoned expenditures for innovation, as for instance the amount of employees in the research and development field
- The innovation results, for example the percentage of sales of new products brought to market or
- How capable companies are in transforming actions and expenditures throughout the innovation process into results. The Nine fields of Design of the Fraunhofer Excellence Model play a decisive role – for example strategy, technology and innovation

culture. Questions concerning the innovation culture deal with aspects such as innovation promoters, courage for new ventures and how the employees identify themselves with the company

This approach is available as paper-pencil-questionnaire or online. In both ways the user receives a score, the so-called InnoScore, which appraises the innovation capability of his company. The online version, available on http://www.innoscore.eu, affords some more features. Beside the score the user receives an extensive and detailed report and evaluation of its company's innovative abilities. To top it off, the evaluation includes useful advices for improving innovative actions and shows practical examples of highly innovative companies. These practical examples and advices help companies detect their own innovation potential.

This approach to analyse the innovation capability and evaluate it with an innovation score will be standardised and normalised. Soon the approach will be available as a CEN Workshop Agreement (CWA), which is a European pre-standard created by a workshop committee. By standardising the approach it will be possible to compare the innovation capability measurements of all enterprises which will use the approach.

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VI Examples and Cases - Critical success factors of a conducive organisation

1 The Cases of invenio, CRIT and FIAT

Andrea Bardi, Peter Butala, Francesca Di Lucchio, Paolo Franceschini, Francesco Garibaldo, Claudia Speth

In the following case studies are connected to the methodology of VIVA.

- Critical success factors of a conducive organisation are:
- Hygienic, physical and ergonomic factors
- Social relations and organisational factors
- Knowledge and competence management
- Human factors management.

1.1 Hygienic, physical and ergonomic factors

The European Agency for Safety and Health at Work[89] (http://europe.osha.eu.int/about/agency) in Bilbao can help in identifying good practices, beyond the accepted international standards, to create a suitable workplace for each activity.

1.2 Social relations and organisational factors

Some sub-critical factors can be identified accordingly to the general definition:

- a) Procedures, time and methods for cooperation
- b) Professional autonomy and responsibility
- c) Procedures, time and methods for integrating newcomers and young people
- d) Organisational framework supporting cooperation, responsibility and social integration

[89] Whose goal is "In order to improve the working environment, as regards the protection of the safety and health of workers as provided for in the Treaty and successive Community strategies and action programmes concerning health and safety at the workplace, the aim of the Agency shall be to provide the Community bodies, the Member States, the social partners and those involved in the field with the technical, scientific and economic information of use in the field of safety and health at work."

The sub-critical factor d) will be considered in its interaction with a), b) and c).

1.3 Cooperation

The kind of social cooperation within a group of people carrying out a common goal can vary considerably. Social analysis alone is unable to assess both the reason for the success or failure of team-working and the nature of group dynamics within teams. It is therefore necessary to turn to a psychological perspective. First of all, this perspective highlights the nature of the interaction:

There is a sociological and a psychological definition of the group ... which is very different. In the first instance, we have a description of those activities and actions that are accomplished at the group level. Vice versa, the psychological perspective is more oriented towards the description of what happens in the group at the mental level. It not only takes account of the actions that take place in it but also of all the mental parts that are activated by being in the group, whether they are of a rational or emotional kind.[90]

At the first stage of group working, there is inevitably a series of resistances that hamper the work itself. These resistances have been catalogued and described in various ways; some are well-known (for example, dependence, pairing up, attack and fleeing). Instances of these occur in all the work groups... In short, it may be said that when defences are triggered in a group, the collective activity is compromised; the group functions as a group work only when the defences are absent.[91].

[90] Rebecchi, E. –Difficulties and Potentialities of Group Work – AI & Society, vol. 8.3

[91] ibidem

From a psychological perspective, it is possible to describe the following factors for group-working:

- The existence of a definite theme, an exact goal.
- It seems obvious but *each one of us brings everything of himself to the meeting he/she is taking part in his/her personal and family problems, etc.*[92]. There needs to be an authority to see to the agenda and ensure it is achieved. Regretfully, this means that the group-work is not in itself as democratic as someone might think it is.
- There must be a leader.
- Once the above two conditions are achieved, this does not necessarily mean that the workgroup will become effective. It depends on many other conditions, which are dependent on both the social environment and the vision of the organisation. Two primary issues arise:
- the possibility of transforming the context by the group; in many cases, however, the environment can impede the activities and the goal of the group (adapting vs. shaping);
- group work is basically a functional activity, illustrated by the following:

The group's work is essentially heterogeneous as it combines different experiences of a more complex knowledge... The group work questions Taylorism because it not only establishes that the duties broken down by Taylorism must be reassembled (the so-called 'reparative' aspect), but suggests that group-work modalities must be utilised in order to realise creative and complex jobs.[93]

This is what we can call a **shared mental space**, i.e. the cooperation of people to deal with complex jobs.

Team setting

It is possible to see a strong convergence between the sociological /organisational perspective, and the psychological perspective. The empirical evidence supports this kind of close relationship between the scope of creativity and self regulation, as being the main reason for team-working. It

[92] ibidem
[93] ibidem

also determines the degree to which the advanced group working paradigm can be implemented.

The analytical digression on the nature of team-working has been influenced by our bias against the very simplistic concept of 'team-working' which is prevalent among social actors and policy makers. The basic concept seems to be that team-working is only a matter of social and organisational engineering: what in the old organisational model was designed as being divided, in the new model it has to be integrated. According to the analysis above, the setting up of teams in the socio-organisational perspective means to jeopardise the old structure as a whole and this is very difficult to attain and requires a large coalition of forces within each organisation involved in the process of change. This process will take a very long time because it will change the daily life of the organisation which is the solid base of the organisation. It will also interact with all social features - visions, values, culture, vested interests, and will involve all levels of analysis and action – micro-, meso- and macro. It means that setting up teams cannot be taken for granted and defined *à priori*.

We thus have two problems common to social research and psychological research: what are the conditions of reality that foster the onset of co-operative working models based upon a shared mental space and how should the organisational structures be interpreted?

On the grounds of the outcomes of the previous argument we can posit a very strong hypothesis: **teams are a *meta-level* of organisational development;** in other words **teaming** is a **state of functioning** and not a permanent feature of an organisational structure. What we mean is the capacity of an organisation to allow and to support a “call to life” of **shared mental spaces** as the very modern form of cooperation. From a practical point of view it implies that what should be inquired to assess an organisation and what should be developed to improve an organisational reality is not the very existence of permanent structures called teams but the **structural conduciveness** of the chosen organisation to allow the level of functioning called teaming. It could also be demonstrated, on the ground of empirical evidence, that there is an inverse relation between the degree of organisational embedment of team-working and its effectiveness. It doesn’t mean that the organisational structure is irrelevant because it must be conductive so it must be a *requisite organisation*, requisite for our purpose. There is not the *one-best-way*, the real conductive organisation, there are, indeed, a set of binding criteria defining *a space* of the possible variety of such an organisation. This space is not shaped and bounded only by the conductivity criterion but from broader criteria referred both to the different

societal levels (analytically) and to many different societal goals (practically).

So our way of reasoning can be summed up, in a practical perspective, in a scheme based on different levels and tools. Our general purpose is to identify a social framework, shared by social actors and sensible to individual's quest for autonomy and creativity at work, to create a new breed of organisations.

Examples

There are clear examples of it. For instance, as illustrated in one of the papers from the European funded PILOT project (financed within FP5 Key Action Improving the Socio-economic Knowledge Base (HPSE-CT-2002-00112) [94] the example of a **German paper mill** with approx. 100 employees may stand as a prototype:

for a systematic improvement of transformative capabilities in the paper & pulp industry. In general the innovation processes in this sector can be differentiated into two phases. There are **periodic fundamental innovations**, which are always connected with very high investments in the development – or better: the purchase – of a new paper machine.

Such a 'break-through' is usually followed by a series of **incremental innovations**, which are additionally needed to yield the maximum return of the high investments of the past. Apart from improvements of the paper-quality, innovations oriented towards an enhancement of productivity or to lower costs are largely prevailing in the dominating field of mass-paper production. As in the late 90ies during the new economy boom the demand for newsprinting paper increased significantly, the analysed paper mill thought of enhancing their production capacity in this sector. After the idea was given up to modernise an already existing company site it was decided in 2000 to found a legally independent subsidiary and thus to build up a totally new plant with extraordinary modern machinery and rather innovative organisational structures in the green field. Within the process the paper machine plays an outstanding, central role. Modern ones are up to 140 metres long, up to 25 metres high and can produce 1900 m/minute of paper. Hence the key challenge in this industry is to adapt all other productive factors hierarchically to the paper-machine. According to the company's

[94] Organisational learning – knowledge management and training in low tech and medium low-tech companies –
Contribution by Holm-Detlev Köhler ,Foundation University of Oviedo, and Klaus Schmierl, Institute for Social Research Munich, to the conference Low-Tech as Misnomer: The Role of Non-Research-Intensive Industries in the Knowledge Economy Brussels 29 + 30 June, 2005

business strategy requiring total productive maintenance the production process is characterised by a very modern and innovative **work organisation**. The huge paper machine is operated in a five shift system, each shift consisting of 14 workers, who run the whole production line. Each shift can on its part be further differentiated into four teams of three and one team of two – whereas each team is responsible for a specific segment of the paper machine. The different shifts and teams operate – in contrast to the usual very hierarchical work organisation in the paper industry – relatively autonomously and self-responsible. For example the change of the shifts is organised by the respective shift personnel themselves. The workers in a team have different, distinct qualifications. In general one is a paper-maker, one is an electrician and one is a mechanic. Such hybrid team qualifications are necessary, as the teams have to fulfil an extraordinarily wide range of various tasks and activities. Quite remarkably each shift is namely not only responsible for the running and operating of the machine, but also at the same time for its maintenance.

The reliance on the knowledge of its workers is foremost reflected by the fact, that only **skilled workers** are employed. Thereby it is interesting, that only a minority of the workers are explicitly trained as paper-makers or could yet gain any practical experience regarding paper production, when they started to work in the company. Because of this lack of practical experience resp. knowledge, the new workers were sent for four months to another paper plant of the company before they began to work at the company. There they could gain by various training-measures the necessary basic (practical and theoretical) knowledge about paper production. Apart from the paper-makers most of the workers were initially skilled mechanics, electricians or chemical workers. This specific composition of the work force is not so much a result of recruitment difficulties – though there actually existed serious problems – but much more a consequence of the company's special work organisation. The model of integrative maintenance namely requires **hybrid qualifications** – within the entire workforce and even within the single work teams. Furthermore it was aimed, that by the implementation of these teams a flux and transfer of knowledge is enabled.

Thereby **a reciprocal training-on-the-job** of the employees shall be initiated, in the sense that for example the mechanics train the paper makers regarding the maintenance of the machines, while in turn the paper makers impart their paper-specific knowledge to their colleagues. Finally, the relevance of this internal source of knowledge is reflected in the efforts the management undertakes to **promote learning processes**. For example a specific collective agreement regarding the working time was implemented

at the plant. Whereas the weekly working time in the paper industry is usually 38 hours, the workers of the company must work 39 hours. In the additional hour the employees are obliged to take part in on-the-job training – e.g. to learn to operate on different sections of the paper machine.

Thereby it is striking, that the concrete proceedings of this training are not determined by the management. Much more the complete training – even the timing – is organised quite autonomously by the employees. Only its content is reconciled with superiors according to production necessities and the company's business strategy.[95]

A second case in point is invenio's hierarchy and project-group system

invenio is an international operating company with locations in different countries. All locations have the same structure and kind of team working. All teams use the same quality handbook and as result of this the same processes and standards of documentation. The teams are led by a team leader and have different sizes, normally between 1 to 12 persons. The team Manager is being responsible for all parts of his own profit centre. The teams are specialised for example working for special branches or customers or depending on the service they provide, like the Digitizing team only does digitising projects or the team for gearings in Rüsselsheim only works for the Powertrain GmbH of Opel. The size of the team depends of the markets situation and is not fixed. In the history of invenio the number and size of the teams did change very often. Every employee of one team has to be able to change the team or the location, having a short introduction phase, than starting to do the job in a new team. This flexibility of changing teams and work is a must to stay competitive in market.

Because of the bright service of invenio and the specialisation of the teams, the employees often have to work together with another team of the company. In the locations you often find open-plan offices to work in. The whole team is sitting in one room and if possible also the leader is in the same room or very near to his group. Therefore all the employees know each other very well and thus make it easy for themselves to get necessary information or decision from the manager very fast. Also the working places are structured to each other, 4 tables are standing together. The four persons sitting there are looking direct into the face of the others and may ask questions or start discussion without having to leave the place. On the other hand conference rooms can be used by all employees to have separated discussion. The history shows that the more rooms a location has and less

95 Ibidem, pp. 18-19

people are sitting together in one room the communication is getting worse. The company provides always new technologies to share information. In Germany all locations are connected to the same data server. Personal meetings, net conferences, e-Mails and telephone are the normal ways of communication.

Internal Culture considering the example written philosophy

Whether working in a large or middle-sized company the employees should get information about the corporate strategy. invenio is certified by DIN EN ISO 9001:2000 and publishes on its intranet a quality management handbook with the companies goals, vision and processes. Moreover information and procedures which are not ISO relevant are stored in a special organisational handbook which is also on the net, accessible to all members. Here the employees find, for example all telephone lists, contact persons, rules in the specific locations and so on. One document shows the corporate philosophy, which was defined by the COO years ago. Split into short sentences the COO defines the way of working together and the attitudes an employee should have.

Beginning with the Visions, like assuming responsibility and to think ahead, the document lists different themes. In a short sentence the headlines are described like the headline “possibility of workers participation” is explained as the employee having sole responsibility as part of the whole organisation. Self-evident points were shown, for example customer and competitive orientation, but also the culture of lifelong learning and to see problems as challenge. The document is binding with all employees on all levels. Starting in the company the new employee is informed about this content and he or she can read it whenever it is necessary. The employees who get this information, especially young ones feel very well, because of the possibility to criticize, to ask and to do faults without getting trouble at the first time. Moreover they see the chance to think creative, to discuss solutions and to bring forward something until result. Also they recognize that they have to take responsibility for the result of their work. To publish this information and to control the performance is one of the critical success factors of invenio.

Tools

Having defined what cooperation can be about it is quite evident that in this case, as in the case of professional autonomy and responsibility, there are two sets of tools to be designed: one to gauge the actual operative situation from the point of view of performance and one to assess the enabling conditions. The final assessment is the combined evaluation of both.

Secondly a set of tools for a self assessment of the specific organisation should be defined, therefore a simple, easy and not much time consuming scheme addressed to the owner/s and /or the manger/s of the organisation. After this stage, in order to start an actual process of change a more in-depth analysis will be required involving also all or relevant parts of the employees.

Self assessment

A check list:

A. Performance factors

1. The rational of the cooperation scheme existing in the firm. Is there a scheme more oriented to cooperation among people carrying very different tasks and with different professional competences or more oriented to people performing quite equal tasks with very similar skills?
2. Was it a top-down decision or were people some how involved?
3. Is this practice only restrained within the boundaries of a corporate function or also cross-functional?

B. Enabling factors

4. Are the team's members autonomous in deciding the way to perform and the timing to fulfil their goals? Have they some budget autonomy?
5. Are there time slots and facilities to allow people to meet to discuss their cooperation duties? Can they access to ICT tools and facilities to support their cooperation?
6. Is quality control a corporate central function or partly delegated to the teams?

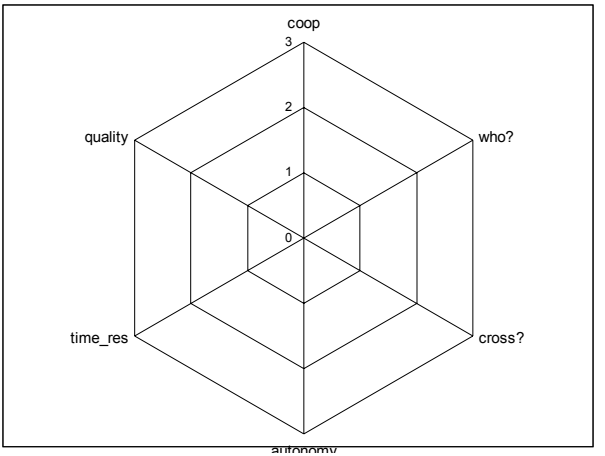
It can be used a score table based on three scores: low, medium, high and quadrants can be drawn. There are tables describing which situation each score is identifying.

Table 18: Score table

Cooperation pattern: a self assessment tool		Enabling factors		
		4	5	6
Performance factors	1			
	2			
	3			

Or a radar figure can be drawn based on the full set of factors without any distinction between performance and enabling factors. The first method is more oriented to identify causal relationships, based on the theoretical assumptions illustrated before; the second one is more oriented to a benchmarking exercise. To ease the self assessment exercise a table connecting scores and answers should be designed, possibly differentiating different kind of activities to make the exercise very up to the point.

Figure 24: Radar figure



In-depth analysis:

There are already existing questionnaires addressed to all or relevant parts of employees to assess in-depth each of the previous factors.

1.4 Professional autonomy and responsibility

If we restrain ourselves to focus only on the problem of professional autonomy and responsibility two patterns are critical: the quest for individual professional autonomy and responsibility and the actual possibility, we mean the capability and the actual conditions to use it, for individuals to participate actively in cooperation-based professional activities. The second pattern is only a different way to look at the problem of cooperation and can be afforded within the same operative framework. The first pattern is closely interconnected with the second one but it is not fully embedded in it; so we need a specific operative framework to assess it. Some concepts are useful; we have to make a clear distinction between the Argyris Model II and Model I; in practical and operative terms we can articulate this distinction contrasting two basic individuals' cognitive models: **problem solving** and **problem setting.** Problem solving is a functional ability to afford a problem in a structured situation and to go through it successfully; it is of course a very important asset for every organisation to have a large stock of this cognitive capability among mangers and employees. What can be considered a special feature of excellence for an organisation is to improve the stock of problem setting capability; we mean the specific cognitive capability to identify what the problem at stake actually is in a semi- or non-structured situation. It should be stressed also in an individual-oriented perspective that this kind of cognitive capability is not only a personal capability but an interaction between personal capabilities and an organisational environment allowing, supporting, recognising these capabilities as personal assets to be rewarded – that is again a problem of conduciveness.

Tools

As already said having defined what professional autonomy and responsibility can be about it is quite evident that also in this case there are two sets of tools to be designed: one to gauge the actual operative situation from the point of view of performance and one to assess the enabling conditions. The final assessment is the combined evaluation of both.

Secondly, a set of tools for a self assessment of the specific organisation should be defined, therefore a simple, easy and not much time consuming scheme addressed to the owner/s and /or the manger/s of the organisation. After this stage, in order to start an actual process of change a more in depth analysis will be required involving also all or relevant parts of the employees.

Self assessment

A check list:

A. Performance factors

1. Authority. The level of personal autonomy referred to the hierarchy, that is an assessment of the average delegation of power;
2. Planning. The possibility for individuals to plan their own tasks;
3. Direct contacts with customers. An assessment of the kind of roles and functions allowed to gave direct contacts with their customers;
4. Functional responsibility. An assessment of the kind of roles and functions with functional autonomy.

B. Enabling factors

5. Staff size. Is the staffing level adequate for allowing people to have time for affording also non-strictly functional tasks?
6. ICT. Are the ICT tools and facilities adequate to allow people to afford also non-strictly functional tasks?
7. Education. Is there a continuous learning scheme? If so, for whom?
8. Knowledge resources. Are general knowledge resources made available for people to afford also non-strictly functional tasks?

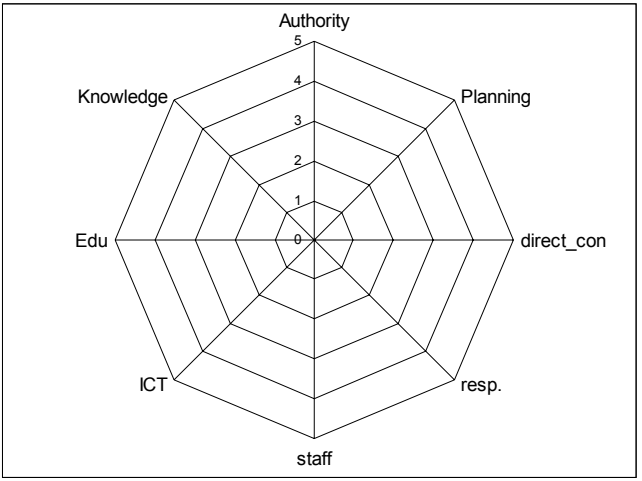
It can be used a score table based on five scores: low, medium-low, medium-high, high and quadrants or a radar figure can be drawn based on the full set of factors without any distinction between performance and enabling factors. The first method is more oriented to identify causal relationships, based on the theoretical assumptions before illustrated; the second one is more oriented to a benchmarking exercise. The reason of a scale with five score instead of three is related to the difficulties to sharply drawing boundary lines among actual levels of personal professional autonomy. There are tables describing which situation each score is identifying.

To ease the self assessment exercise a table connecting scores and answers should be designed, possibly differentiating different kind of activities to make the exercise very up to the point.

Table 19: Table connecting scores and answers

Professional autonomy and responsibility: A self assessment tool		Enabling factors		
		4	5	6
Performance factors	1			
	2			
	3			

Figure 25: Radar figure



In-depth analysis:

There are already existing questionnaires addressed to all or relevant parts of employees to assess in-depth each of the previous factors.

1.5 Procedures, time and methods for integrating newcomers and young people

The case of invenio can be considered as a best practice to be taken as a benchmarking case.

Induction of a new employee at invenio:

Beginning in a new company always is a critical phase in business life for all people. The first days the person needs to learn about the rules and processes of the company, to get to know the colleagues and their corporate behavior. Maybe they are friendly or they are in a snit because they lose time training the new one. Many questions are waiting to be asked at the right time to the right person. The good and fast integration of new employees is one of the success factors in companies. The idea of invenio is to accompany the new people personally and with written information on their first days. Before the new colleagues enter the door different things have to be prepared by the line manager, for example business cards or an introduction interview as information for the employees. The first day starting at invenio begins with an introduction seminar. Differentiated into two groups, employees and manager, the seminar has different contents and length of time. Starting with a short introduction of each participant, they feel well, because not being the only new one in the company. Basic Contents in both events are the presentation of the full invenio service by the sales department and the explanation of the philosophy. Another significant part is also the presentation of rules in the company (i.e. the whole office is non-smoking area; coffee in the kitchen is free for all employees, but the one who takes the last cup out of the machine, has to boil new one) and the social events (i.e. every year in summer there will be a barbecue party for employees and their family). The new employee coming out of this seminar, they know about the necessary rules in the company, about the whole service and the spot, where he gets all written information (i.e. the storage location of the Quality manual or the Organisational handbook). After that the program follows with a round tour through the office, presenting important persons and infrastructure. The seminar for the managers lasts 2 days including the round walk and introduction to all management colleagues. Both groups get furthermore an introduction map with necessary information for the next days and a summary of the seminar. Accompanying the people in this way is helping them to start quickly and with a good feeling. Creativity and teamwork is cultivated and the corporate behaviour shown very well.

Education methods and appraisal interviews at invenio

Lifelong learning is one of the tasks in the invenio philosophy and a success factor for innovative companies. To secure the realization of this task a personnel education program is implemented. The program shows all training activities which can be offered by invenio, differentiated in internal and external trainings and training methods. In addition a career model for all positions in the company is defined and published. Every employee is able to look at it, if he needs information about, because it is on a central storage place. Knowing about the two contents the employee may create his own goals for his personal and business future. Every year an appraisal interview between manager and employee has to be done. It is subdivided into two parts; the first is a review about the last year and the fulfilling of the tasks and personal competencies of the employee. The second part is future-oriented and defines the new common goals and necessary trainings in the following year. This appraisal interview is not very simple to handle, both participants have to prepare the contents before the meeting. Normally the expectations, the self-assessment and the personal goals of the employee are different to the one of the manager. The task of the manager is to create a common understanding and goals. Both come up with their own estimation and discuss it to get a common agreement. After that the second part leads to define the tasks and goals for the future. One point of that is the definition of training requirements. The training program helps the manager to arrange everything with the employee without taking too long and without bureaucracy. The appraisal interview is a well structured form that leads the involved persons through all necessary points. The education program and the appraisal interview are some of the employee oriented processes which are part of the quality manual of invenio. This shows the high priority of these processes in the management strategy.

Introduction of a new employee at CRIT

CRIT research implemented over the years a simple and easy methodology, that allows to develop, day by day, the relevant competences in newcomers, through an effective and comprehensive training on the job.

Newcomers are immediately involved in operative tasks, with an increasing awareness of the role and competences they are expected to provide to the company.

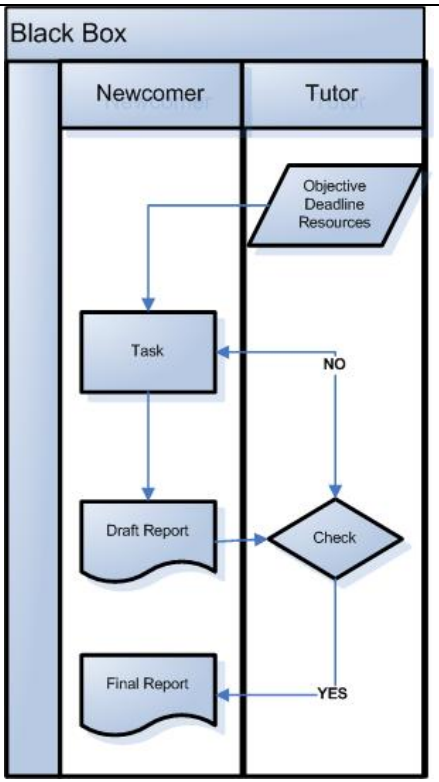
Basically, the methodology can be implemented by:

- Black Box Session;
- Tutorial Session.

Both systems are based upon interaction among two actors: company tutor (in charge of supporting new comers in the first period of activity) and new comer. Following paragraphs clearly describe both approaches.

Black Box Session

Figure 26: Black Box Session



Black box session has the objective to test the initial competences of new comers. Autonomy is assessed as well.

The company tutor gives newcomers some basic indications on the objectives to be achieved: expected outputs, deadline, available resources. Newcomers are left free to choose methods, tools and methodologies to solve the case.

Only a final check is performed.

In this case the output does not fit to the planned objectives, executive tasks are performed again.

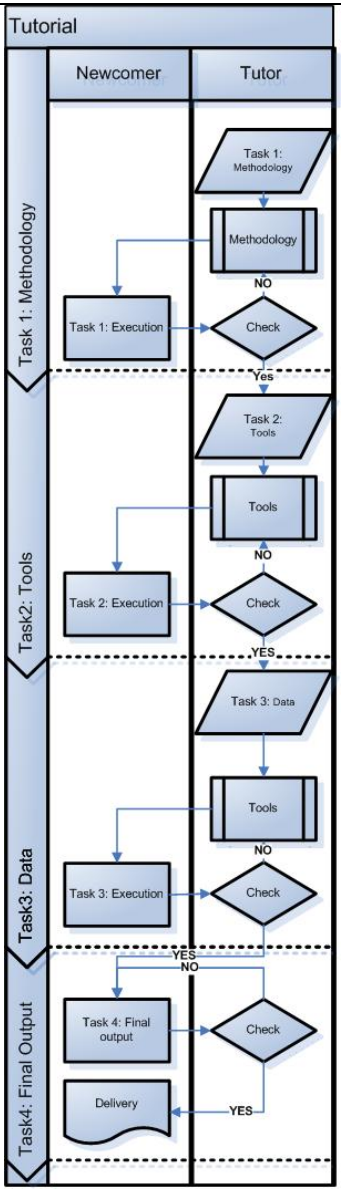
Benefits

This method allows to immediately evaluates resources as regards:

- Autonomy
- Creativity
- Motivation
- Technical preparation

Tutorial Session

Figure 27: Tutorial



Tutorial session is a step by step process that allows to teach newcomers, on single tasks.

Main blocks that are considered are:

- Methodology
- Tools
- Data

Each executive step of new comers is checked and assessed, before prosecuting to the following task.

This methodology is quite more time expensive than the Black Box session.

It requires an in depth tutoring of newcomers, whose activities are checked in details.

Benefits

- This method allows to immediately evaluates resources as regards:
- Technical preparation.
- It does not allow to check and assess the newcomers' autonomy, neither motivation.
- It is really useful to assess technical resources.

1.6 Knowledge and competence management

In VIVA Work Package 5 was chosen the conceptual approach of **open innovation**.

The concept is very convergent with that of a conducive organisation as to two main points:

- stressing the relevance of the permeability of a firm's boundary from processes occurring outside and the existing or missing ability of that firm to internalise those processes as drivers of innovation;
- the qualification of the organisational aspects of the process of change toward innovation excellence as a shift from vertical integration to smart organisation, one of whose feature is what we call the capacity of an organisation to allow and to support a "call to life" of shared mental spaces as the very modern form of co-operation, i.e. its conduciveness.

In the last decade the competitive global scenario has deeply changed compared to the past: a turbulent environmental and competitive contest, characterized by global competition, incentive to innovation, automation spread and information technologies development, replaced a relatively static environment. Organisational contest dynamics, in terms of both managerial culture and business disciplines evolution, replied to it.

Therefore, the birth of more and more flexible and transient flat structures, in which the individual and his competencies assume a central role, corresponded to the functional approach overcoming and to the adoption of the process vision: management system focus moves from organisation to people, underlining the performance qualitative aspect.

For this reason competency-based systems of management (of human resources but not only) are spreading at present.

Competencies Management Subject is a set of methodologies and tools, supporting the firm in Planning, Selection, Evaluation, Human Resources Assignment, Training, Reward, Competencies Diffusion, Carrier Planning, Document Management, according to business strategy, values and objectives.

The aim is to optimise human resources employment in business processes, in order to produce in requested times, at competitive prices and respecting quality objectives. For this purpose the main thing is to identify which competencies are required by the process taken into consideration and which

ones are available in firm, in order to define human resources needs of each activity and to assign the most suitable resources to each one.

In particular, Competencies Management Systems diffusion involves highly variable and complex sectors, in which firms are forced to continually adapt to environment, in order to survive, and are pushed to innovate, in order to achieve a defendable competitive advantage.

A further parameter is joined to firm dimensions and processes/projects number and integration. The quantity of data to manage and the difficulty in Planning and Human Resources Assignment, typical of big firms, are added to differentiation and innovation needs, basic for small firms.

1.7 The FIAT Research Centre (CRF) model

Fiat Research Centre has developed a set of tools and methodologies about Competencies Management during the last 5 years.

Once implemented, they allow firms to exactly identify and develop the competencies required by each role and those ones that each individual is able to offer.

The macro-phases of a Competence Management Approach are the following:

- Competencies Mapping
- Identification of Competencies in the firm:
- Historical data analysis (work situations analysis, positions analysis, processes analysis).
- Interviews.
- Results organisation in list, tree or matrix.
- Definition of a knowledge levels legend for each professional figure (declaration).
- Competencies Evaluation
- Identification of observers' network.
- Evaluations Survey (interviews, questionnaire,…).
- Evaluations analysis and join.

There is also the opportunity to support Human Resources Assignment and Activities Planning, analysing and comparing the available and required competence profiles before assigning resources to processes and activities.

Advantages/Disadvantages

The Competencies Mapping allows identifying a list (which can also be structured as a tree) of the competencies available and/or required by an organisation or a part of it, and/or necessary in order to implement their processes/activities. To reach these objectives, the firm has to define values, strategies and business objectives, which are the phase inputs.

This activity is interfaced with the organisation and its processes analysis, as with document management, being a valid support.

Competencies evaluation methodologies aim to provide tools and methods for collection and join of (numeric or verbal) judgements, expressed by an observers' network (bosses, colleagues, self-evaluation) on each individual. Each resource can be assessed, during several evaluation sessions, on the base of the competencies enacted in a work situation. It is necessary that this phase gets the organisation structure and/or its processes and competencies map as inputs.

The resulting evaluation forms can be used in order to manage Selection, Rewards, Training, Carrier Planning and Mobility activities, on the base of the knowledge level individually or organisationally owned.

Finally, the opportunity to support Human Resources Assignment and Planning is dependent on the enterprise capability to identify the competence profiles requested by each process/activity and to compare them to the available resources, assessed on the base of their competencies.

1.8 Practice example of implementation Alfa

Company presentation: Alfa is a small molding enterprise, born in Southern Italy in 1997. It is made up of 9 people and is organised in two units, dedicated respectively to molding processes and administration ones.

Initial Situation - Problem

- To identify, analyse and organise the technological competencies for the molding production processes.

Application of method – Solution

Approach

- Analysis of production processes.
- Data gathering about the processes and the related competencies requested, throughout interviews to managers and technicians.
- Analysis and organisation of collected information and competencies map building.
- Activities done
- The molding processes have been analysed. Several interviews have been conducted to managers and technicians in order to:
- Identify different existing technologies, from the traditional to the innovative ones, by means of which the process is implemented.
- Structure each technology in phases.
- For each phase, identify the competencies requested to carry it out.
- Link the specific professional role (job profile) to each phase.
- With regard to each phase and technology, define a scale of knowledge levels (from Awareness to Application to Master), provided with a legend (declaration), and establish the related level requested for each competence.

Results

- For each technology of each process, the map of competencies (with related knowledge levels) has been built.
- For each process, the legend of knowledge levels (Declaration) has been built for each process phase.

Table 20: Example of Competence Map for a process technology

TRADITIONAL INJECTION					
Competencies	**Level of knowledge**			**Phases of Process**	**Roles (Job Profiles)**
	Aw	**Ap**	**M**		
Knowledge of traditional simulation tools		x		Simulation (Calculation molding check)	CAE Analyst
Knowledge of traditional modelling		x			
Knowledge of fluidodynamics	x				
Knowledge of traditional process (polymer injection)		x			
Knowledge of material		x			
Knowledge of die components			x	Die Design	Technical Designer
Knowledge of material	x				
Knowledge of traditional process (polymer injection)	x				
Knowledge of CAD			x		
…					
…		…		...	...

Table 21: Example of Declaration for a process technology phase

Process: traditional injection

Process phase: simulation (calculation molding check)

Competencies	**Awareness**	**Application**	**Master**
Techniques and tools to model physical phenomena. Knowledge of process Knowledge of modelling Knowledge of fluidodynamics Knowledge of material Knowledge of simulation tools	He knows the theory about the main performance parameters.	He knows metrics and parameters describing physical phenomena in detail.	He is a professional reference to his colleagues in understanding and interpreting the system performance data.…

Advantages, added value by the use of the tool

Comparison among existing technologies, from the traditional to the innovative ones, in terms of phases, competencies requested to carry out each phase and competence knowledge levels.

Opportunity to identify the competencies shared by several technologies and therefore more critical for the process.

Opportunity to identify the competencies gap and competencies knowledge levels gap between two technologies, in order to define specific training paths.

Conclusion and recommendations

Competence Management is cross-sectorial, therefore it can be applied without exception by:

- Small and Medium Enterprises
- Extended Enterprises
- Sector Enterprises
- Services Enterprises

1.9 Human factors management

Again invenio as benchmarking case.

The human resources of invenio are one of the highest capitals invenio has. Therefore many indicators were developed and measured to manage the people in the company in a good way. Some of them shall be explained afterwards.

Losing people is losing very much competence, know-how and yearlong experience that means in sum having much new investment and a lack of time till a new one is able to replace the leaving one. Sometimes you lose directly with the person the project he or she was working on, too. Because of this high priority one of the quality goals is to reduce the number of unplanned leaving employees. Setting the number of withdrawals as indicator for the company's success and quality, it is measured regular and in the case of having bad results the general management is informed and actions always have to be defined and practiced.

As service provider in the engineering area invenio has to teach his employees very often. The range of the necessary number of training hours and the budget is defined as company goal every year. It is not a maximum

budget, but a range to reach in minimum. For example the CAD-Software which is necessary to design and develop is not taught at universities. Therefore every young engineer starting after his Diploma has to be trained in the basic CAD-Software and usually, he gets update training or induction in new modules every year. Project management, communication and creativity tools have to be taught, too. invenio established a training department with trainers who work together with the employees in the operative work. The trainings they develop are real practice oriented and were also sold to other companies. The more training invenio can produce inside, the better results invenio reaches. But new training techniques like E-Learning combined with training sessions are tested at invenio as well.

From the beginning the new employee is leaded and coached. On the one hand an education program was developed and established in the quality manual. On the other hand appraisal interviews every year analyse and discuss the competences, goals and measure the well being of the employees. The quality audits check this in practice.

The training program and the standardised appraisal interviews of invenio are kinds of examples and indicators of invenio to motivate employees to stay longer in the company and feel well.

1.10 Networking capabilities

The process of globalization requires a rethinking of how economic activities are carried and organised. Firms must learn how to operate effectively in this new economic context, which has seen a concomitant opening up of markets and increasingly technologically complex products, the multiplication of the varieties of products and services, and a reduction in lead time and the life cycle and development of products.

SMEs are frequently incapable of managing this new complexity inside value chains that, today, are on the one hand longer – sometimes global – and transformed with respect to their previous forms.

What is needed is to increase the capacity of small and medium firms (SME) to seek forge new paths that allow them to capture value added that is today the *appanage* of others.

For this purpose a tailor-made intervention strategy and proper tools should be designed. The objectives of these methods are to help productive systems with a significant presence of SMEs to overcome the fragmentation and characteristics of such systems. This approach is not based on the promotion of traditional processes of concentration and verticalization, but on

supporting the construction of horizontal company networks, taking advantage of SME's characteristic flexibility. In this context, a network is a dispersed but integrated productive system, made of autonomous and complementary firms, collocated inside the same product or service *filière* and capable of recomposing itself flexibly as a function of the client's demands.

To arise the awareness of the advantages deriving from the implementation of the structured networks the Emilia-Romagna Regional Government created a specific innovation centre called Pi.M.I.NET. One of the main goals of such a centre is to define a specific toolbox.

The Pi.M.I.NET Innovation Centre focuses on supporting firms in the identification of existing but not adequately exploited product, market and technology synergies. The Innovation Centre then guides those firms in the definition and implementation of the most appropriate organisational and management models for taking better advantage of the synergies identified.

In this sense, we promote the birth and development of new and more integrated networks, capable of adding incremental value from which all of the firms in the network benefit.

The birth of groups and integrated networks is a phenomenon already underway, in as much as it is imposed by market dynamics. The objective of Pi.M.I.NET is to accelerate this process, providing SMEs with a series of instruments capable of permitting more effective levels of integration among firms and an increased capacity to take advantage of existing and potential complementarities and synergies. To this end Pi.M.I.NET, in the design phase of the network, supports firms in the eventual search for complementary industrial partners where such partners have not previously been identified. This does not mean simply doing old things at a lower cost. Here we are talking about doing something new.

The following figure sketches the general framework for the development of networks between SMEs.

1.11 A self assessment tool for SMEs

A practical root to arise the awareness of the opportunities deriving from the upgrading and/or the creation of networks between interrelated SMEs may be supported by tailor-made vocational training activities for SMEs.

The companies involved could be gathered according to problems instead of sector. All SMEs that act in extended value chains managed by big contractors or SMEs that are far from the market may be in principle

involved in the training activities. The target persons should be the owners in case of micro-company or the employees responsible for supply chain, the operations managers or the managing directors, according to the company profile.

In case of declaration of interest from single companies or sub-group of company, one-to-one tutorship activities provided by Pi.M.I.NET could create the condition to arise networking capabilities.

A tentative selection of potential actions devoted to boost networking between companies and valorise interconnections among sectors is:

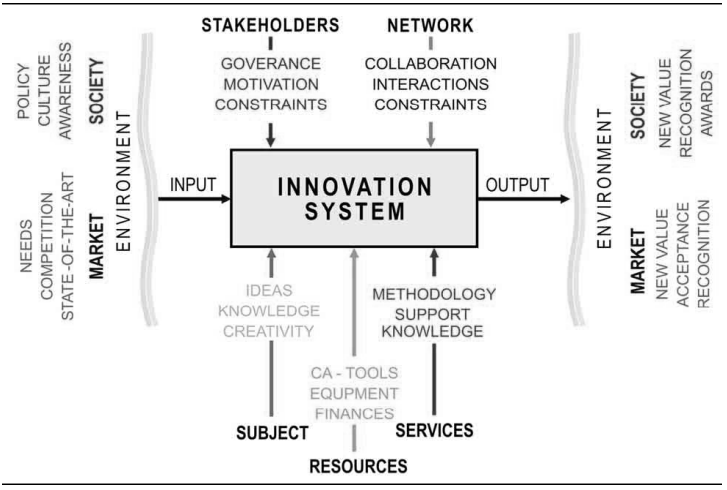
- Mapping the interconnections among sectors and local productive systems, in other words the analysis of the existing and potential complementarities and synergies, among sectors and territories.
- Mapping of the system of relationships among firms.
- Analysis of the value chain inside of which the firm or network of firms operate.
- Identification and analysis of the existing and potential complementarities and synergies among firms (market, product and technological synergies).
- Evaluation of the possible areas of competition.
- Research and selection of the network partners, if they haven't already been identified.
- Organise innovation dialogues and workshops to involve stakeholders.
- Definition of the organisational model of the network.
- Definition of the distribution of the competencies inside the network and of the activities the coordinating node is in charge of.
- Assistance in defining the system of governance (rules for entrance, exit, *benchmarking* against firms outside the network) and of the mode of formalising the network.
- Accompanying the implementation and monitoring of the network following the start-up phase.

1.12 A system oriented assessment of excellence in innovation management of a network/cluster.

Following the WP 4 findings we can now draw the innovation system's basic diagram, as analysed by Butala and Sluga[96], which is shown in following figure.

"From the systems' point of view, innovation is a process, which transforms inputs into outputs. In order to control the process, an adequate control system has to be introduced, which performs goal-oriented control and provides control inputs into the process.

Figure 28: Innovation system model



In the case of innovation systems within a network/cluster, two elements control the whole system. The first one represents the stakeholders representing individual network partners, which provide governance, motivation and a set of constraints. The second is the network/cluster management, which supports collaboration and interactions as the driving forces of innovation. An additional set of constraints in terms of rules related to network operations can be put in here.

The innovation process is performed by the human subject (individual, team, virtual team). The role of the subject is to perform the innovation process. Therefore it has to possess (tacit) knowledge,

[96] Butala,P., Sluga, A. – Innovation in Clusters and Networks, paper presented to…

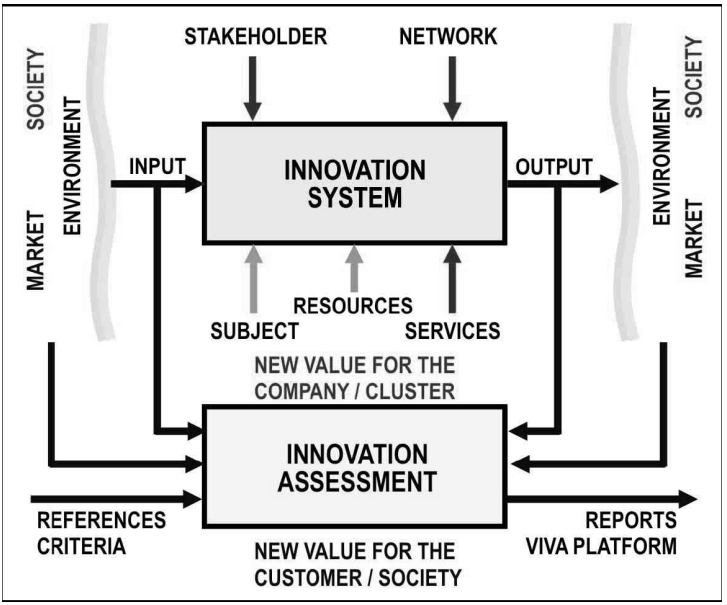
should be creative and capable of generating new ideas. In order to perform the process, different resources are available for the subject, such as development equipment, computer aided (CA-) software tools, tools for e-collaboration, etc. and, perhaps the most important one, the finances. The process is also supported by various services. Here, explicit knowledge from a knowledge base and, if needed, supporting expert advice flows in. A comprehensive methodology is needed as well. As the networks/clusters are relatively new forms, adequate methodologies are still under development." The innovation system should be observed as a dynamic system. As the environment is changing (both the market and the society segment), the innovation system is evolving, too; this co-evolution is a very important issue and should be maintained permanently. And as the authors clarify:

In order to assess the capability of a network/cluster for innovation as well as innovation excellence one has to examine the input, control input and output factors of the innovation system. The factor groups described with corresponding capabilities are listed in the table below. For scoring of the factor groups, normalized and unweighted scores in the interval [0, 1] are proposed as shown in the table.

The distinction between innovation capability and innovation excellence can be drawn between the input factor groups (FG1,…,6) and output factor groups (FG7, 8). The input factor groups define the innovation capability IC or readiness for innovation, while the input and output factor groups together define the innovation excellence IE.

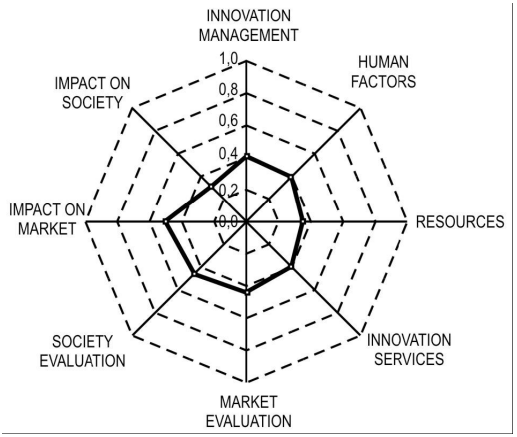
For the assessment, i.e. scoring of the factor groups, clear criteria have to be defined. As the assessment is relative to a reference, the references in terms of best practices, etc., have to be at disposal. The assessment can be performed by a neutral group of referees (experts) or also in a self-assessing manner. In the last case one just gets an indication of the company's or network's innovation capabilities and excellence.

Figure 29: Model for assessment of Innovation capability



As mentioned, the proposed assessment model includes eight factor groups, i.e. eight dimensions. In order to make the scoreboard more interpretable, the data can be visualized by the 8-dimensional spider net diagram type, as shown in the figure below.

Figure 30: Visualization of the eight-dimensional space of the innovation excellence assessment – an example



2 WITTENSTEIN AG – The Fitbone® Success Story

Helmut Ortmeier, Miriam Spangenberg

2.1 Vision and Innovation = Realise Generated Ideas

The largest source to enable raising strategic competitive advantages is the vision. The task of leadership is to develop consistent ideas of the future and to enforce them, because innovation needs vision!

A holistic vision

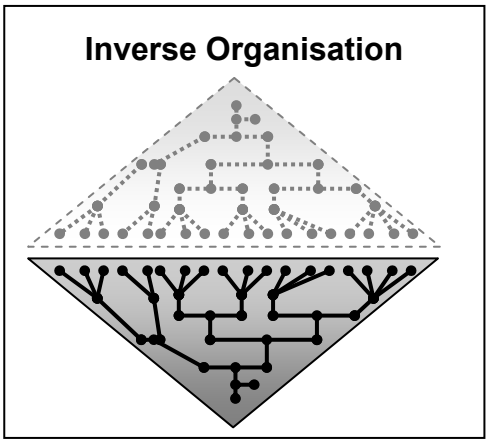
- donates signification
- fosters and postulates innovation and
- generates the necessary profit.

However, the practical realization of this dictum creates natural antagonisms which are meant to secure the status quo in the system. So there is the need for a force founded on the vision for the enforcement of the innovation and furthermore the employees conviction in order to make the status quo changeable at all. The aim is to enforce a change in terms of the vision preferably completely and frictionless and to cause a positive development and acceptance of the economical respectively social circumstances. We all admire successful firms and people who succeeded in realizing their vision and living their dreams. Discovering one's values clearly and defining them as well as formulating the vision, goal and appointment is reckoned a cumbrous notional process. Therefore, most people surrender in the very beginning and everything stays as it was.

Our thoughts own enormous power. They determine our expectation, attitude and acting.

2.2 Function of leadership

Figure 31: Inverse Organisation



In the established imagination of an enterprise organisation we all see the chief and the managers on the highest hierarchy level and the employees below. The structural organisation places the top management on the first position in the organisation chart. This Tayloristic approach – thinking above, acting below – made sense in the past, when unlearned workers manufactured industrial products. But when it comes to generating ideas and innovations, these hierarchies act more and more counterproductive. Ideas do actually not emerge at the push of a button. Furthermore, each employee in the enterprise is an expert in his job and more competent there than any boss could ever be.

The model of the „Inverse Organisation“ grants highest priority for the employees working on the maintenance of frictionless business processes. The managers in this model care for the fluency of the processes and create room for creativity and innovation for their employees.

So, the manager is the highest service provider of the vision and the structure and uses its exercise of influence in order to fulfil this task.

The classical hierarchies are the ideas killers par excellence since they work according to the principal „knowledge is power“. New knowledge and ideas nearly always endanger the established circumstances. Therefore, alterations which are positive for the enterprise but negative for the management are often suppressed or at least hindered. If someone brings in new challenging ideas – and an innovation is challenging per definition – is often catching resentment. Hierarchies foster opportunism instead of innovations.“

(Ulrich Klotz, Technology Expert in the directorate of the IG Metall).

2.3 How do we understand innovation?

„Innovation is a dazzling term. Management Expert Fredmund Malik defines it representatively for many others in the following way: „Generating ideas is completely different from realising ideas. Just this is innovation. Each and every innovation is an expedition into virgin soil, an alpinist first climb, but they are mostly treated as paschal airing."

At WITTENSTEIN, we understand innovation as a continuous process, as an active and participative cooperation within the firm. It is the task of the managers to create design spaces and eliminate obstacles with regard to the vision.

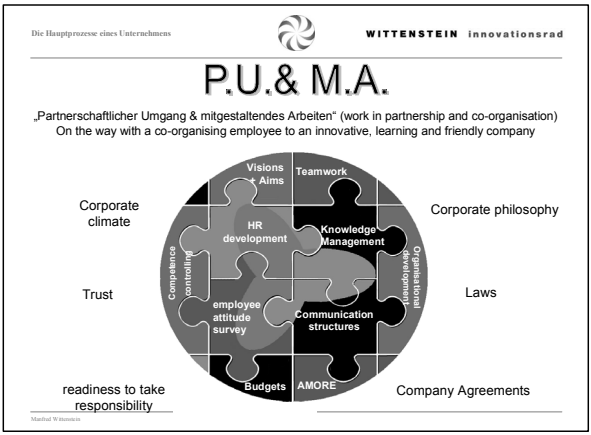
Each employee – whether manager, appointee or worker – is called up for innovation.

We consider components as precious; we realize them by manifold act ivies and programs:

First component: Enable the change

We want to give our employees the tools for participating actively in the innovation process and for designing it. Qualification and further education are important elements here: In the WITTENSTEIN Academy numerous seminars for the most different topics are provided, a trainee program for new employees ensures the getting to know of the firm from the very bottom and in manager procreation programs future managers are prepared for their task comprehensively. In addition, the WITTENSTEIN foundation awards a scholarship for a high school graduate annually and in the competition „Young Creative Heads in the Taubertal", students in the region are able to demonstrate themselves as inventors.

Figure 32: P.U. & M.A.



Themed by „dare responsibility“, all employees at WITTENSTEIN are requested to make commonly carried out decisions. Within the scope of the project P.U.&M.A. (in partnership association and design contributional work) budgets are managed independently and all employees are requested to participate actively in the design of the enterprise.

Second component: Sensibilisation by in-company design

An enterprise should create a comfortable atmosphere for its employees in order to increase the motivation and foster the creativity. WITTENSTEIN implements this e.g. by an open architecture of the building which is embedded in a “world garden” containing crops from all five continents. Sport possibilities such as beach volleyball and a fitness room as well as a barbecue area cater for the necessary balance and revive the communication; so also does the annual “Schnulleralarm” where WITTENSTEIN parents and kids come together and cultivate contacts.

Third component: Look beyond the edge of the plate

Developing and realizing successful ideas, we do not restrain our focus on the interior of the enterprise. Workshops such as “WITTENSTEIN meets Science” or the series of lectures “Sommerkolleg”, for which already important referents like Prof. Dr. Eckard Minx or the Fraunhofer chairman H.-J. Bullinger had been won, care for a wide horizon and initiate new

impulses. And the European opera offspring competition DEBUT is all two years about high potential talents in the field of opera singing – and not "only" about quality in the field of power train engineering.

Fourth component: Bonding of the public

No enterprise exists autarkic and insular from its environment. Therefore, WITTENSTEIN joins in the region and public generally in many activities in and about the enterprise. Vernissages of regional artists in the house draw a bow between technique and art, and in cross-thinking workshops among others for teachers, the development manager teaches the abstraction of problems and their innovative solving. Ongoing, nonprofit activities of employees are supported and intensive public relations work is done.

These are just a few examples how WITTENSTEIN likes to realize innovation with and by its employees. The imperative of the hour is trust, transparency, self-confidence, self-organisation and self-control. The challenges of the 21st century can just be coped with open and clear communication, an understanding of citizens as political actors and of his employees as co-entrepreneurs by honing their senses for their own and the common situation, fostering lateral thinkers, allowing competition without endangering the coherence, connecting instead of separating and merging what has been separated.

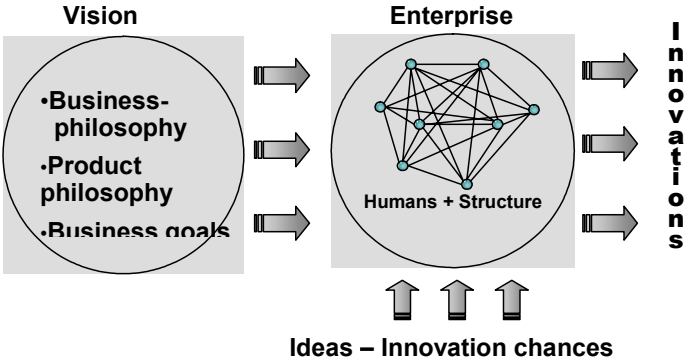
So, innovation always takes place and is always there; in society, economy and technique, if we want it or not. Innovation concerns us all and we all have to deal with that topic.

Behind each innovation – product or process innovation – social innovation takes place first because the future has to be thought of.

2.3.1 The innovation process at WITTENSTEIN

Basis for innovation and – as described above – at the same time the largest source from which strategic competition advantages may grow, is the vision that can be found in our business philosophy, our product philosophy and our business objectives.

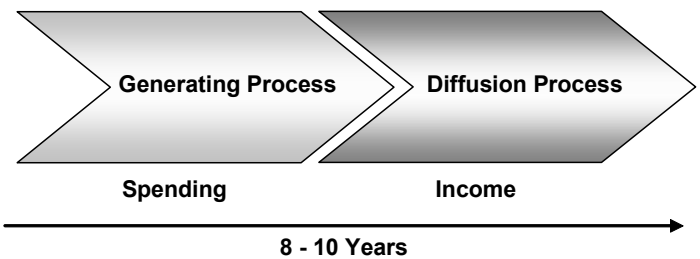
Figure 33: Product philosophy and business objectives



The vision must pervade the enterprise – humans and structure – like a melody in order to select the numerous existing ideas and innovation chances and transform them into innovations afterwards. The innovation process pulls through the whole enterprise and strikes all employees. Due to this fact we aligned our enterprise process-oriented.

2.3.2 The WITTENSTEIN Wheel of innovation

Figure 34: Generating and Diffusion Process



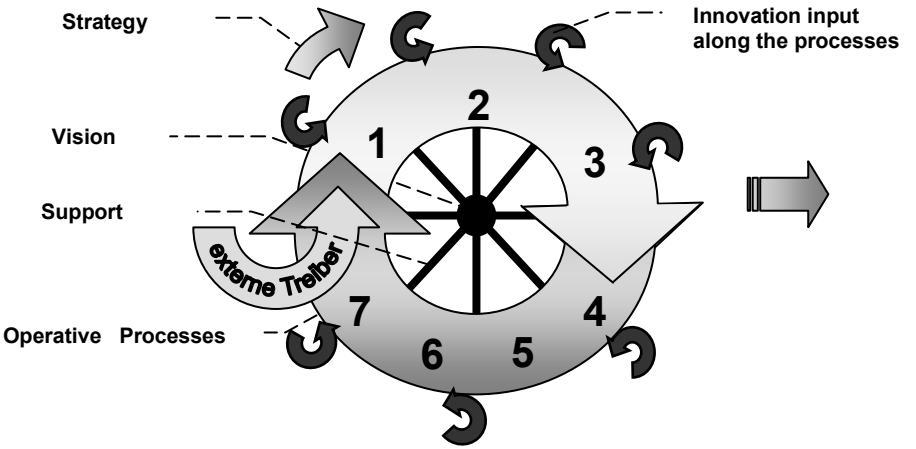
Which are the most important processes in an enterprise? In a simplified description there is a generating process in the beginning in which a product is designed or a process developed. When this has happened, one can be on target for production and market, what we call diffusion process. Both processes together comprise eight to ten years when they are run one time. In the generating process basically money is spent, whereas in the diffusion process the money flows back to the enterprise; the product is placed on the

market, revenues are generated. With the money earned in this phase the next generating process can and must be initiated.

In practice both processes interlock permanently and important feedbacks take place – generating and diffusion process together build the "wheel of innovation" which is to be powered.

In front of this background we do not want to restrict "innovation" to the market oriented definition of Fredmund Malik; innovation is an activity running along the process chain all the time – therefore we estimate each employee as latent innovator. We try to describe this picture by the wheel of innovation: the more innovation each person brings in, the easier we can put and maintain the wheel in motion together and so transform a relatively static devolution into a dynamic process.

Figure 35: Wheel of innovation



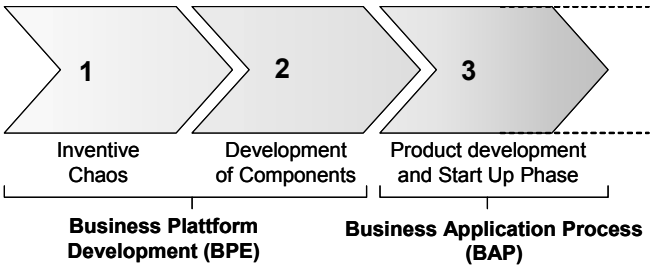
It is difficult for one person alone to bring the wheel in motion but together this is an easy task. Everybody is part of the wheel of innovation– everybody creates innovations. Due to this ability to maintain innovation, each employee has the right to emerge as responsible for his innovation.

If we do not use this potential, our wheel will soon turn clumsy and slowly since the opponents gain overhand and retard the course of the wheel by barriers and resistances. The generating process as a part of the wheel of innovation describes now the discharge of product's and processes' development. How do we precede practically in these phases?

2.3.3 Business platform development and business application process

Under "generation" we understand the development of products which are sold to costumers as well as the development of processes necessary to produce and sell products.

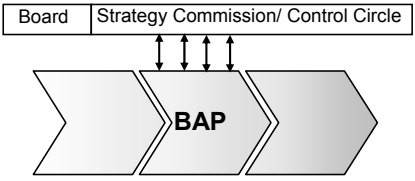
Figure 36: Business Platform and Business Application Process (BAP)



Each phase of the generating process has its typical characteristics, organisation forms and goals: in the "inventive chaos" new ideas are filtered; this happens preferentially in a network – here an intensive exchange between all participants is possible and ideas can "sputter". The aim is to select a variety of products and processes which further develops the vision and the long-term business goals.

The sub process "development of components" is about the generation of interfaces and product elements which can be combined multiplicatively. Here, basis systems are designed. The ideal organisation form is represented by small teams of experts who work with a high degree of individual responsibility under a coach.

Figure 37: Clearance Process



The focus of the product development and start-up phase lies on a product which is producible and marketable and fulfils the project goals. For this phase, the exponentially increasing costs are characteristic – high expenditures are necessary in order to achieve product and market maturity. The organisation form of choice in this case is the project organisation. The project leader is

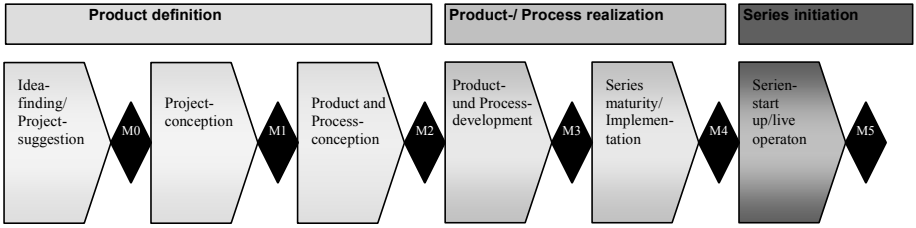
responsible for the realization; a project manager controls the process. The project participants mainly come from the other process domains.

In order to ensure the professional execution of the projects in practical, the WITENSTEIN project management manual was written: it assures the efficient adoption of projects by allowing binding constraints and standards and making the work easier for the project leader and participants. All participants act on a common knowledge basis and with the same procedures; processes can be better retraced that way.

In the manual a frame for the regular checking of the project road map and the progress is granted: this is done by the separation of the project in phases and the definition of milestones, where certain predefined results have to be achieved.

Six phases had been defined which are completed each with a milestone:

Figure 38: Project phases and milestones



Milestone clearances are given by the strategy commission or by a “strategic control circle”; a control circle is established if a higher control frequency is necessary during problematic or difficult projects. In both boards there are – beneath the main persons in charge for the process – members of the management active as well. The boards assure that a project stays within the target corridor and intervenes if a project is in a difficult phase which can not be coped with by the project management alone. They bring the project back on the right way or make further work possible. Both boards have a controlling function, but they do not make decisions. Due to their position, free spaces can be established, investments and resources approved or changes in the project appointment achieved.

2.3.4 Practical Example: FITBONE®

The clear alignment of the WITTENSTEIN Group on top-quality, controllable gearing systems, brushless servomechanisms and engines as well as complete electromechanical power train systems opens up new fields

of application. Drivers are on the one hand the demands of the market and on the other hand the company's own marketing. The high growth in sales of the group with about 20 percent p.a. in the last eight years is evidence for the precise accuracy of the persecuted MINI-Strategy (Miniaturization, Integration, Network, Intelligence).

The by then completely new application field for the technology of WITTENSTEIN had been entered in the beginning of the 90's in the field medical engineering. The future prospects of the branch are good per se. Reasons for this are the demographic development, the continuous medical and technical progress, the increased consciousness of health of the population and the related readiness to invest in the own health – medical engineering promises to be a long term growth market. In contrast, this dynamic and innovative branch is characterized by increasing investment costs, shorter product life cycles and the partly long time to market launch respectively profit capability which is connected to a continuously climbing research risk. A fast return in investment by the entrance in this market could not have been awaited.

Figure 39: FITBONE

The WITTENSTEIN Group dared the market entrance despite respectively because of the named preconditions. This step was enabled by the lived corporate philosophy which allowed a young team of – until then – not medically skilled engineers free spaces for the creative thinking and an impact on the realization of ideas and innovations. Research and Development manager Thomas Bayer prefers the "TRIZ"-System for innovative ideas – with great success. "He who has to solve a problem stands always in front of a room full of solving possibilities", says Thomas Bayer. For orientation, the development chief of the WITTENSTEIN AG recommends strategy instead of intuition. He used among others for the development of the marrow nail FITBONE® the "Theory of the ingenious problem solving" (in short TRIZ) of the Russian patent expert Genrich Altschuller: he postulates that the most different problems can be solved by a few basic ideas and formulated 40 basic rules of innovation. In order to use them, it is necessary to abstract the concrete problem so far, that it fits the abstract principles. For Bayer this is a good way to disengage from "mental

clottedness" – and the WITTENSTEIN AG can be pleased with two-digit growth rates.

The step into virgin ground concerned not only the technology transfer from products of the mechanical engineering to products of medical technology, but also the altercation with new target groups and markets, the communication with external partners from the field of orthopedics and surgery and the design of the processes.

The first project was the devolution of the minimised WITTENSTEIN power train technology (here: highly precise minimized electromechanical drive trains) on medic-technological products: the intramedullary marrow nail for the elongation of bones in the human body.

The new focus "intelligent and high precise power train technique in or on humans" with laborious research and development projects was connected with the foundation of a new enterprise WITTENSTEIN intens GmbH in a middle and long term strategy.

2.3.5 Problem description

The bone elongation via external retaining apparati ("Fixateur extern") like e.g. the ring fixateur from Ilizarov shows severe disadvantages. For an elongation of ca. 40-50 mm with the "fixateurs extern" it has to be bargained for applying them at least 9-18 months. During the time of carriage, in over 50 percent of all cases pin infections occur, what makes a replacement of the linking elements (pins, screws, wires) between the outer rings or bars and the bone necessary. This is especially true for the thigh since here, the bone is surrounded by a voluminous soft part mantle. The linkage of the outward laying stabilizing metal parts with the bone, like wires, screws or nails, might lead to momentous infections. This stretches the time in the hospital and in the worst case, the infections might cause the loss of the leg. Due to the fixation bars, the patient is very restricted in his elbowroom, what leads to sleeping problems among others. Concerning the classical fixateur systems, there is often the danger of axis defective positions of the cut through bone. Indeed, the montage of ring fixateur reduces this risk, but it can not be expected for the patient at the thigh due to the carriage problems. Beneath the already named problems, the external fixateurs show further disadvantages:

- Extremely painful
- Discomfort and restricted hygiene possibilities due to the ring respectively the external equipment

- Strong scarring
- Restrictions concerning the physiotherapy, thereby longer timeouts

2.3.6 Application of TRIZ

After the realization of the problem analysis, the ideal end result (IER) had been defined. Thereby it is tried to describe the ideal system for the concrete application case. The ideal end result concerning the problem of bone elongation was defined by WITTENSTEIN as follows:

IER: A system that the patient does not perceive concerning size and weight, which does not cause open wounds. It is therefore not noticed. The patient is able go to work normally, to shower, to walk and sleep. Daily, the bone grows about one millimeter painless and in any length.

Subsequent to the elaboration of the ideal end result, the antagonism matrix had been applied. Therefore, first the correcting parameters and the coherent undesired changes were identified. Secondly, the innovative basic principles were checked concerning their success probability.

By the application of the TRIZ methodology, the WITTENSTEIN intens GmbH developed a completely implantable system, which uses a special distraction marrow nail – the FITBONE® - for stabilization after the bone separation. This elongation is comparable with a prolongable radio antenna. The FITBONE® is completely implanted and therefore open wounds no longer exist. The infection risk is clearly reduced thereby.

The management's decision of the WITTENSTEIN group for the long term pre-financing assured the necessary entrepreneurial independence of the young medical technique enterprise. It was granted the possibility to collect experiences, overcome high entry barriers and to cope with backstrokes. The challenges are obvious at the beginning: the new business unit WITTENSTEIN intens GmbH had no history in the market, no multipliers and no costumer or supplier relationships in the new environment. In addition, no existing and established WITTENSTEIN product was transferable to the medical technique branch, respectively there was no mutual acceptance of mechanical engineers and surgeons.

The new enterprise demands an intelligent controlling in undefined market circumstances without the necessity of daily checks. In addition, the management of the WITTENSTEIN group had the task to assure that the young enterprise is able to prevail against internal and external opponents. The coordination with the strategies and technologies of the WITTENSTEIN

group therefore was tightly geared in the different boards and commissions. The management transfused responsibility and trust to the young enterprise – just that created the necessary freedom and the independence in the new environment and market. Only due to this certainty, the team was able to concentrate (despite loss-generating business results in the first years) on

- the new "application" human with bones, sinew, ligaments, biomechanics and musculoskeletal system, psychological barriers and expectancies
- new materials and technologies (titan, implant steel, biocompatible materials, laser welding)
- the establishment and fast enforcement of new processes (white room assembly, batch management, new QM-System, hygiene monitoring, execution of biomechanical tests, plasma sterilization procedures)
- the admission procedure for medical products
- a new market with new applicants, multipliers and promoters (doctors, patients, clinics, medical insurances etc.)
- the acquisition of new qualifications respectively education/further education in the field of medical technology
- the establishment of sustainable and stable chains for new added value partners (suppliers, co-developers from the field of surgery)

Figure 40: FITBONE

From 1995, with FITBONE® the first electromechanical intramedullary marrow nail worldwide had been developed and key applicants executed the first operations with experimentees.

Until now, over 400 FITBONE® operations have taken place. The FITBONE® system is stable and successful. By the new cognitions of applicants, the door to new products and developments had been opened. New products like the intramedullary power train of a growth prosthesis followed. The WITTENSTEIN group focus in terms of the IMI-Strategy – intelligence,

minimization, integration – has been strongly persecuted.

The example FITBONE® shows: responsibility and trust in ideas and motivation of the employees result in a constitutive, constructive force. Without that force, nothing is changeable, reconstructable or mobilisable in enterprises. And without them, critical situations cannot be vanquished.

VII Dissemination of the VIVA results: SME´s innovation management in the future

Ilja Hauß, Anne Spitzley, Thorsten Rogowski

Innovation Management is an emerging topic in many companies all-over Europe. The relevance of innovation management is well accepted but still SME's lack of competence how to implement and organise innovation management. There is a huge variety of information sources in the internet and consulting companies jump on the bandwagon with more or less competence. But specialised and approved contents also as standards for methods and tools are hardly to find or their progress is not finished yet. The reinforcement of SMEs requires visions and knowledge platforms. VIVA (European Virtual Centre for Innovation Excellence Assessment) built up a strategic and strongly target-oriented platform to link European interest groups with know-how, new technologies, methods and best-practices concerning innovation excellence for SMEs.

The strategic objective was and still is to initiate and coordinate a European-wide exchange of results, approaches and ideas on innovation excellence assessment by setting up a European Virtual Centre for Innovation Excellence Assessment web portal. This serves as a foundation to aid SMEs developing innovation excellence that will replace the current ad-hoc methods. VIVA aimed at creating a self-sustaining community and supported the infrastructure for sharing the latest developments concerning the topic innovation excellence by bringing together the available critical mass of innovation competence experts in Europe. By fostering networking between research and public institutions, associations and industry, a perfect basis was created for starting a harmonisation or even standardisation process for innovation excellence assessment. In order to not leave it by starting a harmonisation but also keep continuing the VIVA results and the VIVA web portal, a business idea was created in various project consortium meetings. The main idea is to build up a virtual institute with core competence in the topic of innovation management, providing specific services and networking activities to innovation management professionals. In the following the business idea, the potential services and the main important organisational aspects are summarised.

1 A business idea – the virtual innovation management institute (IMI)

The vision of the virtual Innovation Management institute is to become a leading content and service provider for innovation management professionals all over Europe. Hereby, the unique selling positioning of the virtual innovation management institute consists of the following three pillars:

- Quarterly updated Innovation Management Report (IM-Report)
- Reviewed content and tools for innovation management (IM-Toolbox)
- Online University: Train & certify Innovation Management Professionals (IMP)

Via the VIVA-Portal innovation management professionals can subscribe an IM-Report and will be continuously updated with most current and relevant information on the topic of innovation management. They can investigate the Innovation Management Toolbox with reviewed methods and tools, tests, best practices and guidelines. The online university, provides web seminars, web based training and exams, so that companies can train and certify their employees to become IM-Professionals.

The approach is firstly to provide the IM-Toolbox and IM-Report in order to gain initial subscribers and community members. On that base further services, like the online-university and certification standards, will be developed. In parallel the institute organisation will be build-up. In the first step the consortium of the VIVA project will be the breeding ground for the institute.

2 Services

In the following the potential services of the institutes are described.

Quarterly IM-report

The IM-Report will be a periodically updated report on innovation management, containing new methods, tools, projects, practices, surveys, technologies and innovations itself. It is planned to have on the one hand a printed report (quarterly) and on the other hand an online report service.

The contents will be provided by so-called IM-Scouts. IM-Scouts usually are persons interested in marketing their new ideas, tools and so on, e.g.

consultants. The motivation of scouts is that their ideas or proposal topics are taken over by the IMI institute. The proposals will be reviewed and selected for the report by the editorial office, respectively the IM Expert Group.

Abstracts of the report will be for free, the full report will be available for subscribers.

IM-Toolbox

The IM-Toolbox (VIVA-Toolbox) is a reviewed database of methods, tools, guidelines and best practices for innovation management. The contents are provided by the IM-Scouts or third parties interested in distributing their content. The IM Expert Group reviews and selects the proposals, which will be published in the database. In the future a test centre for specific methods and tools could be offered.

Abstracts of the content will be for free, the full content will be available for subscribers.

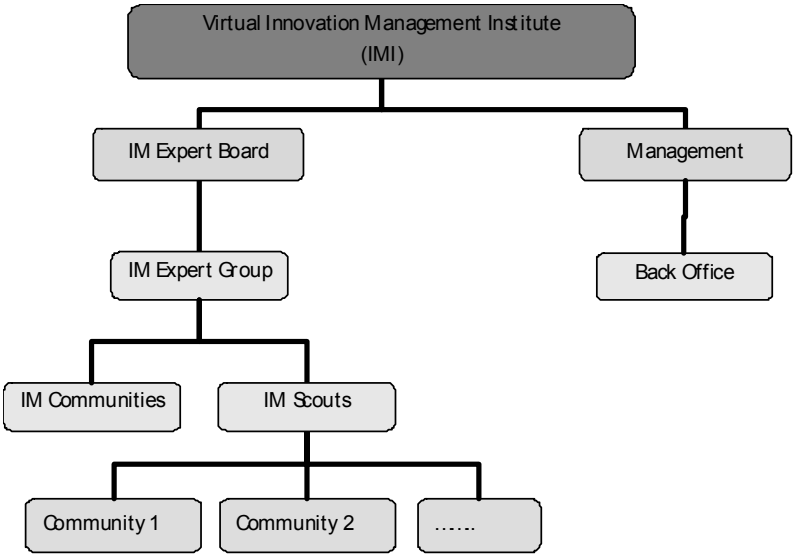
Online University

The online university will offer web based training, training material and a specific course to become a certified IM-Professional. The main idea of the virtual institute is to develop a standard procedure for innovation management and to develop an acknowledged certification programme, comparable with the PMI standard in project management. In addition, in-house training with certified trainers can be offered. Training resources will be for free, the certification and online course will be for available for subscribers and IMP Community Members.

Organisation Chart

In the following chart the main key players of the institute are illustrated.

Figure 41: Organisational Chart of the IMI



The key player of the virtual institute will be

- a high-level expert board in the meaning of an advisory council
- the expert group in the meaning of an editorial office for the IM-Report, IM-Toolbox and Online-University
- the IM Scouts providing content for the IM-Report
- the institute's management and back-office

The expert board consists of well acknowledged experts in the field of innovation management. The board is responsible for the strategic planning and the scientific quality of the provided contents and offered services.

The expert group is responsible for the coordination of the IM Scouts and the IM Communities. The expert group is in charge of the contents and services of the platform, especially IM-Report, IM-Toolbox and Online-University.

The innovation management scouts are journalists, editors or other persons who are interested in innovation management. The scouts provide input for the IM-Report and collect ideas, new technologies, best practice or new techniques about innovation management.

The management supports the operative coordination and provides a back office, e.g. to organise physically meetings, conferences as well as administrative matters.

The IM Communities represent the subscribers and the members of the institute. Hence, these are the customers.

3 Road map

In the following the Road Map to build-up the institute is summarized.

Phase 1: Build-Up the IM Expert Group

Table 22: Phase 1 – Build-Up the IM Expert Group

	Topics/ Tasks	(Re) Financing	Term
IM Expert Group	Create IM-Report Search for IM Scouts Build-up IM Toolbox Initiate High-Level Expert Board Apply for a research projects	No financing.	9 m
Back Office 25 percent (1 day per week)	Provided by a member of the Expert Group Coordinate activities Support the VIVA Portal.	Fee for expert group members.	

The first phase is characterised by the foundation of the IM Expert Group and the development of the IM-Report, respectively the development of the basic knowledge and content pool of the portal.

The idea is that in the first phase the Expert Group will be formed by interested partners of the VIVA project consortium, paying a minor one-year member fee in order to finance the back office and maintenance of the basic infrastructure.

Further the concept of the institute will be elaborated and the IM Expert Board will be initiated. Marketing activities will start after finalizing the first IM Report and refining of the portal content base, especially the IM-Toolbox.

Phase 2: IM Institute Foundation

Table 23: Phase 2 – Institute Foundation

	Topics/ Tasks	(Re) Financing	Term
IM Expert Group	Develop the IM Scout network Create quarterly IM Report Maintain the content base Develop the certification standard for the IMP	Research project	6 m
Back Office 50 percent (half a day)	Provided by a member of the Expert Group Coordinate activities Support the VIVA Portal	Fee for expert group members.	
IM Expert Board	Prepare the Online University programme Do public relations	Fee for expert group members.	
IM Scouts	Provide content proposals for the IM-Report and the IM-Toolbox	No financing.	

The second phase is identified as the preparation and planning of the innovation management institute (IMI). The major tasks are the finding and initiation of the high-level IM Expert Board as soon as the developing of certification standards for the innovation management professional (IMP). Member fees (see at phase 1) are used for the (re) financing of the back office and VIVA portal. Further incomes from sales of the quarterly report as well as from current research projects are made. The time schedule of this phase adds up to six months.

4 Customer definition

For the IMI the following types of a customer can be identified:

Innovation Manager

The relevant customer for the IMI is the innovation manager, respectively the innovation management professional of an organisation. This group has the need to find reliable content sources of methods, tools and case studies.

Consultants

Consultants engaged in the topic of innovation management are potential customers as well. They can use the portal as an information portal, in order to search for required content, surveys and methodologies.

Training and education institutes

Other Companies which want to accomplish trainings for their employees as well as education institutes have the possibility to order qualified trainers and experts from the IMI. As well companies of education can implement certification standards of innovation management with the help of the IMI and they can train employees to an IMP.

5 Customer benefit

For the customer there is a set of reasons to use and to apply for a membership of the IMI:

- The customer receives new information, developments and trends (quarterly innovation management report) about innovation management.
- The customer can train itself in topics of innovation management with the help of the IMI and reduce these to practice.
- The customer can share information, network with practitioners and may be involved in research projects and surveys.
- IM Scouts and IM Experts can achieve a high degree of reputation.

6 Competitive analysis

Beside the VIVA platform there are numerous platforms available. Based on the results found here and based on a competitive analysis the IMI approach tries to integrate the features of different platforms in one integrated approach (see table below).

Table 24: List of important competitive players and internet resources

Name	URL	Portal/Member	Report/ Journal	Certification	WBT/CBT	Training (seminar)	Consulting	Case studies	Surveys	Benchmarks	Events	Shop
Berlecon Research	http://www.berlecon.de/	x	x				x				x	
CATT	http://www.catt.at/					x					x	
Danube	http://www.danube.or.at									x	x	
DIW Berlin	http://www.diw.de/		x								x	
GARTNER	http://www.gartner.com	x	x		x	x	x			x	x	
ISPIM	http://www.ispim.org	x	x									
ORGANIC	http://www.innovationmanager.org			x		x						
Kompetenz-netze	http://www.kompetenznetze.de		x					x				
World scientific	http://www.worldscinet.com		x									x
KMU Innovation	http://www.kmuinnovation.com/									x		x
Symposion	http://www.symposion.de/		x					x				x
Forrester	http://www.forrester.com	x	x				x	x	x	x	x	
Applied Innovation	http://www.appliedinnovation.com		x					x			x	
Frauenhofer ISI	http://www.isi.fraunhofer.de		x									x
Service inno. group	http://www.serviceinnovation.com						x					
IMIG	http://www.imig-ag.de						x					
Nielson NetRatings	http://www.nielsen-netratings.com					x	x		x	x		
IMI (VIVA)	http://www.viva-eu.net	x	x	x	x	x	x	x	x	x	x	x

7 Conclusion

Innovation fosters new ideas, technologies and processes that lead to better jobs, higher wages and living standards. Increased attention on innovation capability of SMEs is therefore key for the European economy. To achieve this aim a fundamental readiness for changes has to exist and actions have to be taken. For example the coordination of initiatives to assess and develop innovation excellence of SMEs, the knowledge exchange of different initiatives with capability of innovation, the engagement of cluster participants to improve exchange of knowledge and experience, and the provision of a tool box for innovation excellence. By developing the European Virtual Centre for Innovation Excellence Assessment the cornerstone of a European-wide exchange of innovation management approaches, tools, and results is laid. Now it is our turn to advance the VIVA platform and to let the idea of a virtual innovation management institute come true.

VIII Directory of Authors

Andrea Bardi	Institute for Labour Foundation (IpL), Bologna (Italy)
Peter Butala	University of Ljubljana, LAKOS, Ljubljana (Slovenia)
Paolo Franceschini	CRIT Srl - Centro di Innovazione e Brokeraggio Tecnologico, Modena (Italy)
Sarah Fried	Fraunhofer Institute for Industrial Engineering (IAO), Stuttgart (Germany)
Francesco Garibaldo	Institute for Labour Foundation (IpL), Bologna (Italy)
Anna Giarandoni	Institute for Labour Foundation (IpL), Bologna (Italy)
Nadim Hamdan	Fraunhofer Institute for Industrial Engineering (IAO), Stuttgart (Germany)
Ilja Hauß	Communardo Software GmbH, Dresden (Germany)
Francesca Di Lucchio	Centro Ricerche Fiat, Torino (Italy)
Javier Mendibil	LABEIN Tecnalia, Derio (Bizkaia, Spain)
Helmut Ortmeier	WITTENSTEIN AG, Igersheim (Germany)
Thorsten Rogowski	Fraunhofer Institute for Industrial Engineering (IAO), Stuttgart, (Germany)
Miriam Spangenberg	WITTENSTEIN AG, Igersheim (Germany)
Claudia Speth	invenio GmbH Engineering Services, Rüsselsheim (Germany)
Anne Spitzley	Fraunhofer Institute for Industrial Engineering (IAO), Stuttgart (Germany)
Willi Schweinfort	Fraunhofer Institute for Industrial Engineering (IAO), Stuttgart (Germany)
Kristina Wagner	A.T. Kearney GmbH, Berlin (Germany)