Managing Innovation and R&D Processes in EU Environment

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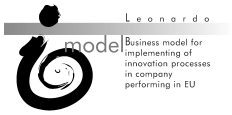

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1. Introduction

Borut Likar

1.1. Innovation, research and development in the European environment

Global competition and new technologies indicate that the economy of the 21st century will offer new challenges for the economy. Knowledge is becoming the crucial success factor in any organisation. Unlike other assets, which loose value over time, the know-how actually increases in value when used and practised. Therefore, individuals at every level and in all industries are challenged to acquire new knowledge, to develop new ideas, and to pursue them as far as they can go.

With the integration of the European Union the companies and employees often lack knowledge and experience for co-operation among countries and a successful breakthrough on EU markets. A company performing in the European Union shall be able to manage its own innovation and research and development (R&D) processes as well as the transfer of knowledge at the national and international level. These complex types of knowledge are lacking not only in large but predominantly in small and medium sized companies.

Therefore, companies need to be encouraged to develop systemic approaches, new skills and competencies linked to the process of innovation, contributing to greater competitiveness, entrepreneurship and new employment possibilities.

According to the aims of Lisbon strategy from 2000 and statistical indicators from 2006 (Scoreboard, 2006), EU is still losing ground on the United States and Japan in the field of innovation and R&D. The situation in the countries in transition proves to be even worse. As the innovation is a cornerstone for achieving a competitive and dynamic knowledge-driven economy we are facing a growing 'innovation gap' between EU and US/Japan (Figure 1).

At the same time we can establish that innovation proves to be directly related to gross domestic products (GDP). Interdependence is indicated in the Figure 2.

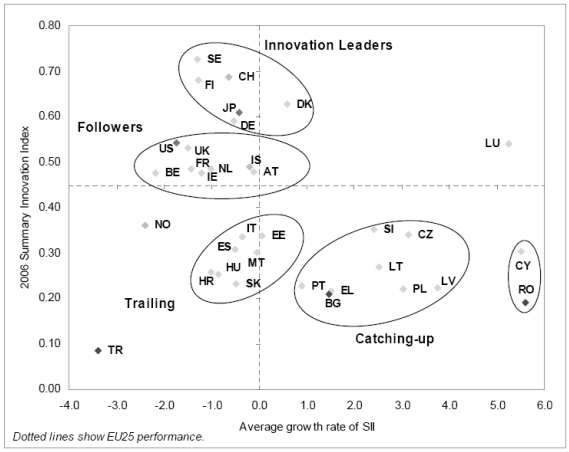

Figure 1: Summary Innovation Index

The Summary Innovation Index SII for 2006 shows innovation index and trends (Average growth rate) for the EU and its individual member states as well as USA and Japan (Scoreboard, 2006).

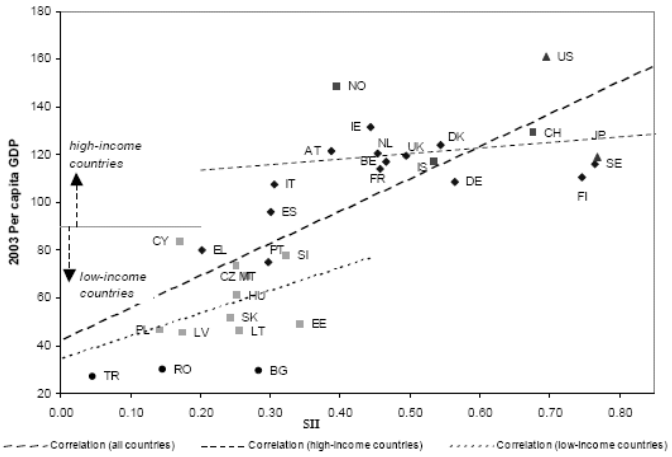

Figure 2: Innovation and GDP

Correlation between innovation and GDP/inhabitant (Scoreboard, 2004).

A detailed analysis demonstrates that the situation in small and medium-sized enterprises (SME) proves to be worse than in large companies. Rough estimate figure confirm that medium-sized companies record twice as less innovativeness as the large ones while the small companies even fourfold less!

It is of vital importance for the companies to be prepared and capable of managing their own invention-innovation and among them also R&D processes. Yet a prerequisite for such activities proves to be their understanding as well as comprehensive management of the latter.

Nonetheless, we cannot neglect a fact that innovation is a complex process which fails to be mastered adequately by a large part of companies. Economic entities strive to increase a level of innovation with various, mostly partial, approaches that frequently remain inefficient. The problem derives from the fact that the improvement of the situation relates to numerous factors which often represent a Gordian knot; where to start, how should all strategic aspects be taken into consideration, how should the most important fields which call for improvement be defined – defining key influential factors, implementing concrete steps, and similar. The first step is definitely a detailed analysis of the situation and clear understanding of the factors which influence the innovativeness (Pervaiz, 1998; Likar and Kopač, 2005). But primarily, how to approach the analysis and improvement of state systemically and systematically (Mulej and Ženko, 2002; Mulej et al., 2005; Markič, 2003).

1.2. Basic definitions

In the beginning, some fundamental definitions of the terms which will be used throughout the book shall be explained.

Invention

Invention is a new, promising idea which has a potential to become useful, i.e. a new product or service, process or system; for example industrial product, design, improved method of work, generated savings, safety at work and similar. Not every idea is to be called an invention. (Likar, 2006)

Suggestion

Suggestion is an invention that does not remain in author's mind yet he/she – as an employee of the company or other organisation – reports it to the authorised department of his/her organisation. By so doing, a frequent and unproductive, almost damaging practice to overlook the suggestion/invention is considerably reduced. Today's practice frequently records the term of suggestion as small and amateur inventions (produced outside working activities) being filed. (Likar, 2006)

Potential innovation

Potential innovation is an invention established up to a point when it may be applied. It is created on the basis of development – professional or unprofessional, intentional or coincidental, technical-technological or any other type of development. Decisions on the potential innovation are made by the authors and investors, the sale may also be an option. Potential consumers are those who are prepared to take risk and invest in the production and commercialisation (or: those who wish to squeeze the idea out of the market). It is therefore an intermediate level of development of a new idea on novelty – between invention and innovation (Mulej and Ženko, 2004).

Innovation

Innovation is a new or considerably improved product, procedure or service which

- appears on the market (innovation of a product, service) or is applied in a procedure (innovation of a procedure/process),
- proves useful.

Product, service or procedure needs to represent a novelty or considerable improvement for the user yet it does not need to be completely new on the market. Innovations are not only of technological nature yet may also be social, sociological, organisational, methodological and similar. (Likar, 2006)

Firstly, invention is created (an idea which has a potential to become innovation), then potential innovation, which means applicable yet not necessarily lucrative or useful new idea. Only the last link of the invention-innovation chain is an innovation – i.e. every novelty substantiated to be useful.

The process of development from an idea to product and its recognition on the market require efforts and creative work in all phases of the process. However, the first, most important step is acknowledgment of a new challenge or a definition of the problem (Figure 3).

Research and development

Research and development (R&D) is just one of the activities and may be performed in various phases of innovation process, not only as a source of innovative ideas but also as a method of problem solving. R&D may thus be a part of the process in all phases leading to the final implementation. (Frascati, 1992). Usually, a term R&D is limited to technical-technological part of inventions, potential innovations and innovations.

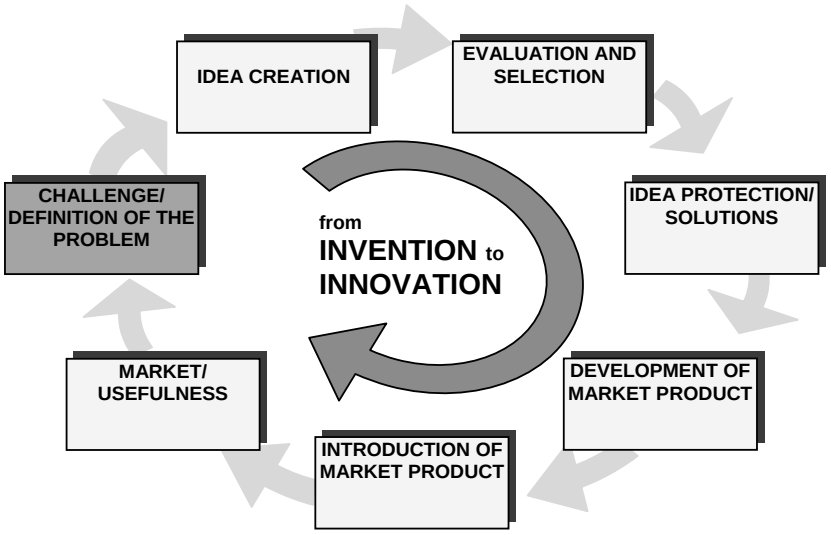

Figure 3: From the problem to implementation

Know-how

Term know-how encompasses knowledge and experience of an individual, group of people or a group of companies which are in any way related to human activities. Companies focus primarily on the area of development and technologies, business functions (commercial area, administration, purchasing, logistics, finances, etc.), human resource management, innovation and suchlike. However, only a fraction of this knowledge is written down (Explicit Knowledge) and thus transferable. Yet the largest part remains "hidden" (Tacit Knowledge). The company that wishes to successfully manage its know-how needs to strive towards registering this knowledge since it is related to cultural and personal characteristics of individuals and corporate culture as a whole.

An example from praxis: The company was selling abroad all its plans (drawings) on the basis of which the purchaser would produce their products or machinery. Drawings represented only a part of the knowledge so the purchaser usually had no practical use of the drawings. Just as important as the drawings was also conveying endless practical details on the execution which were omitted in the drawings. Therefore, it proved wiser for the buyer to purchase the know-how. It is a matter of considerably wider term which in practice meant that producer's experts and other workers went to purchaser's factory and taught them the "secrets" of practical work which thus gave the purchased drawings the original lustre and applicable value. Sometimes, the contract on know-how included also an agreement on the transfer of practical-technological knowledge which enabled work and hastened quality.

2.Building the fundamentals of a successful innovation management

Vassilis Tsaggaris and Peter Fatur

2.1. Defining innovation strategy and goals

According to the words of management guru Peter Drucker each organisation needs one key competence: innovation. Innovation is the process by which businesses improve their competitiveness and profitability by creating and/or adopting relevant new products and ideas. Innovations result in the development of new products and services, new features in existing products and services, and new ways to produce or sell them or a different approach to any other process within the company (Beerens et al., 2004, Vemuri et al., 2003, Gellatly and Peters, 1999).

Innovation management begins with defining the strategy and setting innovation objectives. Innovation strategy is a strategy of efficient answer to competition.

- *Production strategy* may focus on improving production flexibility, reducing lead times, improving working conditions, or reducing labour costs.
- *Product strategy* may centre on improving product quality, replacing products that are being phased out, or extending the product range.
- *Market strategy* may focus on opening new domestic or foreign markets, or simply on maintaining current market share.

Developing successful innovation strategies is often difficult, which explains why many firms choose not to do so, even though the benefits of innovating are widely understood.

The scope of innovation can be quite varied. Activities ranging from automation of order taking to developing hydrogen-powered automobiles are broadly considered innovations. Specifically, the most important innovations *goals* are the following:

- Increase added value for customers
- Reduce product/ service cost
- Increase innovation hit rate

- Improve product/ service quality
- Increase development efficiency
- Increase rate of product/ service introductions
- Shorten time to market
- Develop new product/ service categories
- Create new business models

2.2. Building the appropriate organisational environment

A vital step in the development of an innovative organisation is building an appropriate organisational environment (Ideachampions, 2006, Beerens et al., 2004, IPENZ, 2002, IWP, 2003, Flynn et al., 2003, Baker, 2002). The term organisational environment is closely related to the organisational culture.

2.2.1. Culture of innovation

Culture is the sum total of values, norms, assumptions, beliefs and ways of living built up by a group of people and transmitted from one generation to another. *The culture of innovation* can therefore be defined as an organisational culture that values innovation, where there is implicit encouragement for staff to think differently, take calculated risks and challenge the status quo. What are its main characteristics?

- Leadership by visionary, enthusiastic champions of change
- Top management support and encouragement of creativity, both financial and psychological
- An effective communication system. Leaders share the business vision with their staff and empower them to optimise their potential in achieving the business goals
- Flexibility towards new thinking and new behaviour patterns. The creative organisation readily adapts to change and proactively searches for new opportunities
- Customer focus
- A creative culture is outwardly focused, looking for ideas among customers, competitors, academe, suppliers, and even industries with a different focus.

The culture of innovation can be developed by:

- Selecting innovative employees,
- Training for creativity and innovation,
- Developing a learning culture,
- Empowering the employees,
- Setting up idea capture schemes,
- Developing managers to support the innovation of others,
- Making creativity a requirement of the job,
- Improving employee participation in decision-making,
- Having appropriate reward systems for innovation,
- Allowing risk-taking as an acceptable mode of practice,
- Encouraging investment in research and development,
- Benchmarking (actively undertaking systematic approaches to locate and assess good practice elsewhere in attempts to improve your own performance).

Obstacles that will need to be addressed if you expect to establish a sustainable culture of innovation:

- Lack of a shared vision and/or strategy,
- Innovation not articulated as a company-wide commitment,
- Lack of ownership by Senior Leaders,
- Constantly shifting priorities,
- Short-term thinking,
- Internal process focus rather than external customer focus,
- Focus on successes of the past rather than the challenges of the future,
- Unwillingness to change in the absence of a burning platform,
- Politics – efforts to sustain the status quo to support entrenched interests,
- Rewarding crisis management rather than crisis prevention,
- Hierarchy – over-management and review of new ideas,
- Under-funding of new ideas in the name of sustaining current efforts,
- Workforce workloads (i.e. too much to do, not enough time),
- Risk aversion (i.e. punishment for "failure"),
- Inelegant systems and processes,
- Analytical thinking ("data is God"),
- Absence of user-friendly idea management processes,
- Unwillingness to acknowledge and learn from past "failures",
- Inadequate understanding of customers,
- Innovation not part of the performance review process,
- Lack of skilful brainstorm facilitation,

- Lack of "spec time" to develop new ideas and opportunities,
- Inadequate "innovation coaching",
- No creative thinking training,
- No reward and recognition programs,
- "Innovation" relegated to R&D.

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Google – Creativity sans frontieres

Borut Likar

Google is undoubtedly one of the fastest growing international companies of the past few years. An extremely simple logic lies behind a record 10 billion dollars in annual sales – making global knowledge accessible to anyone. With the latter Google has surpassed the fundamental philosophy of other Internet providers since its user is able to reach over 12 billion web sites simply by using Google. The support offered to such a possibility is a vastly spread network of over 200,000 high-capacity computers which constantly buzz all over the world. Google reaches into the areas of electronic mail, magazines, books, films, music and plenty more. Moreover, Google allows you to communicate, purchase, market, perform financial transactions and similar. Internet media advertising is one of the fastest growing activities given that it is likely to record 30 billion dollars in two years time – the largest portion of which goes to Google which has developed the most price-effective advertising. A reasonable question pops up, i.e. what drives this giant to always walk one step in front of the competition?

Beside the two founders – who with their vision and concrete ideas gave the company its basic orientation – one of the key tasks of the senior managers is an everlasting search of new ideas. The latter becomes evident once you enter the Company's main building Googleplex, which also hosts the headquarters of the company. Creative and hassle-free atmosphere, excellent wages, free of charge meals, technical and medical services for employees are only a few of the perks. Yet one of the most important "perks" proves to be the fact that the employees are allowed to use one fifth of their entire working time for their own projects. In doing so, the superiors present no obstacle since in such a way the Company expects fresh and unusual ideas which shall open new market prospects. Google managed to realised quite a few of such ideas in the past years. Allow us to mention

just a few: the Internet services for blind and weak-sighted, a possibility to observe the earth from the air – as though as you had your own spy satellite.

The Company is well aware of the fact that the employees are the company's main "asset". The Company has thus created the following strategy:

"We hire great people and encourage them to make their dreams a reality. We believe in hard work, a fun atmosphere, and the sort of creativity that only comes about when talented people from diverse backgrounds approach problems from varying perspectives. Googlers have been Olympic athletes and Jeopardy champions; professional chefs and independent filmmakers. And whether you work at our headquarters in Mountain View, California, or in any of our locations around the world, we think you'll find Google a place where you can aspire to outsized accomplishments" (Google, 2006a).

Working environment which encourages innovativeness is closely intertwined with the corporate culture. An example of such connection is unquestionably the Googleplex, Google's world headquarters building. While not all Google offices around the globe are equally well-stocked, these are some of the essential elements that define a Google workspace (Google, 2006b):

Lobby Décor - Piano, lava lamps, and live projection of current search queries from around the world.

Hallway Décor - Bicycles and large rubber exercise balls on the floors, press clippings from around the world posted on bulletin boards everywhere. Many Googlers standing around discussing arcane IP addressing issues and how to build a better Spam filter.

Googler Offices - Googlers work in high-density clusters remarkably reflective of our server set-up, with three or four staffers sharing spaces with couches and dogs. This improves information flow and saves on heating bills.

Equipment - Most Googlers have high-powered Linux OS workstations on their desktops. In Google's earliest days, desks were wooden doors mounted on two sawhorses. Some of these are still in use within the engineering group.

Recreation Facilities - Workout room with weights and rowing machine, locker rooms, washers and dryers, massage room, assorted video games, Foosball, baby grand piano, pool table, ping pong, roller hockey twice a week in the parking lot.

Google Café - Healthy lunches and dinners for all staff. Stations include "Charlie's Grill," "Back to Albuquerque," "East Meets West" and "Vegheads." Outdoor seating for sunshine daydreaming.

Snack Rooms - Bins packed with various cereals, gummy bears, M&Ms, toffee, liquorice, cashew nuts, yoghurt, carrots, fresh fruit and other snacks. Dozens of different drinks including fresh juice, soda and make-your-own cappuccino.

Coolest stop on the tour – A three-dimensional rotating image of the world on permanent display on a large flat panel monitor in the office of the engineer who created it. What makes it special is the toggle switch that allows you to view points of light representing real time searches rising from the surface of the globe toward space, colour coded by language. Toggle and you can see traffic patterns for the entire Internet. Worth a trip to the second floor.

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2.2.2. Some other measures affecting the organizational environment

Responsibility of innovation placed on all staff: while some roles will be more directly involved in innovation (e.g. research and development, product development) all staff should have a mandate to act innovatively within their roles.

Human resource system that develops and encourages staff to be innovative. This requires a dedication to training, education, mentoring and the rewarding of staff for innovative behaviours. Staff also needs time and resource allocations to stop and think about new ideas, which will not happen while they are giving 100% of their time to the daily routine.

Performance measurement system that measures the innovative pulse of a company. Simple measures that are often used include spending on innovation (often labelled R&D expenditure), new product percentage (number of new/changed products introduced this period as a proportion of total product numbers) and number of patents held.

Linkages with the marketing function: Understanding the customers, their needs, and the competition is critical for targeting resources to the innovation systems. The most successful innovators understand the customers needs better than the customers themselves. They are often able to identify and solve problems before the customer has realised that perhaps there is a problem, let alone thought about buying a solution.

Knowledge acquisition and management processes that constantly bring into the organisation new ideas, information, concepts and knowledge. This can range from simple things such as receiving trade, scientific, engineering and professional magazines, attendance at conferences and participation in industry networking forums right through to having a comprehensive research capability. Where knowledge is not readily available, polytechnics, universities and research institutes have the capabilities for developing it for you.

Intellectual property management systems that identify, protect, value, manage and audit the organisation's intellectual property (IP). This intellectual property is the new knowledge that arises out of the innovation process e.g. it may be a unique understanding of a production process that facilitates superior efficiency or design in a new product. Some organisations have difficulty in identifying their IP. One way of doing so is answer the question: what do we know that our competitors don't and that we don't want them to know? Once identified, it needs to be protected or the competitors will find out! Protecting your IP can range from simply keeping it confidential, not only physically but also electronically (Trček, 2006) through to the more formal means such as trademark protection, patents and plant variety protection.

Collaboration with other organisations who can contribute to innovation processes. Most organisations cannot achieve best-practice innovation working in isolation. They need to work with research providers, tertiary education institutes, associated and support industries and even their own competitors. Clustering of similar organisations and their support industries is a proven tool for ensuring collective growth by sharing those parts of the innovation process where their interests overlap. This may require collective ownership of the IP that arises from that sharing.

Flexible, organic structure, which encourages team work and also acts as a stimulant to people to be more creative. Having an elastic business definition helps to ward against protectionist instincts and the organisation thus avoids subconscious defence against necessary changes. Management of the organisation should be directed to spend a significant amount of their time looking for opportunities outside the boundaries of the business they are managing.

Employees' motivation: motivating an employee means that he should feel his personal success at work, feel that he positively contributes to the company's goal, to feel responsibility corresponding to abilities, receive acknowledgement for his or her performance, feel that he acquiring new experience and develops his abilities.

Participative leadership style: managers focus both on the task and the subordinates and enable them to participate in the planning and decision-making process.

Have a fluid notion of organizational boundaries: It is not necessary to create all innovations internally. Partnerships can be a useful strategy to promote innovation. Also, in addition to development, acquisition can be an effective innovation strategy.

Manage the risk: Strategy should not be monolithic; it should be sufficiently varied to allow for organizational agility and flexibility. Remember that most innovation ideas will not pan out, so don't think big in terms of funding any one innovative idea. The strategy should be to fund a number of ideas. Low-risk experimentation is of key importance – invest in many ventures but start out small. Although most new ventures will fail, important learning can be acquired from each. Project risk must be distinguished from portfolio risk – the risk of any new project will be high but if there are enough innovation projects, the portfolio risk will be manageable.

Transform organizational strategy: Typical strategic planning is often antithetical to promoting radically innovative business models and strategies. Innovation cannot be held to a scheduled strategic planning timeline; it should be on-going. Also, strategy should not be restricted to the same set of top level decision-makers. Innovative strategy does not necessarily come from the top but too often not a word about contributing strategically appears in the performance criteria for anyone below the level of senior executive.

Other factors, as a systematic collection of all impulses that could lead to innovation, good team work, continued education of employees, the ability to finance the innovation activities.

2.3. Management of ideas

2.3.1. The goal of innovation

The goal of innovation is to create business value by developing ideas from mind to market. And it is, for most companies, tremendously difficult to achieve. Innovation isn't difficult because employees don't have good ideas. The world is awash with creativity and technological breakthroughs. Rather, myriad obstacles in the idea-to-cash process limit a company's ability to innovate. Rigour and training are required to overcome these obstacles. Seen as the

creator of new value, innovation isn't hit-or-miss, trial-and-error lateral thinking, but a repeatable process (CSC 2005).

Idea management (hereinafter also IM) is a formalized mechanism for encouraging employees to contribute constructive ideas in order to improve organizations in which they are employed (Milner et al., 1995). Idea management encompasses planning, organizing, managing and control of the process of invention creation and their transformation into potential innovations and further into innovations in the widest range of employees – unprofessional innovators (Fatur, 2005). Idea management does not cause a rapid progress of the company yet it may importantly influence its competitiveness providing it is appropriately organized. It may also indicate the starting point of successful professional innovativeness, i.e. the innovativeness that assures the company the basis for survival and its competitive advantage.

Idea management focuses the creativity of employees on critical business problems and increases their participation in solving both line-of-business and "big picture", market and revenue related issues. Marsha McArthur, innovation manager at Bristol-Myers Squibb, one of America's largest pharmaceutical companies, used an idea management solution to help the company through a period of industry consolidation and widespread patent expiration on many "blockbuster" drugs. When a patent expires and an alternative generic drug enters the market, it is possible to lose 80 per cent of revenue in the patented drug line within six months.

In the past, innovation was defined largely by creativity and the development of new ideas. Today the term encompasses coordinated projects directed toward honing these ideas and converting them into developments that boost the bottom line. A new event, fact or idea emerges, and is sent for evaluation by those able to make the appropriate judgements, and guide the development of the idea. Does the idea embody the possibility for a new dominant design, service or platform? Can a project be constituted to manage the development of this initial "seed"?

Companies seeking new wealth need to look towards intelligence, and intangibles; and of course, people. Innovation and competence are locked in an inseparable embrace. According to Ridderstråle and Nordström, "This is the age of time and talent, where we are selling time and talent, exploiting time and talent, organizing time and talent, hiring time and talent and packaging time and talent. The most critical resource wears shoes and walks out the door around five o'clock every day". They mean innovative people.

Encouraging innovative career development at Svea

Bernard Likar

The employees of a company are still its largest unexploited source for their further development and growth. This is particularly important in the wood processing industry which proves to be one of the most traditional and work intensive branches. Encouraging the development of competences as well as innovativeness of employees is probably one of the main tasks of development-oriented companies. The fact remains that companies may not be built exclusively on employees who have developed within the company, however, they are extremely important for the company's growth. The company needs to be able to detect the said potential at the very beginning of their employment, possibly even before the very employment, i.e. identify the talented individuals and actively support the development of their careers.

The possibilities of planned encouragement of employees' development may be presented with the example of the Slovenian furniture company Svea d.d.

The company decided to support a young technically talented student at an early stage of his education, and granted him a scholarship when he was still a secondary-school student. The said student, Mr. Srečko Baloh got familiar with the craft very early since his grandfather was a self-learned master of handicraft. He was able to work with and process the wooden and metal parts of buckets, barrels, carts as well as grain mills. The grandson was thus close to the both basic materials. He was deciding between the hot iron and natural wood and chose education at the wood technology vocational college which he combined with the practical training with a master cabinetmaker.

After the concluded apprenticeship, the company offered him employment. As a young technician he was faced with the work of a quality-control officer and standardiser as well as with the tendency that the things may go their own way unless we channel them onto the right track.

When facing a string of current problems that the individual positions within the company entailed, he managed to find a lot of possibilities to find solutions, to find a path to a better quality work and working atmosphere, with less effort and faster. He was following the idea that the effectiveness of a worker cannot be measured in the amount of his sweat but rather in the number of high-quality products.

After a decade of improving his skills on various positions and challenges within the company, the company offered him the position of a technologist. In that new creative environment he was able to do his utmost and was so promoted to the position of the development technologist and later to the head technologist. He was so able to upgrade his rich technical-operational

knowledge by complementing it with his affinity to construct and design and so brought his company a string of innovative and designer solutions for products which are now successfully placed in the market and bring the company awards at various innovation competitions.

With deliberate recruitment policy as well human resources management and training in the technical field and other fields, the company managed to make a leap forward as regards technology and innovation despite the difficulties which were a consequence of inadequate technological equipment, a heritage of past difficulties and adverse economic situation. The company has become the leader in its branch of industry.

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2.3.2. Implementing the idea management

The organization of IM in the companies may be divided into three systems, namely the classical system, the supervisors-managed system and a combination of both. The *classical system* provides for the entire process to be managed in a centralized manner. The employees submit their ideas on improvements (i.e. "suggestions") in a written form to the central department or an individual who is responsible for processing employee suggestions within the company. The role of a line manager in this system is only partial or does not even exist (he/she may be receiving the suggestions and forwarding them to the central department or may only be informed that the suggestion was generated within his/her department – at times not even that).

On the other hand, the *supervisors-managed system* proves to be completely decentralized since the predominant responsibility for implementing IM is entrusted to line managers. The IM goals on the company level are delayered down to the level of particular department and the line manager remains responsible for their achievement. The employee submits a suggestion directly to his/her superior (verbally or in writing) who then decides upon its acceptance. Furthermore, he/she may upgrade the suggestion together with the author and his/her colleagues and delegates the person responsible for its implementation (providing the said does not exceed his/her competences), defines the amount of the award and also grants it. Very often the formal department operates as a working group and expresses its innovativeness pursuant to the group/team problem-solving principles. The central department (IM department) acts only as a coordinator, trainer, animator and motivator.

Modern trends in IM are abandoning the centrally-driven system and are beginning to introduce the supervisors-managed system (Fatur and Likar, 2006).

What are the main issues to be dealt with when introducing the idea management programme into an organization?

First of all, IM is a matter of the *top management decision*. But its decision and its declarative support offered to innovativeness are not enough – they must be followed by a strong *commitment* shown not only by words but also by concrete management's acts. Usually, the strategic role of IM is well-defined yet the problems occur at the implementation phase.

Innovativeness needs to be a declared *value* and has to be made a part of the companies' *strategic plans*. Then, the strategy needs to be turned into IM *objectives* which are defined not only at the company level, but also at the level of every individual department (organisational unit, work group). *Objectives* have to be defined as per contents and value and set with consensus of all the organizational levels. This means that the responsibility for reaching them at the company level has to be devolved upon middle and lower management. Namely, the objectives in IM may only be reached on the base levels, i.e. among employees working at the lower organisational levels. The results at the company level can only be a sum of results recorded by individual department. In the event the latter fails to have any objectives set, its results may not be expected and accordingly also the results of the company as a whole. Of course, if the set objectives fail to be reached, the management has to demand appropriate measures to be imposed.

Low level of top management's awareness as regards the importance of innovativeness leads to a low level of awareness at the subordinate organisational levels. Unlike other aspects, the aspect of goal setting remains the top management function. Communication system, organisation, employee development and similar may be established and developed by the IM department regardless of the level of interest demonstrated by the top management. Yet the same does not hold true for the aspect of goal setting. Setting goals and objectives and providing means for reaching them remain a direct responsibility and concern of the top management.

A company should appoint a person responsible for IM – an *idea manager*. Reputation and power of the personality are particularly significant as to the position held by the idea manager. In principal, innovation is voluntary activity of the employees. Therefore, the idea manager should use not only his formal authorisations but also his informal power if he wants to encourage the employees to be innovative. In the companies with supervisors-managed system

or combined system, idea manager proves to be a reputable person who not only implements formal processing of submitted suggestions but also holds a role of leader, mentor and consultant. In the classical system idea manager is merely engaged in formal processing of suggestions, looks after their implementation and calculates the amount of award granted to the innovator – which are tasks that do not require a large amount of personal power and reputation.

Both the management and employees as well as evaluators have to be appropriately *trained*; the subject of training is not only the procedures (IM process execution, evaluation of ideas) but also the contents (creativity techniques, team work). Attention should be paid to the *creativity techniques*. Formal frames, which encourage ideas submission and enable their processing and implementation, are only a part of the story. These frames enable a certain level of creativity and consequently innovativeness within the company. Employees are offered a possibility to be creative. Nevertheless, the creativity of each individual is limited. In order to surpass its fundamental level, creativity needs to be "pulled" out from the individuals as well as teams. This means that management should no longer be passive and awaiting for the ideas to be generated yet use various tools and techniques which shall help employees to be more creative.

Companies must be aware of the high importance of *suggestion implementation*. Idea which remains unrealised is worthless. In order to avoid comments given by the workers, i.e. "he received an award, we got work", companies may transfer most of the implementation work onto inventors that are personally interested into implementation of their ideas, thus willing to contribute their efforts in this field. Throughput time (time elapsed from suggestion submission to its implementation) as one of the key elements of efficient IM system still holds great reserves. Successful companies are able to implement the process from invention (idea submission) to innovation (idea implementation) fivefold faster than average ones.

Communication between the author of suggestion and IM department proves to be a very delicate field since it involves personal interests of the individual. Satisfaction of the individual innovator and his interest in future cooperation depends on the form of communication which the idea manager was able to establish. In case the suggestion is unfoundedly rejected or, even worse, if the suggestion is lost somewhere in the procedures and without any feedback given to the author, the author shall most definitely decide to discontinue any further cooperation. Unsatisfied individuals shall suppress the innovation climate more effectively than the most efficient information system may create it. However, the most favourable answer given to the author is definitely the fastest possible implementation of his suggestion providing it proves to be justified.

The company should strive to integrate the awards granted to innovations into the salary and wages system. Connection of the IM with other systems introduced by the company is of extreme importance for its vitality. Only when the IM becomes an integral part of company's life, it shall grow to be self-evident. And when it becomes self-evident, it shall operate spontaneously without any consideration that huge amount of energy needs to be invested into its safeguarding.

According to most of criteria the supervisors-managed system proves to be more successful than classical system. A recent study (Fatur, 2005) shows that the proportion of inventors (i.e. employees who submitted at least one suggestion in the period of one year) in the entire structure of employees is threefold higher in the supervisors-managed system than in the classical one. Suggestion throughput time (time elapsing from the submission to implementation) is twofold longer in the classical system than in supervisors-managed system. Supervisors-managed system prioritises mass engagement before the quality which brings suggestions with smaller economic savings yet these deficiencies disappear due to a much higher number of suggestions submitted. In comparison to the combined system, the supervisors-managed system brings almost twofold higher economic savings per employee and almost fourfold when compared to classical system. Therefore, restructuring of existing classical centrally-driven systems proves to be the next logical step to be made by the companies which have failed to implement it so far.

2.4. How to overcome resistance

A manager or company owner trying to implement a change, no matter how small, should expect to encounter some resistance from within the organization. Resistance to change is a normal reaction from people who have become accustomed to a certain way of doing things. A critical component of any successful project is to overcome resistance to change deriving either from employees or senior staff. Without the acceptance of user, any process improvement is doomed to fail. Therefore, proper anticipation and understanding the approaches to various resistance tactics is essential to success.

Generally speaking, a comprehensive change strategy is comprised of three critical areas:

- Content (what is changing for example the structure, the systems, the technology)
- Process (how the change will be planned, designed and implemented)
- People (those impacted by or participating in the change)

Employee resistance can be generated by each of these three areas, either from negative reactions to the content of the change, how the change is being handled (process), or from intra-personal dynamics that occur naturally in all people. Which of these areas is causing the resistance is very important, because how you might resolve the resistance will depend on what is activating it.

2.4.1. Employees' resistance

The employees resist change when they perceive the direction of the innovation change is wrong. They do not accept the change because they feel it is bad for either them personally or the business. But this kind of resistance is healthy, and it could be a good thing. There is always the possibility the change to be wrong. Perhaps the employees know something the leaders of the company do not know. Employees are often closer to the customer or the operations and very well could have information the managers can't possibly possess without talking to the employees.

Employees usually resist the process of change when they:

- don't feel included in it or don't have their needs or interests represented,
- don't feel informed or adequately communicated to about it,
- perceive the decision-making process driving it as unfair,
- feel overwhelmed by the number of change activities taking up time and resources necessary to do their "real" work, or
- feel they can't succeed in it because of inadequate expertise or training.

Managers who lead innovation change using a command and control style often provoke this type of resistance due to misunderstanding the impact their change process plans have on the people who must carry them out. These managers often create change efforts that are full of inadequate communications, low participation, minimal local control and insufficient training.

This type of resistance often occurs when senior managers rely on external consulting firms to design their innovation change solution, the content of what needs to change. This relies on the fact that these firms, who are very competent at the content of change, usually don't understand the people and process dynamics of change. Therefore, many of their practices cause resistance without them even understanding this.

Resistance occurs in all employees' levels, from the CEO to the line worker. In fact, the initial stages of transformation efforts often include weeks or months of meetings where senior executives work through their own resistance. These

meetings are often discussions about what needs to change in the organization, why it needs to change, and how it will change. These debates often include significant political posturing as executives try to maximize their own organization's individual gain from the change. Once all this gets resolved, senior management announces the change effort to the organization, as if they have always been aligned. Unfortunately, when employees do not automatically accept the announced change, the senior managers immediately label their behaviour as resistance and are dismayed that it exists. All humans resist change, it is natural and it should be expected. And it must be accounted for in how company plans, designs and implements its innovation change efforts.

2.4.2. Techniques for overcoming resistance effectively

One efficient method for overcoming resistance of company's human resources through innovation change is education and communication. Employees can be informed about both the nature of the change and the logic behind it before it takes place through reports, memos, group presentations, or individual discussions.

Another important component of overcoming resistance is inviting employee participation and involvement in both the design and implementation phases of the change effort. People who are involved in decisions understand them better and are more committed to them. This was already discovered by Eisenhower. Instead of giving simple orders to his generals, he used to seek different ways of performing important tasks. He tried talking to them, convincing them and tried to get their approval for his idea. He knew that the generals would carry out the task which they believed in much better than simply complying with his orders. During these kind of persuading Eisenhower sometimes discovered that he had been wrong. As a consequence many of his ideas were rejected or amended to make them better than the original one – which would have been implemented without reservations.

Another possible approach to managing resistance to change is through facilitation and support. Managers should be sure to provide employees with the resources they need to make the change, be supportive of their efforts, listen to their problems with empathy, and accept that their performance level may drop initially.

Some companies manage to overcome resistance to change through negotiation and rewards. They offer employees concrete incentives to ensure their cooperation. Other companies resort to manipulation, or using subtle tactics such as giving a resistance leader a prominent position in the change effort. A final option is coercion, which involves punishing people who resist or using

force to ensure their cooperation. Although this method can be useful when speed is essential, it can have long-drawn-out negative effects on the company.

Resistance to change is inevitable and everyone experiences it to some degree. Leaders must be prepared to manage this aspect of change effectively in order to help the organization move quickly from resistance and denial to acceptance. Bateman and Zeithaml (1990) identified three steps for managers to follow in implementing organizational change:

1. Diagnose the current state of the organization.

This involves identifying problems the company faces, assigning a level of importance to each one, and assessing the kinds of changes needed to solve the problems.

2. Design the desired future state of the organization.

This involves picturing the ideal situation for the company after the change is implemented, conveying this vision clearly to everyone involved in the change effort, and designing a means of transition to the new state. An important part of the transition should be maintaining some sort of stability; some things – such as the company's overall mission or key personnel – should remain constant in the midst of turmoil to help reduce people's anxiety.

3. Implement the change.

This involves managing the transition effectively. It might be helpful to draw up a plan, allocate resources, and appoint a key person to take charge of the change process. The company's leaders should try to generate enthusiasm for the change by sharing their goals and vision and acting as role models. In some cases, it may be useful to try for small victories first in order to pave the way for later successes.

Additionally, the content of company's innovation change must be planned while *keeping the people impacts and the process elements in mind*. The best way to ensure that company's process of innovation change will be accepted and positively supported by its employees is to include employees on company's change project teams and bring them face to face with the external pressures to change. Staff can be energized to participate in a change initiative if they understand how their work contributes to the company's success.

You could always *engage change leaders from your own staff*. People who "own" and drive the change can serve as role models. A clear best practice is to identify the

leaders early and encourage them to drive the changes. Some will have influence because of their positions or titles; among them will be early adopters and resisters of change, and both will affect the way people around them think. Others will be in the cultural center of the organization. Still others are leaders not because of their titles or positions, but because of their connections and ability to persuade or influence others.

Do not forget to provide employees with the same type of opportunity the senior managers had to resolve their own resistance. As with the executives, the other employees should also have the opportunity to discuss and challenge the change issues and be asked for their input. Not all of what they want and feel will be accommodated, of course, but the act of asking, listening and considering their input will greatly reduce their resistance. This can be handled in large group meetings, work teams, or one-on-ones, with the information generated channelled directly back to the change leaders in charge.

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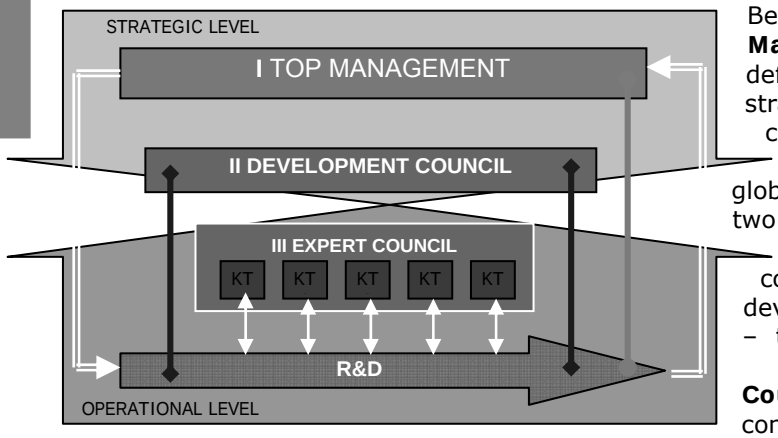
Trimo's "complete solution"

Miloš Ebner

Trimo d.d. is a provider of complete solutions in the area of prefabricated steel buildings, steel structures, facades, roofs, containers and sound-insulation systems, located in Trebnje, Slovenia.

For many years Trimo has been investing into the development and thus also systematic growth of innovative spirit as an important part of the expansion strategy on the international market. Trimo applies the **concept of "complete solution"** as a significant part of the differentiation strategy that distinguishes Trimo from the rest of the competition which in the majority "only" produces construction products. This means that Trimo starts its process chain with a strong development which is enhanced with technical consulting and design, while the production is sustained with assembly and service at the other end of the process chain. All these components enable Trimo to design solutions which prove to be optimal not only in the field of production or project solutions but also in the field of assembly and maintenance. Furthermore, feedback obtained at the assembly, maintenance as well as technical consulting, which holds a constant contact with the architects and clients, offers an important source of information to the R&D Department on what the customers want, where the possibilities for improvement are and what the trends and expectations of the architects are.

The R&D Department in Trimo is in charge of not only the development of new products/services/processes and improvement of the existing ones but also of disseminating "the innovative spirit" within the company. Among others, Trimo's R&D Department encompasses so-called "**module knowledge specialization**" in which individual researchers are in charge of following the latest trends and discoveries as well as the state of technology in particular areas, such as ecology, alternative energy sources, noise protection and similar. These individuals are obliged to collect, select and disseminate the said information among their colleagues within the company. Moreover, development projects include not only the researchers from the R&D Department but also individuals who possess specific knowledge necessary for implementing individual development projects. In such a manner, dissemination of knowledge within the company is ensured as well as the ideas collected from people who also in praxis deal with a specific problem.



Beside the **Management**, which defines the input strategic policy and controls the final results on the global level, there are two other key bodies that actively cooperate in the development process – the first being the **Development Council**, which is composed of the Design and R&D Director, the Head of Marketing, Commercial Director as well as the Technical Director, and which acts as some sort of intermediary link between the strategic and operative level of decision-making. The Development Council deals with the key input suppositions of development project, such as the product concept, preliminary market analysis, preliminary business plan, etc. and confirms key milestones of development projects, i.e. purchase of technology, confirmation of trail batch and similar. The **Expert Council**, which is composed of key people from all parts of the process within the company, such as the Production, Purchase Department, Logistics and Dispatching, is a body to which all members of the project development team are obliged to present all milestones of the development project and they also need to consult with the said body about possible implications to their part of the process. As a result, well-timed incorporation of all parts of the company into developing a new product is thus ensured.

Trimo encourages innovativeness and enables generation of new ideas through several parallel channels. The first one is institutionalised through the **development process of new products** – which defines that information or ideas on new development projects provided by the commercial network, technical consulting, marketing department, developers and the Expert

Council – are collected on annual basis. These ideas are then profiled through the market needs analysis. The needs are defined on the basis of customer questionnaire, market analysis, technical and economic and social trends, analysis of the competition and other prospect lines of industry as well as regular annual meetings with architects, suppliers, strategic clients, etc.

The other channel of collecting ideas, which are primarily generated by the employees, is though the so-called "**Idea Basket**" which enables employees to rapidly and without any administrative work submit their ideas on possible development projects, namely directly via the Internet where they may later also follow the "fate" of their suggestion (whether the latter was accepted, what its current status is, etc.) Customers and business partners may submit their suggestions via Trimo's web site. Trimo's web sites are designed is the way which enables efficient exchange of information, documents and other data among all employees. The said system further contributes to better dissemination of knowledge within the company and thus indirectly helps towards generating new ideas.

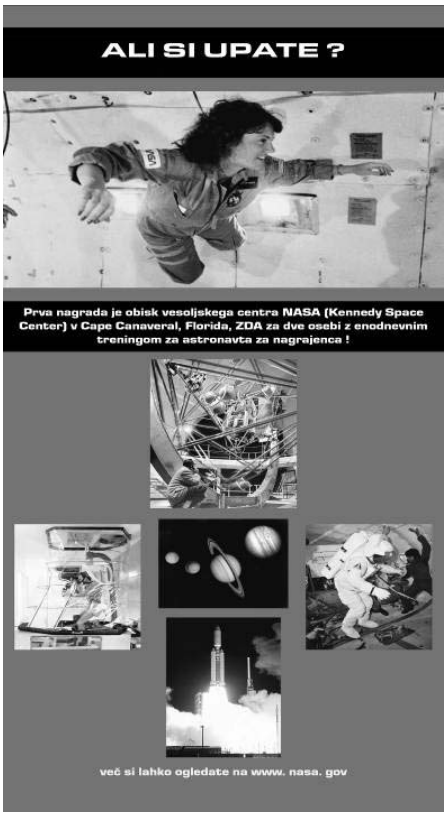
In order to »hunt« for ideas, Trimo applies also some other tools, such as for example the "**Continuous improvement process**" or "**CIP projects**" – as often referred to by the employees. CIP projects are indented for collecting ideas on making small and medium improvements, mainly improvements to concrete products. It is extremely important that the suggestion, which is usually submitted by a group of employees, includes expected saving – which is also closely followed after the improvement has been implemented. Beside practical prizes for minor improvements, the employees are given also concrete financial awards for suggestions offering higher financial effect.

Trimo cooperates closely with the external business partners at the idea collection and the development itself. As a result, Trimo organises the **theme gatherings** or workshops with major suppliers at least once a year where opportunities for improvements and challenges in the forthcoming year are reviewed and potential cooperation in joint development project are arranged. Furthermore, meetings with architects and designers are frequently organised at different locations where Trimo presents its products and development plans for the future. Opinions and suggestions offered by the designers and architects on the existing and also future or potentially interesting products are collected during the talks and on the basis of surveys. External architects, designers and industrial designers are regularly invited to join the teams which work on particular development projects – not only in the process of setting and testing of idea concept of the product but also its operative development.

Trimo strives to include **research centres** into its development projects, such as the universities and research institutions at home and abroad. Consequently, Trimo holds regular annual contracts on cooperation with quite a few universities and institutes in Slovenia and abroad. In 2005 Trimo thus cooperated in the development of its products with more than 25 faculties and institutes of which more than 40 % came from abroad. Beside these research centres Trimo engages also individuals and companies which possess

necessary knowledge and which are directly incorporated into Trimo's teams where they cover particular expert areas – there were more than 30 of such partners in 2005.

Strategic partners (clients) are intentionally incorporated into the development processes. The said partners (clients) are met on regular basis where development activities are reviewed and coordinated. Development priorities are thus adapted to these partners' (clients') suggestions and needs. What's more, strategic partners are incorporated into particular development teams which develop products that reflect their needs. Hence, Trimo accomplishes that particular new products are designed in such a way that they already have first known users when entering the market. As a result, the risk of failure or higher entry costs is minimised.



So-called **Key Files** are intended for improvements in the processes and intradepartmental cooperation in the process of TQM. Key Files are run by the TQM promoters within the particular departments who collect the so-called costs of non-quality, follow key value drivers and who suggest the opening of new Key Files on the basis of colleagues' suggestions submitted at the regular TQM meetings as well as establishment of intradepartmental teams which should search for appropriate systemic solution. Key CIP projects and Key Files are regularly presented to the General Manager, namely by the project leaders at the Board of Directors Meetings.

Trimo also publishes a tender called **Trimo Crazy Idea** whose purpose is to encourage unconventional, unburdened, and different way of thinking among the employees. The tender ensures that those who are capable of thinking differently are no longer a burden but an important part of the innovative spirit of the company – as written in the annual tender carrying a motto: "I dare – thinking differently!" A significant difference between Trimo Crazy Idea and other tools for collecting employees' ideas is that Trimo Crazy Idea is not necessarily useful for Trimo in the near future. The selection criteria encompasses factors such as an open way of thinking and an efficient presentation – all with the purpose of encouraging unconformable way of thinking as a value. At the end of the year, namely at the New Year's Party, an award is granted for the Craziest Idea. The award itself is also slightly

unusual – the last being a trip for two people to Kennedy Space Centre in Cape Canaveral, Florida and a one-day course for astronauts.

Beside internal awards Trimo has been granting also international **Trimo Research Awards** for the best graduate, masters and PhD thesis. The tender is published annually in Slovenia and some other European countries and is intended for any scientific work which in any way relates to the areas covered by the company Trimo. Most of the works come from the area of architecture, civil engineering, mechanical engineering, information technology, economy, law, management and similar. Beside being published in media and special collection of scientific papers, the prize-winners are given a special awards and financial prize. Alongside developing cooperation between the company and universities located in the markets where Trimo is already present and increasing the awareness among the students and professional public on these markets, one of the fundamental purposes of these awards is to encourage transfer of information, knowledge and ideas between Trimo and external research centres which operate in the fields interesting for Trimo and support cooperation between the most promising students and Trimo. More than 130 awards were granted in the last five years, with almost a quarter of all prize-winners having cooperated with Trimo in one way or another after the awards were granted.

An important source of information on modern trends and market needs are also regular international **Trimo Architectural Awards** which are granted every two years for the best architectural solutions using Trimo products. Analysis findings on these trends are directly incorporated into new development projects and thus also into new products of the company Trimo.

As regards all these activities which are carried out internally and externally and whose sole purpose is to increase the level of innovativeness within the company and thus increase the efficiency of the development process, it is important to understand a fundamental Trimo's philosophy that acknowledges the innovativeness as a complex, mutually intertwined process which incorporates different final segments (employees, suppliers, architects, strategic customers, etc.) that only together attain critical mass which enables the establishment of innovative spirit within the company and that is organically incorporated into the everyday performance of the employees.

2.5. Assessing the innovation process

2.5.1. Measuring innovation

To understand if an organisation is successful in its adoption of innovative work practices and pursuing its innovative strategy they must measure innovation performance. Essentially, if an organisation is being innovative then they have embraced change. Consequently, their overall business indicators should reflect a positive performance. A stable business performance would suggest that the organisation is simply maintaining its relative position to the external environment (maintaining a reactive stance). A downward performance might be explained by uncontrollable factors such as interest rates, GDP and so on, however this only serves to disguise an organisation's lack of internal capabilities to monitor its external influences and respond accordingly. Thus, an innovative organisation should see improvements on all business indicators, especially over the mid- to long-term.

The following sets out some ways of measuring innovation performance along the four types of innovation explored above. Combined these represent a means for measuring the success of a firm in embracing innovation.

Input innovation – requires assessing the performance of an organisation to seek out and provide new resources or source of resources, together with new knowledge.

- Number of technology licenses bought – will provide a means for determining the extent to which a firm explores and utilises technology developed by other organisations.
- Number of collaborative agreements signed – will measure the degree to which an organisation is extending its value chain into the supply side of the business, and collaboratively working with suppliers on innovations.
- Ratio of supply value to number of suppliers – will indicate the degree to which an organisation is embracing supply relationship management, insofar as the key suppliers supplying the bulk of input materials.
- Investment in business intelligence – will show the degree to which an organisation seeks data about its external environment as input into innovative activities.
- Number of linkages with universities – as a means of determining a potential source of new information.

Process innovation – requires measuring the performance of all activities within the organisation to determine if continual improvement is being adopted. These measures need to include the structure, process, people and culture.

- Span of control index – measures the degree to which an organisation is introducing flexible, autonomous work structures.
- Number of supply-chain collaborations – indicates the degree to which a firm has adopted innovative network organisation structures.
- Cost of quality measures – internal failure, external failure, prevention, appraisal – provide a measure of the quality associated with the service or product 'production' process.
- Cost of sales performance – can indicate whether the 'production' processes are constantly being improved to reduce overall costs.
- Cost per innovation – provides a guide as to whether the innovation introduction process is, in itself, being innovated. That is, that the cost of brining new innovations on-line is reducing.
- Number of innovations undertaken by size – to gauge whether the organisation is constantly innovating and has a range of projects underway.
- Investment in process innovation as a percent of process costs – will measure the degree to which process innovation is encouraged.
- Human relations measures – absenteeism, turnover, morale – measure the effectiveness of human resource management activities.
- Cost of human relations function as a percent of total expenditure – to indicate whether innovative human resource management is becoming integral to the organisation.

New product innovation – refers to changes to existing products (minor and significant) as well as the introduction of entirely new products. To ensure that the innovation pipeline continues to yield a progression of innovations, the following performance measures are required.

- R&D expenditure as a percentage of sales – indicates the level of commitment that an organisation has to innovation.
- Market research as a percent of sales – to indicate the degree to which an organisation actively seeks data about customers' needs.
- Number of research programs – to ensure that too many projects are not undertaken simultaneously thereby stretching resources too thin.
- Mix of research programs – to ensure that the organisation is investing in a range of innovations (short- and long-term; high and low risk) to increase the success rate and have a continual flow of innovations entering the market.
- Number of product innovation introductions – minor, significant, major – will measure the outcome of research programs.

- Product innovation progression rate – per innovation type – will monitor the effectiveness of the innovation process to allow for the removal of blockages, thereby minimising cycle time.
- Number of patent applications and approvals – while patents do not signify viable commercial projects, innovative organisations will be developing proprietary intellectual property that must be protected. A further measure might be the relationship between patents such that a firm is developing a web of patents to protect a field of inquiry.
- R&D expenditure per patent – can measure the efficiency of the research process and allow benchmarking against competitors.
- Percentage of sales from new products – to determine the level of return from innovation to an organisations financial success.
- Number of licenses issued for new technologies – provides a measure of collaborative arrangements with customers and partners, and that intellectual property developed by an organisation might be utilised by other organisations.
- Number of collaborative agreements – customers and partners – provides an insight into the value web of an organisation.

Strategy innovation – can be measured by an organisations growth; that is, that innovative strategies have enabled the organisation to grow. Growth is an essential element in Kaplan and Norton's (1992) Balanced Scorecard.

- Sales – indicates whether the demand for an organisations products or services is attracting more customers as a result of innovative activities.
- Profitability – will provide insight into whether the organisation is undertaking innovations in such a way as to improve its overall business performance.
- Return on assets – to determine the organisation's ability to generate a return on its investment.
- Market share – will provide data as to whether an organisation is growing relative to its competitors.
- Market value – provides a measure of the market's perception of the organisation and its ability to be innovative.

In sum, innovative organisations require constant feedback, not only from the external world and the influences that impact its performance, but data relative to its performance per se. Such indicators enable strategies to be developed, tailored or new programs devised.

2.5.2. Scorecard to assess enterprise innovation capabilities

Another methodology, presented herein, helps organisation to assess its own innovation and to improve its understanding of innovation.

The capacity for continuous innovation requires the integration of management processes (Markič, 2004). In "Reaping Value From Knowledge and Innovation" (Young, 2001), Gartner described how continuous and leveragable innovation depends on the integration of strategic, human capital, knowledge, innovation and intellectual capital life cycle management processes within and across enterprises. We refer to this integrated system as the *innovation value chain*. The good news is that, for most enterprises, these processes – components of the innovation value chain – already exist. The bad news is that these processes may be immature and they have almost always evolved in isolation, leaving value chain participants blind to the others' needs, interdependencies, capabilities and opportunities. These conditions undermine the enterprise's ability to innovate.

The key to growing innovation is to optimize the overall performance of the value chain by improving the components themselves and the links between them. This requires an understanding of the theory of constraints, which is based on the implicit assumption that all systems are comprised of individual steps that perform a value-added function, which ultimately results in some kind of outcome. Traditionally, each step would be optimized separately; therefore, some would work faster or with greater reliability than others. This results in one of three conditions:

- Bottlenecks, where work from faster preceding steps piles up before a slower one.
- Shortfalls, where steps beyond a bottleneck are idled, waiting for bogged-down work in progress.
- End runs, where preceding steps are circumvented to speed up the process, which results in inconsistency and unreliability.

Given these conditions, outcomes are only as reliable and as fast as the value chain's weakest step or component. To optimize a system such as the innovation value chain, leaders should focus on the identification and incremental resolution of the poorest performing component and its adjacent links, proceed to the next when the worst is resolved, and so on. Doing anything else is a waste of time and resources because it will not improve outcomes.

Gartner's innovation scorecard (see Table 1) is a simple tool for facilitating the identification of an enterprise's weakest component and links in the innovation value chain (Gartner, 2002). Once the primary weakness is identified, remedial action can be taken to resolve it.

Innovation Value Chain Process Component	Yes ~ Pts. 5 Usually ~ Pts. 3 No/Don't Know ~ Pts. 0
Strategic Management • Vision, values, mission • Strengths and competencies • Business drivers and strategies • Leadership	• Are failed experiments regarded as a source of learning? • Are business processes such as R&D explicitly focused on core competencies or stated business objectives? • Does the enterprise systemically encourage, explore and reward creative thinking? • Are strategic partners evaluated in the context of innovation capabilities and processes? • Are business unit leaders and partners held accountable to strategic innovation objectives?
Human Capital Management • Strategic sourcing • Recruitment/retention • Performance mgmt. • Continuous learning and development	• Does the enterprise consciously hire creative, adaptive staff? • Are workers expected to continuously develop and stretch provided the opportunity to do so? • Is work performed in interdisciplinary, cross-organizational • Do mechanisms exist to retain and exploit human capital economic turmoil, in the event of mergers and acquisitions, relationships? • Are human resources required and encouraged to share information?
Knowledge Management • Information capture, synthesis, sharing • Creative communities • Continuous learning • Relationship mgmt.	• Do skills systems exist for identifying, growing and allocating experts? • Do collaborative systems for information analysis, knowledge capture and sharing exist, and are they actively utilized? • Do workers consistently indicate the information and tools available to them actively assist, rather than hinder, their performance? • Are sources of knowledge and innovation (organizational and individual) and their outputs known, nurtured and systemically monitored? • Where strategic partners are integral to business process execution, do workers have ready access to cross-organizational data, knowledge, information systems and personnel?
Innovation Management • Competitive intelligence • R&D • Collaborative systems • Learning	• Are downstream, non-R&D organizational units regularly consulted as potential sources of leveragable innovation? • Does the enterprise regularly monitor patenting activities of competitors, partners and key customers and use that information to help shape innovation and business strategy? • Is there an explicit process for discovering, evaluating and funding potentially leveragable innovations throughout their development life cycles? • Do tools and processes exist for data mining, information and knowledge repositories for potential opportunities? • Are the capabilities of existing or potential partners considered in determining which innovations to pursue?

IC Life Cycle Management • IC asset and portfolio mgmt. • IC valuation • Global value extraction policy • IC protection	• Does the enterprise attempt to describe and quantify the value of its intellectual assets and are the results made public? • Is a strategic organization tasked with maximizing the financial return of the IP portfolio on a continuous basis? • Are non-native industries, countries and markets continually assessed in evaluating an IP asset's potential? • Does the enterprise proactively consider adopting business strategies in the context of its asset portfolio, even if exploiting certain assets would take them outside their core competencies or business-value proposition? • Does the enterprise include process and business practice innovations in its IP management practices?

Table 1: Gartner's innovation scorecard

This scorecard is designed to assess the process components themselves, as well as their integration with preceding or following steps. It also considers the increasing role of strategic relationships. For any given process component, a subtotal score of 18 to 25 indicates strong positioning; a score of 11 to 17 indicates reasonable positioning, with the need for some further refinement; a score of 0 to 10 indicates an exceptionally weak link in the value chain. Component scores should be compared, and those with the weakest ratings should receive the most immediate attention to optimize innovation outcomes. If most or all of the component scores are in the moderate (11 to 17) range, then one of two conditions exist:

- The enterprise's performance in relation to the scorecard's questions is actually unknown, and responses were made based on surmise or on anecdotal evidence.
- Any positive positioning in terms of adding value to innovation is purely accidental.

In both cases, deeper investigation into the performance of the value chain components should be conducted and the scorecard assessment reconsidered in advance of any attempts to reengineer or more-deeply integrate component processes. If two components appear equally dysfunctional, management can design specific measurements to obtain a more-granular understanding of relative weaknesses or make an informed judgement with regard to the relative cost and effect of improving one component instead of the other.

2.5.3. I-model – An innovation assessment tool

There are also somewhat different approaches towards systematic analysis of innovation performance benchmarking. One of the systematic in-depth analyses

is developed within the EU framework of Leonardo da Vinci (Innovation model) which discusses the following topics:

- strategic aspects of encouraging innovation (strategic, managerial and fundamental organisational aspects)
- goal-setting and assessing of results (as regards organisation, time and innovation watch)
- organisational culture and climate (creative atmosphere and related relations and systemic measures)
- human resource management (related to knowledge and skills for managing innovation and implementing innovative activities)
- organisation of idea management generated by employees (mass inventive activity)
- idea generation techniques (seeking possibilities for improvement, for generating solutions and solution check)
- appraisal system (monetary and non-monetary recognition)
- role of managers (as an important instrument for encouraging innovativeness)
- innovation co-operation (with university, suppliers, consumers, competition)
- identification of factors hampering innovation activity
- innovation expenditure (including R&D) within the organisation and in cooperation with outside colleagues.
- effects of innovation (indirect effects such as intellectual property, new market product, market share, production flexibility, effects on health and environment..., direct effects: savings and financial effects owing to new products and services...)

On the basis of individual questions, the aforementioned areas are assessed and we may thus establish opportunities for potential improvement. The praxis clearly indicates that harmonised activities on individual areas bring the most optimal business results, which means that no distinctive discrepancies prove evident.

3. Need analysis tools supporting innovation

Arne Kullbjer and Borut Likar

Innovation is closely linked to needs. However brilliant and innovative a product it will be of no use if nobody asks for it. Innovation is also related to design and sustainability. If we do not foresee sustainable development using renewable resources, low energy etc there is no need to develop a product further. Design is an important factor taking the interest of the end user of a product into account.

Extensive background information about end users needs is important before even thinking of developing a new innovative product. Tools for finding the needs can be very different and here we will just give a brief background on some of them like questionnaires, SWOT-analysis, On-line tools, focus groups and technology watch methods.

3.1. Questionnaires

Most of us have probably responded to different types of questionnaires. This is however not equivalent to the construction of a questionnaire where your intention is to get responses and adequate answers to your problems and the items you want to investigate. Many questionnaires include simple and short questions which fail to be carefully prepared and there are just too. This is mostly not effective and takes a long time to answer for the best results. If too ambitious, many questions not being applicable, the response could be low and the results not as representative as they should be.

It is important to exactly define the information you need and not go beyond these borders even if tempting. Define and write a clear objective to get the scope of the survey and then make a draft of the questionnaire. If you have settled your objectives then it is easy to define the exact items planned to be measured by the questionnaire.

A reference group or colleagues could be consulted. You could also use a small group of responders, who you know very well, to get an input from their reaction on the draft version of the questionnaire.

Open questions where the responders are expected to give written answers are easy to construct but also often tend to give less response than other type of

questions. Of course you could include some questions of that type to get further information from some of the persons responding. If you expect many responses to the questionnaire it might create problems in the process of evaluating the responses. Be careful.

Try to make the questions as objective as possible. If you make a scale where the respondents are expected to choose between a number of boxes and numbers to choose, make it as conform as possible through questionnaire. One example can be seen in Table 2.

Rate the questions from 0 to 5 according to the following chart:

0	1	2	3	4	5
Don't know/ N.A.	Strongly disagree	Don't agree	Indiffer-ent	I agree	Strongly agree
	Rarely			Quite/En	Easily
	Never	Not often	Some-times	Almost always	Always
	No				Yes

Table 2: Question rating

Such an approach makes it easier for the respondent to fill in the questionnaire. It could also be discussed if there should be a middle-point where you do not take any positive or negative response to the question. This procedure would be a way to force the respondent to take a standpoint.

Questions like "Yes-No" and "Multiple choice" might be needed to include into the questionnaire.

Important to keep in mind at all time is;

- All questions should be coherent with the well defined objectives of the questionnaire
- All questions should enable answers from the respondents
- All questions should produce answers you really need
- All questions should be easy for the respondents to understand

A nice, attractive layout, professionally printed, is important. Such a serious approach will make the response rate higher.

3.2. On-line tools

It is of course possible to provide the questionnaires on-line over the Web. Many commercial websites are available where you can create the survey,

conduct it on-line, make the analysis and download the results which could be presented in different forms/software.

Just search the web for on-line surveys and you will find many such examples.

The on-line questionnaires and services offered by them are naturally of interest as they might analyse and present the data in a convenient form. But they could go even further and suggest actions as a result of the analysis.

One example is a project, eCASME (2004), coordinated by University of Limerick which has developed a tool for Training Needs analysis where the training (or Competencies) is broken down into sub components to specify training needs into detail. From this a training plan is generated to individual employees. The training plan specifies a method to allow companies to generate their own training content where possible (Devetak, 2002).

The result of the analysis is an individualised training plan per employee specifying content required for a training program. One further development of it could be to offer on-line training compiled from "Learning objects" that exactly matches the need of the employee. In principle all could be generated on-line and offered to the employee. This point has not been reached yet, but it is not an unrealistic future vision.

Another example is the project COMBAT. This being a co-operation of eleven partners based in eight different EU countries. As part of the Leonardo da Vinci umbrella they have developed a methodology that guides companies step by step in the most effective and efficient training for their personnel. As part of this project a number of tools were developed:

- competency analysis
- assessment of workers at the workplace
- training needs analysis
- training plan development
- training delivery

These examples cover training need analysis, but they also give views on how much further you might go with on-line tools compared to the paper based questionnaires. We will probably see more of these types of need analysis tools not only making surveys but also providing solutions to the results analysed, and why not make it a part of the innovation process when new products are being developed.

3.3. SWOT analysis

SWOT-analysis is a tool where you can find out your own Strengths and Weaknesses as well as looking for Opportunities and Threats you face now or will face in the future. It is a simple method but nevertheless quite powerful to help you understand your business and how to act in the future.

The SWOT analysis is often presented in a worksheet or diagram with four boxes according to Table 3.

Strengths	**Weaknesses**
Opportunities	**Threats**

Table 3: SWOT analysis diagram

In the diagram you can write down Strengths, Weaknesses, Opportunities and Threats.

There are of course a number of questions you could write down the answers for in this diagram and after that try to make an analysis.

Examples on criteria are shown in Table 4.

Strengths	**Weaknesses**
• Advantages of your business • Your capabilities • Experience and knowledge • Marketing • Innovative aspects and possibilities • Resources • Price	• Improvements needed • What to avoid • Capability gaps • Cash flow • Quality • Market penetration • Missing resources
Opportunities	**Threats**
• Opportunities you think you have • Market • Production innovation • Technology innovation • Geographical expansion • Trends you could foresee • Strengths that could be opportunities	• Obstacles • Competition • Cash-flow problems • New technology threats • Key staff • Market changes

Table 4: Examples on criteria in SWOT analysis

Several criteria's could be placed in more than one of the boxes and could for instance both be a Threat and an Opportunity.

Strengths and Weaknesses are considered to be internal to your business or organisation while Opportunities and Threats are more depending on external factors. It is of course also possible to try to analyse your competitors through a SWOT-analysis even though you probably do not have all data available to be sure how correct the analysis is.

Try to make the analysis not too big and complicated, just finish up not exceeding 4-10 sentences in each box.

With a good analysis you can focus to decrease threats and take advantage of your business opportunities.

You might also make an SWOT analysis on a personal basis to identify your own opportunities and threats.

3.4. Focus groups

The method of focus groups is often used for planning, marketing and/or evaluation of a product or a service especially during a development phase. This is a possibility to strengthen the process of new innovations within a company.

The focus group could be chosen to collect information and to check out your assumptions while being in an innovation process. They could also get involved in the marketing process and definition of the market.

If you want to establish a focus group it is important to be very clear with the purpose/objective of the group and to define the questions to be tackled and answered to. The members of the group should be well prepared and have a good understanding of the purpose, be given background material etc.

After a preparation time of 1-2 months there will be a session where the focus group meets in a convenient location for maybe one day. During that session a facilitator will lead the discussion and keep it at all time focused on the objectives to gain most possible output from the group.

After the session it is important to analyse and document the outcomes.

The focus group should not be very formal and exact, it is more essential that the members of the groups are comfortable with the situation, especially during

the session when they are supposed to give their contribution and answers to the questions defined. Choose a nice surrounding with good support during the meeting.

3.5. Desk research

Desk research is as the term suggests a research you can do at your desk using a computer. This term is mainly used as an expression when trying to define customers and market to your product, and the competition you are facing. Internet is nowadays the main source to find and to use published information.

To make desk research you must know what you are looking for and understand the quality of the material you find. Correct information is essential. It is easy to find material on Internet, but the problem arises when using a search engine you receive an enormous amount of links. Which ones are the most interesting? To make an analysis of the market or the competitors related to a certain product will probably take several days. The analysis takes time and even though being careful it is easy to leave out key issues within the material.

The quality aspect needs a lot of experience. You need to look for how the information has been gathered, and if the website seems to be reliable. As to the market analysis you often get only small pieces from different sources needed to evaluate and to put together to get the proper overview and understanding.

During desk research always bear in mind where and what to look for, quality and selection of necessary information. It is easy and tempting to get into directions beyond the scope of the research but try to keep your focus during the whole process.

3.6. Technology watch

3.6.1. The purpose of technology watch

Technology watch encompasses establishing the state of research and technology in international scale. We wish to establish what has been done in a specific field of technology or which the guide criteria of development are.

Type of data	Sources of information	Level of applicability for enterprises
Development guide criteria of states, EU, USA and similar	• governmental documents • official state web sites, EU – e.g. CORDIS	• strategic decision-making of enterprise
R&D projects (current) – universities, institutes, commercial research laboratories	• specialized databases (national, EU – 6 & 7 Framework Programme, Marie Curie and similar) • publications at scientific conferences	• strategic decision-making • sources of knowledge and ideas for enterprises with leading strategy
R&D projects (concluded) – universities, institutes, commercial research laboratories	• specialized databases (national, EU – 6 & 7 Framework Programme, Marie Curie and similar) • publications in scientific and expert journals • reports of R&D groups and national as well as EU tenders	• strategic decision-making • sources of knowledge and ideas for enterprises with leading strategy
Patents	• specialized databases on granted patents (Espacenet, USPTO …) • patent representatives	• strategic decision-making • sources of knowledge and ideas for enterprises with leading strategy
Enterprises – commercial offer	• enterprises' web sites and other materials • specialized databases (yellow pages and similar) • fairs, exhibitions	• strategic decision-making • sources of knowledge and ideas for enterprises with
Experts' analyses	• specialized databases • tailor-made production	• strategic decision-making • sources of knowledge and ideas for enterprises with tracking or leading strategy
Other info	• macroeconomic reports, financial statements of enterprises, stock exchange data, news and similar	• strategic decision-making • sources of knowledge and ideas for enterprises

Table 5: Technology watch

Knowledge on the state of technology proves to necessary due to rapid development of technology and globalisation effects, that is to say not only in the development of new products and services, selection of material and components, purchase of development and production equipment, logistics as well as following the competition as regards the development but also their marketing activities. The results of analysis serve also at managerial decision-making on new inventions and of course strategic decisions of the management.

3.6.2. Independently or with a help of an expert

Overview of the state of technique is performed mainly by large enterprises themselves, while small and medium-sized enterprises may order the analysis from the qualified institutions. As regards the quality the prices range between a couple of thousands and some ten thousands of euros. A good analysis may be performed only by a well-qualified expert – generalist, who knows the method of work and payable databases at his disposal and by cooperating with experts from concrete fields (universities, faculties, consultants, senior managers and similar). The work is mostly performed via Internet since the latter may prove to be a valuable source of information if used deftly. In recent times, even professional information agencies collect a significant part of the information they require on Internet. According to some data more than 80 % of information is collected in such a way.

The work is carried out in numerous stages. In order to obtain appropriate information, the problem needs to be clearly defined otherwise the right information may be hard to select among a great number of obtained information. This phase is followed by information collection – outside experts may be brought in if thus proves necessary. After this phase, filtrating is essential together with organising of obtained data as well as their analysis. This is followed by the preparation of basic report and the presentation to the contractor. Paying regard to contractor's comments, additional data collection is carried out followed by analysis and preparation of final report.

In praxis, the results prove to be considerably more useful to the contractor if the latter continuously cooperates during the work since the research is oriented and directed according to the needs of the contractor.

It is worth mentioning that some enterprises perform part of this process on permanent basis. They follow different Internet or other resources, visit fairs, exhibitions, and expert conferences. They are at least partly familiar with the competition and suppliers of technology and equipment. Yet the praxis indicates that systematic analysis on the basis of new and considerably more in-

depth approaches including experts may represent the enterprise value added which is used to their benefit during the business process.

3.6.3. Searching via internet

General browsers may be used for independent substantiation of the state, such as Google (www.google.com), Altavista (www.altavista.com), Hotbot (www.hotbot.com). Yet we may also use special type of browsers which try classify more or less successfully the hits according to technological-entrepreneurial nature. Examples of the said browsers are www.search4rss.com, technology.monster.com. It is furthermore advisable to have a look at the web sites which specialise in following technological development. Perfect information of course cannot be found but you may find performed comprehensive studies, papers, reviews, assessments and similar, which partly comply with your area of interest. Thus documents (researches) on technology development in the field of e-learning, nanotechnology, new technologies of screens, optical telecommunications and similar may currently be found on www.primetechnologywatch.org.uk. It is also worth highlighting more challenging databases such as Dialog (www.dialog.com) which deals with the filed of entrepreneurship and finances (over 14 million American and international enterprises), chemistry, energy and environment, food, patents, medicine, pharmacy, technology and similar. The use of the said databases is demanding and above all not cheap. Particularly useful are databases collected within EU information service (http://cordis.europa.eu) (CORDIS – Community Research and Development Information Service). Numerous databases on R&D work may be found under the heading "Database and Web Services" which is financed by the European Union. Moreover, the said web site also offers browsers of partners for R&D work, databases of programmes and projects and similar.

When browsing for literature, search and purchase of literature via Internet bookstore Amazon.com (www.amazon.com) proves to be popular. Amazon.com has been followed by other bookstores such as Barnes&Noble (www.barnesandnoble.com). The purchase of books may be made easier by checking the table of contents of the book and sometimes reading the purchasers reviews of the book.

The Internet offers numerous browsers of patents databases yet only a few are free of charge. The browser of the American Patent Office USPTO (www.uspto.gov/patft) and the browser of European Patent Office (ep.espacenet.com) prove the best in praxis (Figure 4). The former enables browsing through American patent files which is necessary for a serious

investigation, while the latter enables reciprocal browsing through European (EPO), international (WIPO) and Japanese patent database.

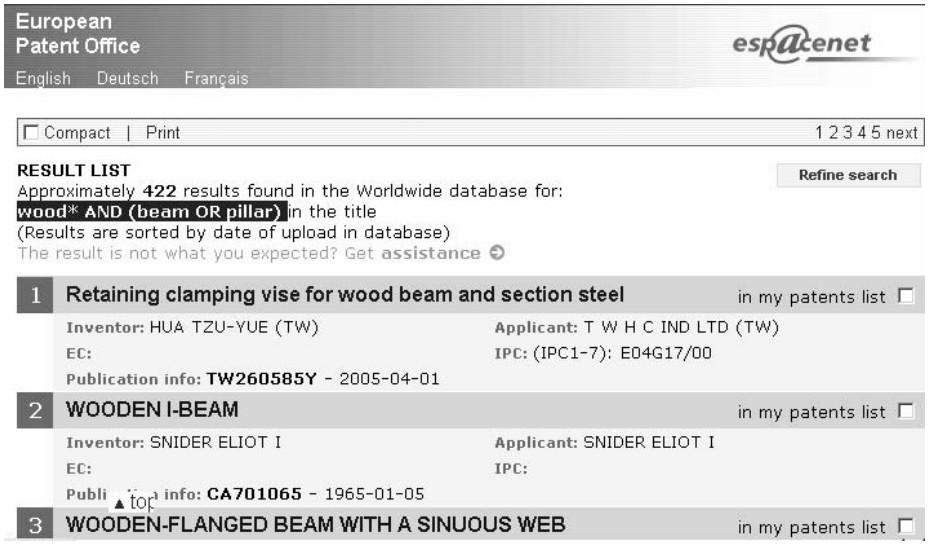


Figure 4: The result of enquiry in EPO

The result of a simple enquiry in EPO patent database describes technical solution for a wooden beam (wood AND (beam OR pillar)). As clearly evident, the enquiry obtained more than 422 hits, which are far too many for detailed reviewing, and the search shall need to be limited more precisely. Furthermore, it is worth establishing that the patents files for solving a concrete technical problem are numerous. Which is of course bad since it indicates that many things are already patented yet also good because very often a particular niche may still be found for protecting our own technical solution (EPO, 2006).*

By using a browser, we often obtain many hits which meet our searched series of items. Numbers of patents, date of issue and the name of the patent are written out. By clicking on the number of patent, we may obtain basic information on the patent, including the abstract, listed literature, a list of patents onto which the patent in question relates, as well as the patents which mention the said patent. All of the aforementioned makes our further search easier since we can easily find all required patents with one good "hit". Beside the already described, the patent includes the classification into which the patent was classified. By clicking the basic classification of the patent, we obtain all hits of the patents which include the said classification and a list of related classification at the same time.

Information on technology development is thus numerous on the Internet, all we need to do is take some time and thoroughly "browse" as well as "winnow chaff from grain".

4. Techniques of idea creation

Cyril Chovan, Silvia Medova and Vassilis Tsaggaris

4.1. Sources of ideas

Ideas come from people we know, stories we hear, the work we do, our interests, our opinions and our experiences. Some could help you get ahead at work, improve your business operations or even make your fortune. Business ideas are all around you. Some business ideas come from a careful analysis of market trends and consumer needs; others come from luck. But how can you find a source of ideas and knowledge?

You could start by examine your own (or personnel's) skill set for business ideas. To find a viable business idea, ask yourself, "What have I done? What can I do? Will people be willing to pay for my products or services? Do I have the skills to develop this idea?"

It is also essential to keep up with current events and be ready to take advantage of business opportunities. Keeping up with current events will help you identify market trends, new fashions, industry news – and sometimes just new ideas that have business possibilities.

Observation of the market is another source of generating ideas and can lead to invent a new product or service. The key to coming up with business ideas for a new product or service is to identify a market need that's not being met. Ask yourself, "How this situation could be improved?" Ask people about additional services that they'd like to receive. Focus on a particular target market and brainstorm business ideas for services that that group would be interested in.

Another opportunity appears at changing existing products or services by adding value to an existing product or improving an existing product or service. You might also add services, or combine the product with other products. What business ideas can you develop along these lines? Focus on what products you might buy and what you might do to them or with them to create a profitable business. There are very few products (or services) that can't be improved. Start generating business ideas by looking at the products and services you use and brainstorming ideas as to how they could be better.

Ideas and suggestions from current customers could be also a source for developing an idea. You could use Customer Feedback Forms with simple questions on what they are expecting from your product/service, what other services they would like to receive etc. Gather their answers and discuss them with your partners and start exploring if any of these ideas could be a marketable product or service.

We all live in the world in which it is sometimes more important to identify the 'right' problem rather than to solve one. Naturally, if a problem appears we tend to ask a lot of questions which produce even more answers. As a result, we work with lots of ideas and can easily get lost or diverted from the core problem.

Therefore, in order to remain on the right track one must start by asking questions in a more systematic and controlled way. There are several idea generation techniques available which vary by the degree of their scientific complexity. This chapter, however, focuses on the ones that are most efficient in terms of everyday business use. We will take a closer look at techniques such as brainstorming, brain writing, mind mapping, Ishikawa diagram and TRIZ. They are the most popular ones because of their simplicity and efficiency not only in generating but also in organizing ideas.

CaseStudy CaseStudy CaseStudy CaseStudy

Make it simple

When Ford Corporation was almost ready to start production of the new truck, they posted its drawings on the walls. Employees were asked to comment, writing right on top of the drawings, on the design and manufacturability. They received over 300 ideas they implemented in three months.

These design changes helped this truck be such a success. One idea shows how simple this can be. One worker asked, "Why do we always put the bolts in the truck bed from the bottom? I have to stand in a grease pit and hold a heavy bolt gun over my head. Sometimes I get tired and let a couple of trucks go by while I rest. Why can't we put the bolts in from the top?"

Of course, the answer was, "We've always put them in from the bottom." No one could even remember the reason. Now they put them in from the top, no more grease pit, no more missed bolts.

From: Godfrey, A. B. Creativity, Innovation and Quality. Juran Institute, Inc.

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4.2. Brainstorming

The notion of brainstorming as an idea generating technique was pioneered by Alex Osborn, an advertising executive, as a way to think of as many ideas (good, bad, or both) as possible (Cory and Slater, 2003, Osborn, 2003, Robbins and Coulter, 2005). In 1941, a team led by Osborn coined the term "brainstorm". Finding that conventional business meetings were inhibiting the creation of new ideas, Osborn proposed some limited rules designed to help stimulate them – rules which would give people the freedom of mind and action to spark off and reveal new ideas. According to Osborn, "Brainstorm means using the brain to storm a creative problem and to do so in commando fashion, each stormer audaciously attacking the same objective." Brainstorming was presented in 1948, in a book called "Your Creative Power". Osborn developed this technique to encourage original and spontaneous thinking among his employees and to produce the maximum number of new ideas. Brainstorming involves creating an atmosphere in which people feel uninhibited and free to propose the sort of wild and improbable solutions to problems that often point to the best course of action. The technique requires some practice and skill to use effectively but is not difficult if certain guidelines are followed.

Brainstorming refers to the process of liberal generation of a large volume of ideas from a number of participants by encouraging each of them to volunteer their creative inputs one at a time in an atmosphere free of criticism and judgment from other participants. In general, there are two basic forms of brainstorming – structured and unstructured. The unstructured brainstorming encourages participants to give ideas as these come to their mind, whereas structured brainstorming provides certain rules that participants must follow in order to make the gathering of inputs more orderly and evenly distributed. Practical experience show that the latter is more efficient.

It enables to collect ideas from all team members about a certain topic, issue, or problem in an organized manner; encourages team members to be more creative and be open to new or non-traditional ideas; prevents dominant team members from controlling the output of the team's idea gathering efforts; and promotes synergy among team members by letting them build on each other's creative thinking. The 'structured' process is also ideal for use by teams that are new to brainstorming sessions, since unstructured brainstorming may be difficult to handle under certain situations.

4.2.1. The brainstorming process

Structured brainstorming basically consists of the following steps (Brainstorming, 2006)

1. State the central brainstorming theme in a question form and write it down where every participant can see it (e.g., white board or flipchart). Ensure that all the members have a full understanding of the question, since they cannot provide answers to it if they don't. Try to optimize the manner in which the question is written by having a couple of members paraphrase it with the objective of improving it.

2. Let each team member have a turn to give his or her input as answer to the question. Start with any team member and proceed to the next in seating arrangement, either in clockwise or counter clockwise direction. If a team member cannot think of any input when his or her turn comes, he or she simply needs to say "Pass", and the next member gets the turn.

3. Write each input in large bold letters on the board or flipchart as it is given. During these brainstorming rounds, nobody is allowed to criticize an input, no matter what. The facilitator simply writes down the input on the board or flipchart using exactly the same words used by the input giver. This encourages the members to open up and keeps the input gathering in a continuous fluid motion.

4. Repeat the brainstorming rounds until everybody says "Pass" in the same round. This indicates that the ideas of the team have already been exhausted.

5. The last step is where the team members are required to "sanitize" the inputs. Review each of the listed inputs for further improvement in the way it is written and maximize its clarity. Now is the time that other team members can ask the input giver what he or she actually means by his or her input. Discard all inputs that are duplicates of another input. Similar but different ideas must be preserved on the list, though. Very often this phase of idea evaluation or "sanitizing" is performed separately with a slightly different structure of group members.

CaseStudy CaseStudy CaseStudy CaseStudy

Brainstorming

One of the most widely used techniques to open up an organization to new ideas is brainstorming. This simple technique frees up people to contribute without criticism. It helps break down quickly the fear of sounding stupid, of having one's idea picked to pieces. It also allows us to quickly build on other ideas.

An easy way to introduce this idea into company discussions comes from Armstrong International. Their problem was simple: How were they going to get people to accept new ideas? The solution was to hand out M&M chocolate candies. The team manager handed everyone entering a meeting an M&M. Then he told them:

"You are allowed one negative comment during the meeting. Once you make that comment, you must eat your M&M. If you don't have an M&M in front of you, you can't say anything negative."

"It was great! Instead of being threatened by new ideas, people supported them. Anything negative was instantly met with a joking "Shut up and eat your M&M."

From: Godfrey, A. B. Creativity, Innovation and Quality. Juran Institute, Inc.

CaseStudy CaseStudy CaseStudy CaseStudy

4.2.2. Individual vs. group brainstorming

Except the brainstorming sessions described above, one also distinguishes so-called individual and group brainstorming (Robbins and Coulter, 2005). When you brainstorm on your own you will tend to produce a wider range of ideas than with group brainstorming – you do not have to worry about other people's egos or opinions, and can therefore be more freely creative. You may not, however, develop ideas as effectively as you do not have the experience of a group to help you (when brainstorming on your own, it can be helpful to use the so called concept maps to arrange and develop ideas).

The group brainstorming, however, can be very effective as it uses the experience and creativity of all group members. When individual members

reach their limit on an idea, another member's creativity and experience can take the idea to the next stage. Therefore, group brainstorming tends to develop ideas in more depth than individual brainstorming. Where possible, participants in the brainstorming process should come from as wide a range of disciplines as possible. This brings a broad range of experience to the session and helps to make it more creative.

To run a group brainstorming session effectively, it is recommended to do the following:

- define the problem you want solved clearly, and lay out any criteria to be met;
- keep the session focused on the problem;
- ensure that no one criticizes or evaluates ideas during the session. Criticism introduces an element of risk for group members when putting forward an idea. This stifles creativity and cripples the free running nature of a good brainstorming session;
- encourage an enthusiastic, uncritical attitude among members of the group. Try to get everyone to contribute and develop ideas, including the quietest members of the group;
- let people have fun brainstorming; Encourage them to come up with as many ideas as possible, from solidly practical to wildly impractical ones. Welcome creativity;
- ensure that no train of thought is followed for too long;
- encourage people to develop other people's ideas, or to use other ideas to create new ones.

4.2.3. The analysis of ideas

Once the brainstorming session is over it is then necessary to perform thorough analysis. As all the ideas are scattered all over the white board/flipchart, it is recommended to put them all into one electronic list. With the ideas stored electronically you can easily restructure them and send them to other people by email. Technically, the brainstorming session is over at this point and the analysis or evaluation process has begun. It is important to make this distinction. Brainstorming is only the generation of the ideas. When you start to analyze the ideas you are not brainstorming. However, brainstorming without analysis is pointless.

The analysis of the ideas can be done individually or in a group. Sometimes, the group can be the same group who did the brainstorming or even better, it can be the dedicated group of colleagues who will eventually be implementing the chosen ideas. Because it is best to have "external" people in the brainstorming

session it is often the case that the group which analyzes the ideas is a different group to that which produced them.

Even there is a group analyzing the ideas it is always helpful to do an initial sort-out to remove duplicates and remove ideas which are really impractical. This removal should be based on valid physical criteria such as cost, time and physical laws. However, one should be very cautious and should not remove any remotely possible solutions at too early a stage. The remaining ideas can be then clustered into various matrixes or groups (depending on the session's goal). For example, they can be divided into the following three lists:

1. Excellent – definitely will work and can be implemented immediately.

2. Interesting – will possibly work or may require further analysis to decide if it will work. Needs more investigating. May work in the future.

3. Useless – will not work.

Depending on the lists it is possible to plan and implement the excellent ideas and to investigate the interesting ones. This is where the management and leadership skills are necessary.

4.3. Brainwriting

Brainwriting is a technique very similar to brainstorming and trigger sessions. There are many varieties, but the general process is that some/all ideas are recorded by the individual who thought of them. They are then passed on to the next person who uses them as a trigger for their own ideas. The method can be carried out in several different ways such as brainwriting pool, brainwriting 6-3-5, idea card method, brainwriting game, constrained brainwriting, etc.

4.3.1. Brainwriting pool

Each person, using post-it notes or small cards, writes down ideas, and places them in the centre of the table. Everyone is free to pull out one or more of these ideas for inspiration. Team members can create new ideas, variations or piggyback on existing ideas.

4.3.2. Brainwriting 6-3-5

The name brainwriting 6-3-5 comes from the process of having 6 people write 3 ideas in 5 minutes. Each person has a blank 6-3-5 worksheet (see Table 6).

Everyone writes the problem statement at the top of their worksheet (word for word from an agreed problem definition). Then they write 3 ideas on the top row of the worksheet in 5 minutes in a complete and concise sentence (6-10 words). At the end of 5 minutes (or when everyone has finished writing) pass the worksheet to the person on your right. You then add three more ideas. The process continues until the worksheet is completed. At the end there is going to be a total of 108 ideas on the 6 worksheets. These should be thoroughly assessed and analyzed.

	Idea 1	Idea 2	Idea 3
1			
2			
3			
4			
5			
6			

Table 6: Brainwriting table

4.3.3. Idea card method

Each person, using post-it notes or small cards, writes down ideas, and places them next to the person on his or her right. Each person draws a card from the neighbours' pile as needed for inspiration. Once the idea has been used, it is passed on to the person on the right along with any new, variations or piggybacked ideas.

4.3.4. Brainwriting game

This method is set in the form of a light-hearted competitive game. Creativity methods normally avoid competition because it tends to be divisive. However,

as long as the game atmosphere is fun rather than overly competitive, and the facilitator ensures that there are no significant losers, the game format might be useful, particularly in training contexts where winning and losing are likely to be less of an issue and both can be used to provide teaching material.

The game takes a little longer than some other brainwriting techniques. However, on the other hand, a very little facilitation skill is needed. The structure should be as follows:

1. Display the problem statement, and explain that the winner of the game is the one who devises the most unlikely solution.

2. The facilitator sells each group member an agreed number of blank, serially numbered cards at, say, 10 currency units each, pooling the money to form the prize. Each group member signs a receipt that records the serial numbers of their set of cards.

3. Members try to think of utterly implausible solutions, writing one per card. The cards are then put up on a display board.

4. Members now have 15 minutes to silently read all the solutions, and to append to them (on further un-numbered cards or post-its) ways in which they could be converted into a more practical way of solving the problem (so reducing that ideas' chances of winning).

5. Each member then has two votes to vote for what s/he now considers to be the most improbable idea on the numbered cards. The idea that attracts most votes wins the pooled money.

6. Form two sub-groups, give half the cards to each, and give each group 15 minutes to develop six viable solutions from their cards.

7. Each sub-group tries to "sell" their ideas to the other sub-group.

8. Everyone comes together and agrees on the best ideas overall.

4.3.5. Constrained brainwriting

On a number of occasions it is necessary to constrain ideas around a pre-defined focus, rather than ranging freely. The versions described here use the standard brainwriting pool technique, but bias the idea generation by using brainwriting sheets prepared in advance.

1. Present starter ideas: The leader initiates the process by placing several prepared sheets of paper in the pool in the centre of the table.

2. Private brainwriting: Each group member takes a sheet, reads it, and silently adds his or her ideas.

3. Change sheet: When a member runs out of ideas or wants to have the stimulation of another's ideas, s/he puts one list back in the centre of the table and takes one returned by another member. After reviewing this new list s/he has just selected, s/he adds more ideas.

4. Repeat until ideas are exhausted. No discussion at any stage.

Presented methods are all very valuable and efficient in broadening the existing and exploring new business horizons. Using team members' creativity not only moves a company forward significantly, but it also helps to maintain its competitive position.

4.4. Gordon's technique

Gordon technique is another method used for generating ideas and decision-making. It is closely related to brainstorming and many people think that it is a variation of the famous technique. The main difference is that the moderator of the group knows the exact nature of the problem under consideration while the participant do not. Leader starts the group discussion and presents the true situation only when the group participants are close to a satisfactory solution.

4.4.1. Key points of the method

The fundamental point of this method is that participants are kept in the dark in order to generate more ideas and suggestions from the very beginning of the session and avoid generating the "solution" very soon.

The first and most difficult task of the leader is to select a topic for discussion. The subject must be closely related to the problem at hand, but its exact nature must not be revealed. Usually, this subject will be a physical principle which is related to the problem that must be solved.

Gordon believes that there is danger in a typical brainstorming session of a participant becoming convinced that one of the ideas he has proposed is the best possible solution to the problem. Consequently, participant may cease

producing additional ideas, and devote his / her energies to defending and selling his "creation". On the contrary, Gordon technique avoids this danger since there can be no best solution proposed for a problem that has never been stated. Additionally, leader does not provide any specific towards a specific problem and participants discuss broadly, talking about the problem but never getting anywhere. Although it seems time wasting, the beneficial point of this technique is that participants usually cover aspects which it would never discuss them if they did know the specific problem.

4.4.2. Examples

The following problem situations are examples of how this technique works:

- The problem is one of seeking solutions to the parking problem of a large city. The group leader could start the session by asking participants to discuss ways to "store things".
- Assume that the problem is to design a new roofing system. Thus, the group leader might have the group discuss "enclosures" or "ways things are enclosed."
- The problem is to review procedures for washing windows, so the group leader selects the topic of "removing dirt." This process may produce some unusual approaches which otherwise may not have been associated with the problem at hand. It is well to remember that these leads are important since they direct you toward the final solution.

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Idea creation on the basis of needs analysis

Borut Likar

A Slovenian insurance company wanted to develop new products that would not only enrich their offer but also represent a cornerstone of their offer in the forthcoming decade, which would be primarily oriented towards the youth. The background to such approach is the joining to the EU and related social changes as well as market economy. Due to many reasons the insurance company engaged a group of young people in their search for new solutions. Primarily, the insurance company decided to take on such a group due to the fact that young people prove to be far more creative than the older ones and less burdened with their knowledge on the existing solutions. Furthermore, young people tend not to restrain their search for new ideas due to their

unawareness of restrictions on implementation, which the insurance experts are well aware of. Last but not least, young people also represent potential users of insurance services and are well-familiar with their needs. The insurance company undertook the challenge with the idea creation techniques, namely brainstorming and brainwriting. After two sessions, the group of young people created more than two hundred ideas, out of which quite a few perfectly reflected their basic demands (orientation towards the youth, consideration of their life styles, Internet applications, differentiation as regards the social factors and similar). Since the project is still under way, concrete ideas may not be disclosed. However, after a detailed analysis of the course of their creative work, the insurance company discovered that certain restraints were met as regards the defined principles of the aforementioned idea creation techniques. Since the problem is identified, the solutions most frequently fail to be original given that the participants are familiar with the existing insurance products at least partially – creative suggestions thus loose their originality.

In order to avoid the aforementioned restraints, the insurance company started thinking of benefiting from the potential of Gordon technique. Creative session of the said technique is NOT based on searching for solutions to an identified problem. As a result, unusual and also very original solutions may be expected. Nevertheless, the challenge was not tackled with the Gordon technique yet its principle was applied in the following way: in the first phase, the question was paraphrased, namely "What young people are concerned about?". During this activity the participants of the brainstorming activity (or brainwriting) did not actually know that the subject of the activity is insurance business, i.e. they were not familiar with the basic problem. The participants were thus reflecting on their health, studies, employment, social aspects and similar. The results were not concrete suggestions related to the insurance offer yet a couple of main areas were defined in which the young people see or suspect potential dangers as regards their future. Some of these areas are still uncovered by the insurance companies and thus represent possibilities which the developing insurances may cover.

In the second phase, some concrete suggestions for a new insurance offer were sought for the aforementioned fears also by applying the idea creation techniques. In comparison with the initial approach, the final suggestions were considerably more original and applicable!

4.5. Fish bone (Ishikawa diagram)

The fishbone diagram (see Figure 5) originally developed by Professor Kaoru Ishikawa, is often referred to as an Ishikawa diagram (Robbins and Coulter, 2005). The technique can help to structure the process of identifying possible causes of a problem. Its possible causes are presented at various levels of detail in connected branches, with the level of detail increasing as the branch goes outward. An outer branch is a cause of the inner branch it is attached to. Thus, the outermost branches usually indicate the root causes of the problem.

The diagram encourages the development of an in depth and objective representation ensuring all participants keep on track. It discourages partial or premature solutions, and shows the relative importance and inter-relationships between different parts of a problem.

The method is ideally organized over a number of meetings, enabling the team to become deeply immersed in the problem. Fresh suggestions regarding possible causes can arise during the break and members are more likely to forget who originated every idea, thus making subsequent discussions less inhibited.

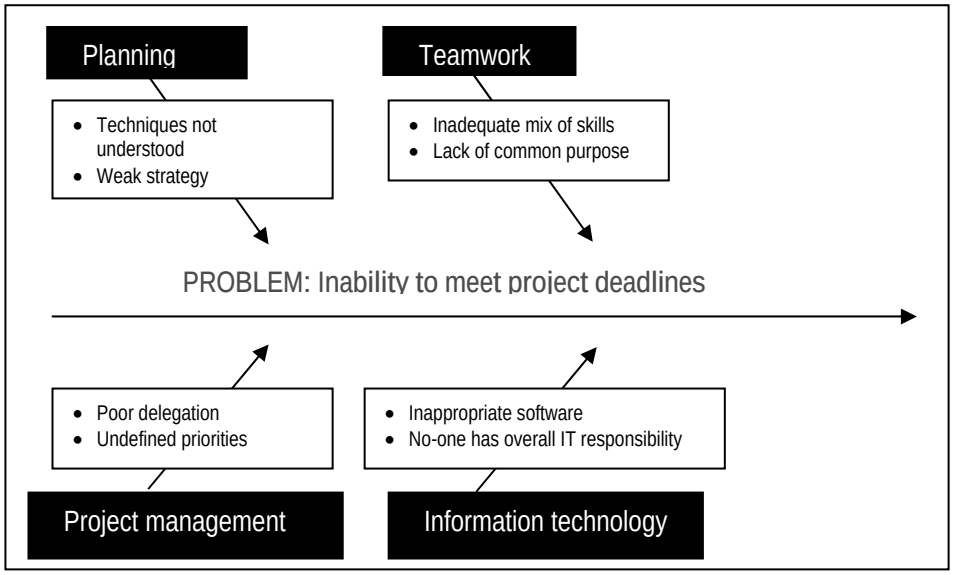


Figure 5: Example of using Ishikawa diagram

The procedure should be carried out as follows:

- On a broad sheet of paper, draw a long arrow horizontally across the middle of the page pointing to the right, and label the arrowhead with the title of the issue to be explained. This is the 'backbone' of the 'fish'.
- Draw spurs coming off the 'backbone' at about 45 degrees, one for every likely cause of the problem that the group can think of; and label each at its outer end. Add sub-spurs to represent subsidiary causes. Highlight any causes that appear more than once – they may be significant.
- The group considers each spur/sub-spur, taking the simplest first, partly for clarity but also because a good simple explanation may make more complex explanations unnecessary.
- Ideally, it is eventually re-drawn so that position along the backbone reflects the relative importance of the different parts of the problem, with the most important at the head end.
- Circle anything that seems to be a 'key' cause, so you can concentrate on it subsequently.

Experienced users of the diagram add more branches and/or use different categories, depending on what would be more effective in dealing with the problem. Figure 6 shows the basic framework of an Ishikawa Diagram.

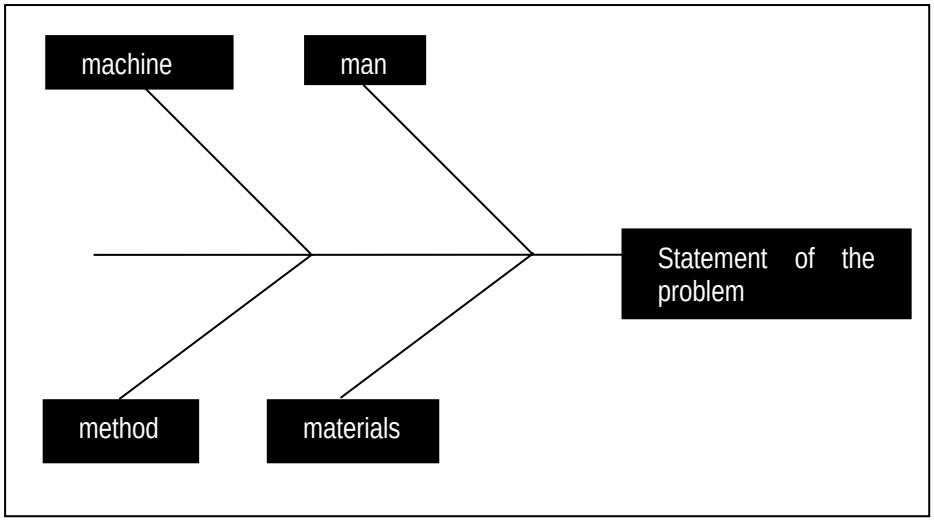


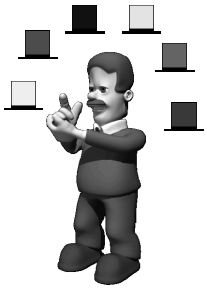
Figure 6: The Basic '4 M's' Framework of the Ishikawa Diagram

The Ishikawa Diagram is employed by a problem-solving team as a tool for collating all inputs (as to what are the causes of the problem they are addressing) systematically and graphically, with the inputs usually coming from one of the techniques of idea creation. It enables the team to focus on why the

problem occurs, and not on the history or symptoms of the problem, or other topics that digress from the intent of the session. It also displays a real-time 'snap-shot' of the collective inputs of the team as it is updated.

There are many ways to interpret the Ishikawa Diagram. The fastest and simplest way to do it is for the group to choose the top five causes on the diagram and rank them, using their collective knowledge and any data available. The selection of the major causes may be done by voting or any other process that allows the group to agree on the ranking. The selected causes are then encircled on the diagram, with their ranks written beside them. The team may then investigate these causes further and use problem-solving techniques to eliminate their occurrences.

4.6. Six thinking hats



'Six Thinking Hats' is an important and powerful technique. It is used to look at decisions from a number of important perspectives. This forces you to move outside your habitual thinking style, and helps you to get a more rounded view of a situation. This tool was created by Edward de Bono (Chan, DAFTAR, 2006, Comlab, 2005).

Many successful people think from a very rational, positive viewpoint. This is part of the reason that they are successful. Often, though, they may fail to look at a problem from an emotional, intuitive, creative or negative viewpoint. This can mean that they underestimate resistance to plans, fail to make creative leaps and do not make essential contingency plans. Similarly, pessimists may be excessively defensive. Emotional people may fail to look at decisions calmly and rationally.

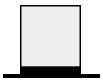
If you look at a problem with the 'Six Thinking Hats' technique, then you will solve it using all approaches. Your decisions and plans will mix ambition, skill in execution, public sensitivity, creativity and good contingency planning.

4.6.1. How to use the tool

You can use Six Thinking Hats in meetings or on your own. In meetings it has the benefit of blocking the confrontations that happen when people with different thinking styles discuss the same problem.

Each 'Thinking Hat' is a different style of thinking. These are explained below:

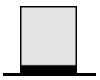
- *White Hat*: With this thinking hat you focus on the data available. Look at the information you have, and see what you can learn from it. Look for gaps in your knowledge, and either try to fill them or take account of them. This is where you analyze past trends, and try to extrapolate from historical data.



- *Red Hat*: 'Wearing' the red hat, you look at problems using intuition, gut reaction, and emotion. The red hat allows the free expression of feelings, intuition, hunches and emotions without apology and without explanation, there must never be any attempt to justify or give the basis for the feelings. The red hat asks a person to express his or her feelings on the subject at this moment in time, it gives full permission to a thinker to put forward his or her feelings on the subject at the moment.

- *Black Hat*: Using black hat thinking, look at all the bad points of the decision. Look at it cautiously and defensively. Try to see why it might not work. This is important because it highlights the weak points in a plan. It allows you to eliminate them, alter them, or prepare contingency plans to counter them. Black Hat thinking helps to make your plans 'tougher' and more resilient. It can also help you to spot fatal flaws and risks before you embark on a course of action. Black Hat thinking is one of the real benefits of this technique – many successful people get so used to thinking positively that often they cannot see problems in advance. This leaves them under-prepared for difficulties.

- *Yellow Hat*: The yellow hat helps you to think positively. It is the optimistic viewpoint that helps you to see all the benefits of the decision and the value in it. Yellow Hat thinking helps you to keep going when everything looks gloomy and difficult.



- *Green Hat*: The Green Hat stands for creativity. This is where you can develop creative solutions to a problem. It is a freewheeling way of thinking, in which there is little criticism of ideas. A whole range of creativity tools can help you here. Under the green hat, we put forward alternatives, seek out new ideas, modify and change suggested ideas, use provocations and movement to produce new ideas, generate possibilities

- *Blue Hat*: 'Blue Hat Thinking' stands for process control. This is the hat worn by people chairing meetings. It is concerned with defining the problem and what is being thought about. It also concerns with: Outcomes, Conclusions, Summaries and what happens next. Blue hat is the organizer of the thinking process.

Example: The directors of a property company are looking at whether they should construct a new office building. The economy is doing well, and the amount of unrented office space is reducing sharply. As part of their decision they decide to

use the 6 Thinking Hats technique during a planning meeting. Looking at the problem with the White Hat, they analyze the data they have. They examine the trend in unrented office space, which shows a sharp reduction. They anticipate that by the time the office block would be completed, that there will be a severe shortage of office space. Current government projections show steady economic growth for at least the construction period. With Red Hat thinking, some of the directors think the proposed building looks quite ugly. While it would be highly cost-effective, they worry that people would not like to work in it. When they think with the Black Hat, they worry that government projections may be wrong. The economy may be about to enter a 'cyclical downturn', in which case the office building may be empty for a long time. If the building is not attractive, then companies will choose to work in another better-looking building at the same rent. With the Yellow Hat, however, if the economy holds up and their projections are correct, the company stands to make a great deal of money. If they are lucky, maybe they could sell the building before the next downturn, or rent to tenants on long-term leases that will last through any recession. With Green Hat thinking they consider whether they should change the design to make the building more pleasant. Perhaps they could build prestige offices that people would want to rent in any economic climate. Alternatively, maybe they should invest the money in the short term to buy up property at a low cost when a recession comes. The Blue Hat has been used by the chair of the meeting to move between the different thinking styles. He or she may have needed to keep other members of the team from switching styles, or from criticizing other peoples' points.

4.6.2. Key points

Six Thinking Hats is a good technique for looking at the effects of a decision from a number of different points of view.

It allows necessary emotion and scepticism to be brought into what would otherwise be purely rational decisions. It opens up the opportunity for creativity within decision making. The technique also helps, for example, persistently pessimistic people to be positive and creative.

Plans developed using the '6 thinking hats' technique will be sounder and more resilient than would otherwise be the case. It may also help you to avoid public relations mistakes, and spot good reasons not to follow a course of action before you have committed to it.

4.7. Mind Mapping

Mind mapping also called "spider diagrams" represents ideas, notes, information, etc. in far-reaching tree-diagrams. To draw a mind-map it is necessary to do the following:

1. Layout a large sheet of paper in landscape and write a concise heading for the overall theme in the centre of the page.

2. For each major sub-topic or cluster of material, start a new major branch from the central theme, and label it.

3. Each sub-sub-topic or sub-cluster forms a subordinate branch to the appropriate main branch

4. Carry on in this way for ever finer sub-branches.

It may be appropriate to put an item in more than one place, cross-link it to several other items or show relationships between items on different branches. Coding the color, type of writing etc. can do this. Alternatively your drawings in place of writing may help bring the diagram to life.

Software packages are available that support with mind-maps, making it easier to amend and reshuffle the map, they often hold notes and documents, etc. associated with the labels (so acting as a filing system). Computer-based maps have the disadvantage of the small screen, and are less flexible than hand drawn versions (e.g., you cannot usually make cross-links).

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Kill the "Not invented here" syndrome

Another impediment to fast innovation is the belief that we must create all ideas ourselves. We have a major emotional roadblock to stealing ideas. We have been taught for years that this is wrong. We must have original ideas. As children we're taught stealing is wrong. But in business that's not always true. You should "borrow" unpatented ideas from the best people and companies you can find. It's an efficient way of satisfying your customers.

The "if it's not invented here we won't use it" syndrome can be fatal. There's nothing wrong with swiping an unpatented idea if the idea will help you do a better job serving your customers.

As AT&T became more competitively challenged in the early 1980s and began working hard to change the culture in order to quickly develop and introduce new products into the market place, this NIH syndrome became a burden.

One lab then created a wonderful way to break down this barrier to creativity and innovation. They created a new award, the "thief of the month." Each month they would honor the individual or team who stole the best idea from somewhere else. These "thieves" would be pictured in the Bell Labs News with a story describing how using these ideas accelerated the development process and reduced unnecessary redundant work.

From: Godfrey, A. B. Creativity, Innovation and Quality. Juran Institute, Inc.

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4.8. Theory of inventive problem solving (TRIZ)

TRIZ is a methodology, tool set, knowledge base, and model-based technology for generating innovative ideas and solutions for problem solving. In contrast to techniques such as brainstorming (which is based on random idea generation), it aims to create an algorithmic approach to the invention of new systems, and the refinement of old systems.

TRIZ was developed by a patent expert Genrich S. Altshuller, who managed to screen over 200,000 patents looking for inventive problems and how they were solved. Of these, only 40,000 had somewhat inventive solutions; the rest were straight forward improvements. Altshuller categorized these patents in a novel way. He removed the subject matter to uncover the problem solving process. He found that often the same problems had been solved over and over again using one of only forty fundamental inventive principles. Solutions were then categorized into five levels presented in Table 7 (Altshuller, 1994).

Level	Degree of inventiveness	% of solutions	Source of knowledge	Approximate # of solutions to consider
1	Apparent	32%	Personal knowledge	10
	solution			
2	Minor	45%	Knowledge within	100
	improvement		company	
3	Major	18%	Knowledge within	1000
	improvement		the industry	
4	New concept	4%	Knowledge outside	100 000
			the industry	
5	Discovery	1%	All that is knowable	1 000 000

Table 7: Five levels of inventiveness

Altshuller found that over 90% of the problems engineers faced had been solved somewhere before. If engineers could follow a path to an ideal solution, starting with the lowest level, their personal knowledge and experience, and working their way to higher levels, most of the solutions could be derived from knowledge already present in the company, industry, or in another industry.

4.8.1. The step-by-step process

Formulate the problem

Example: We cannot control the height to which the beverage cans will be stacked. The price of raw materials compels us to lower costs. The can walls must be made thinner to reduce costs, but if we make the walls thinner, it cannot support as large a stacking load. Thus, the can wall needs to be thinner to lower material cost and thicker to support stacking-load weight. This is a physical contradiction. If we can solve this, we will achieve an ideal engineering system.

Search for previously well-solved problem

Altshuller extracted from over 1,500,000 world-wide patents 39 standard technical characteristics that cause conflict. These are called the 39 Engineering Parameters.

Example: The standard engineering parameter that has to be changed to make the can wall thinner is "length of a non-moving object". In TRIZ, these standard engineering principles can be quite general. Here, "length" can refer to any linear dimension such as length, width, height, diameter, etc. If we make the can wall

thinner, stacking-load weight will decrease. The standard engineering parameter that is in conflict is "stress". Therefore, the standard technical conflict is: the more we improve the standard engineering parameter "length of a non-moving object", the more the standard engineering parameter "stress" becomes worse.

Look for analogous solutions and adapt to your solution

Altshuller also extracted from the world wide patents 40 inventive principles. These are hints that will help an engineer find a highly inventive (and patentable) solution to the problem.

Example: The engineering parameters in conflict for the beverage can are "length of a non-moving object" and "stress". The feature to improve is the can wall thickness or "length of a non-moving object" and the undesirable secondary effect is loss of load bearing capacity or stress". Looking these up on the "table of contradictions", we find the numbers 1, 14, and 35 in the intersecting cell (Table 8).

As an example a solution of the basis of principle #35 is described changing the composition to a stronger metal alloy used for the can wall to increase the load bearing capacity while linear parts or flat surfaces are replaced with curved ones on the basis of principle #14.

In less than one week, the inventor Jim Kowalik of Renaissance Leadership Institute was able to propose over twenty usable solutions on the basis of TRIZ method to the U.S. canned beverage industry, several which have been adopted.

By analyzing the current technology level and contradictions in our products, TRIZ can be used to see the evolutionary progress and create the future. For example, Altshuller was able to predict the future technology of glass plate manufacturing. The earlier process was to roll hot glass onto a conveyor. During this process, the glass would tend sag between the rollers resulting in waviness in the final product. Using pattern #7, Transition from Macro to Micro, Altshuller predicted that rollers would get smaller and smaller until they reached the theoretical limit of atom sized. Several years later, an English company introduced a new process of rolling the glass out on a bath of liquid tin.

Due to the complexity of the method, in-depth study of literature is advised for a concrete use (e.g. http://www.mazur.net/triz/).

Inventive Principle #1	Segmentation	Examples:
	• divide an object into independent parts • make an object sectional • increase the degree of an object's segmentation	• Sectional furniture, modular computer components, folding wooden ruler • Garden hoses can be joined together to form any length needed
Inventive Principle #14	**Spheroidality**	**Examples**
	• replace linear parts or flat surfaces with curved ones; • replace cubical shapes with spherical shapes • use rollers, balls spirals • replace a linear motion with rotating movement • utilize a centrifugal force	• Computer mouse utilized ball construction to transfer linear two-axis motion into vector motion
Inventive Principle #35	**Transformation of the physical and chemical states of an object**	**Examples**
	• change an object's aggregate state, density distribution, degree of flexibility, temperature	• In a system for brittle friable materials, the surface of the spiral feedscrew was made from an elastic material with two spiral springs. For process control, the pitch of the screw could be changed remotely.

Table 8: Inventive principles as possible solutions

5. Techniques of Idea Selection

Borut Likar

5.1. The need for invention assessment

The phase of idea assessment and selection is one of the most critical phases of invention-innovation chain. The praxis demonstrates that inventors or companies' managements frequently fail to consider its value precisely enough. They thus continue with development and the phases which follow while the costs increase dramatically. Only when they introduce the product on the market, the deficiencies arise. Consequently, it is essential to have numerous ideas at the disposal, out of which only the most promising may be selected on the basis of extremely strict criteria (Figure 7).

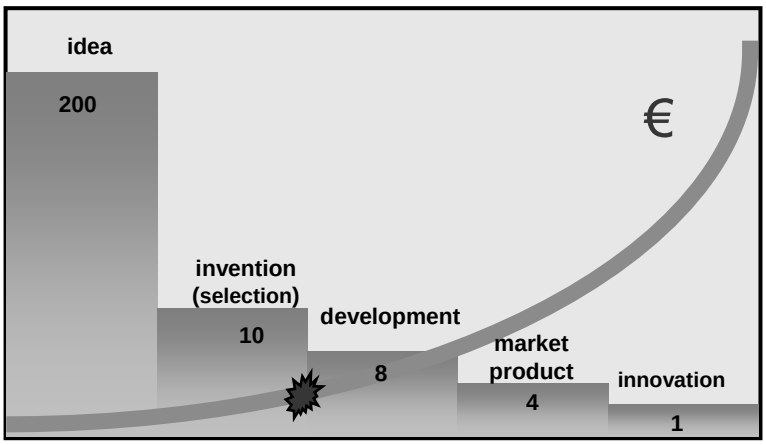

Figure 7: Development of idea to innovation

Only a few ideas prove to be inventions, even fewer become innovations. Among many ideas only a small part passes over to the phase of development and production. Among all technical novelties which have already appeared on the market, only a quarter of them "survived". It is thus necessary to have as many ideas as possible at our disposal in order to select the best.

5.1.1. The need for assessment

A constituent part of every presentation of a new idea, suggestion, technical improvement or potential innovation is a business plan with financial expected costs assessment or evaluation of anticipated expenditure and revenues as well as other effects. Beside the financial plan, other elements also need to be taken into consideration, especially the elements which cannot be financially evaluated or demonstrated in figures. Due to the complexity of the matter, each novelty needs to be regarded comprehensively from various aspects which are specific as regards the type of novelty, market, company, competition, and especially as regards the staff which are company's main "asset".

Firstly, an assessment group needs to be selected which should as a rule be composed of representatives of various profiles. The aforementioned should be experts with analytical skills and knowledge in the fields which are to be assessed.

To begin with the assessors need to set down the criteria on the basis of which the ideas shall be assessed. In case the ideas are many, they should initially be grouped according to their contents. After a short review, proposals, which are inspected from every important point of view, are short-listed in accordance with the criteria.

Preparation of plans and setting of financial and market forecasts are hard to be avoided. Yet we need to realise that it is just a matter of hypothesis which very often prove to be based on shaky grounds. Therefore, we cannot expect that the result or presupposed economic impact is any more precise than the forecast. All financial, market and other forecasts thus need to list and take into consideration all hypotheses! The most frequent unknowns in novelties are related to unknowns in technologically demanding development and assessment of the market. Incorrect assessments have buried many impatient entrepreneurs.

Numerous methods of invention assessment have been developed for economic application. Due to multi-layered nature of the problem or numerous aspects triggered by each invention, it is impossible to define strict rules according to which individual novelty could be assessed. In some cases clear and comparable mathematical measurements may be applied while others require less exact methods, which are based on subjective criteria.

5.1.2. Categories of invention as regards their economic effects

So-called *closed-type system* encompasses improvements introduced within a closed system which means that we are familiar with all parameters of the system and may thus forecast the effects of the invention.

Typical example of such type are innovations where by changing the existing process (for example production) we are able to save raw materials or energy, improve workers productivity, increase production capacities and quality of the products, reduce number of rejected units, claims, stock, and flow time, and similar.

The other type of inventions is related to so-called *open system* – unknowns prove to be too many in order to forecast the effects accurately. The assessment of the results proves to be too unreliable since the number of unknowns increases with a level of novelty.

The example illustrates the introduction of new global mass video system which has visible advantages in comparison to the competition yet also some deficiencies and higher price. Almost at the same time, many new producers appear on the market. At the beginning the buyers are still distrustful, only the most daring decide for the purchase.

It is widely known that after a certain time a standard is formed which squeezes other products out of the market. Which system shall become a standard is still unknown in the phase of development, and depends on the quality of the product, competition, market, multinational companies that produce video media, political factors... After the standard is accepted, a successful company gains larger market share and higher profits (at least in the first phase when it is the only one present on the market), yet the others incur greater loss. Only the most successful company has been able to turn an invention into innovation.

5.1.3. Effects may not be financially defined

By innovating, we follow development. When we follow the development enforced by a stronger competition, we only follow the said competition and thus preserve our market share. When failing to do so, our market share starts decreasing gradually. A more precise assessment proves impossible.

Results are long-term. Example: by innovating, the company builds positive image (contemporaneousness, trust in the company and its products is established, the buyer is prepared to pay more) which indirectly and in the long run influences on the business results.

Opening of new posts. Innovation fails to bring considerable profits yet represents a new possibility of recruitment. This is particularly important in case of self-employment and in regions where employment is hard to find.

Results are related to further development. The basic idea is great yet not necessarily applicable. Providing the company succeeds in developing the basic idea to the phase of useful value via creating new ideas, the original idea shall be successful.

Results are not directly financial. Such example arises with ecological awareness of inhabitants living in the proximity of thermo power plant. They put forward claims for cleaning devices. From financial point of view, the investment represents clear costs yet it depends on the company's innovativeness what these costs shall amount to. They are financially compared to the costs of ending the operations, and similar.

Improved flexibility of production. Example: Automation in automotive industry greatly increases the adjustability of producer to individual wishes of buyer namely at lower costs. Market share thus increases and delivery times are shortened due to the possibility of modifications implemented on production lines. Consequently, a return on capital accelerates. This is only a part of advantages brought by automation. Some parameters may be assessed directly while others not (Likar, 2001).

5.2. Numerical sensitivity analysis

In particularly within the closed type systems with known parameters, the exact calculation gives the final decision a particular importance. The final result of the calculation, being positive or negative, does not necessarily mean that the invention shall prove to be all-round successful or not. It primarily illustrates the financial side by taking into account the parameters regarded during the analysis.

5.2.1. Process simulation

The process is run in the following manner: firstly, a model is designed – all fundamental elements of the process are defined and correlations are established and expressed in the form of equations. In case of a simple process, the aforementioned equations enable a calculation.

Example: Factory of springs, which are used as a component of industrial scales, decides to introduce novelty into its production. So far existing annual

production costs amount to €150,000 with 200,000 units produced annually. Due to the process of tempering the energy costs per unit prove to be relatively high and account for 1/3 of all costs. Proposed novelty relates to the process of heating and cooling, while the calculations show that by introducing an invention, the said costs would lower the energy consumption to only 40% of currently existing consumption. The modification requires additional investments in the amount of €3000. Moreover, changeable costs would rise to €0.03 per unit produced.

We should also be aware of the fact that the aforementioned data are hard to be obtained. In case we wish to know what proportion of energy out of entire production is related to tempering the springs, the data need to be measured or the company should have an exact cost management in place – which most of the companies fail to have!

5.2.2. Example

Let us define all fundamental elements which influence the decision:

- annual production costs: €150,000,
- annual production: 200,000 units,
- energy costs per unit: 1/3 of all costs,
- energy consumption decreases by 40% with the introduced modification,
- assets required for modification: €3,000,
- additional production costs per unit: €0.03.

+ + + +		- - - -	
Production price per unit	€150,000 / 200,000 = €0.75	Assets needed for modification	€3,000
Energy costs	€0.75 * 0.33 = €0.25	Additional production costs	€0.03 * 200,000 = €6,000
Saving of energy per unit	€0.25 * 0.6 = €0.15		
Total	**€0.15 * 200,000 = €30,000**	**Total**	**€9,000**
Difference in profit = €21.000 >> investment is justified			

Table 9: Comparison of costs arising from eventual innovation

The correlations among individual parameters are shown; left column demonstrates savings arising from innovation while the right column shows the costs related to the said innovation.

A simple calculation enabled us to establish that the investment in development and implementation of invention proves to be justified. Many different options need to be inspected in praxis and only the worst case scenarios considered.

It is a fact that some parameters (for example development costs) fluctuate by more than 100% without any particular damage. There are also some parameters existing – in particularly in less innovative segments (bread production and other basic necessities) where even the smallest modification causes extremely unfavourable financial changes. Such case may be simulated with demonstrated model. If we decided to lower for example the selling price, lower profits would be incurred while the sensitivity to modifications would increase dramatically.

It thus proves reasonable to perform also so-called sensitivity analysis and check what the modification of certain input parameters brings.

Demonstrated example encompassed sensitivity analysis of a part of possible scenarios which are listed in Table 10.

Alterations of input parameters	Difference in profit	%
Additional production costs per unit increase by 100 % (from €0.03 to €0.06)	is reduced by	29
Energy costs per unit are reduced by 35 % (from 33 % to 26 %) due to price reduction	is reduced by	50
Energy consumption is reduced by 61 % due to modification	is reduced by	50
Energy consumption is reduced by 82 % due to modification	the same	0
Assets required for modification increase by 300 % (from €3,000 to €9,000)	is reduced by	29
Energy costs per unit account for 15 % of all costs, assets required for modification amount to €10,000	loss amounts to €2,500	12

Table 10: Results of sensitivity analysis

Profit is shown as regards different input parameters.

An extremely simple example was demonstrated which was easy to calculate (due to simplicity, Excel was used). However, when there are more data, the process of model design is the same yet the appropriate computer programmes need to be used for calculation; often tables prove to be sufficient (Excel, QuattroPro and similar). In such a case more complicated relations may be included in the model as well as time and quantity variable parameters, for example monthly fluctuations of prices of electric energy, changes in quantities sold as a consequence of increased market shares, decreasing of production price as a consequence of increased quantities produced (rebates obtained at the supplier for purchasing larger quantities), and similar. There are also some professional software programmes which simulate more challenging cases.

5.3. Effectiveness assessment by introducing questions

5.3.1. Characteristics of the method

The method systematically processes various aspects of innovation project as regards the entire company and its interaction with the environment. In this case not only the critical hypothesis prove to be important but also all the others which would be influenced by the introduced invention; also those which have positive effects. The more thorough questionnaire is, the more comprehensive picture is obtained.

5.3.2. Main aspects of problem processing

Selected problems may be systematically processed from many different, and particularly essential points of view, while the basis includes the following aspects:

Strategic aspects reflect: harmonisation with the company's vision and strategic objectives, company's image, social and ecological policy, harmonisation with actual possibilities and similar.

Economic aspects are related to: anticipated costs and benefits (cost/benefit), risk, possibilities of financing and resource provision, market management, opening of new markets, competition and similar.

Main *technological aspects* which need to be tackled relate to: general technological development, number and importance of core problems, relations to other projects, application of knowledge in other projects, level of industrial protection and protection of other intellectual property, availability of fixed and current assets.

Long-term *timeframe aspects* should also be taken into consideration. Regardless of the wishes and short-term needs, which we would wish to obtain with eventual innovation, the effect of the said innovation shall be present also after many years. An example of negative long-term effects may be presented with the costs of nuclear power plant decommissioning and radioactive waste disposal. While on the other hand the development of ecological engines proves to be an example of positive long-term effects. Whoever fails to implement such improvements shall pay higher taxes and decrease its market share.

The advantage of this method is that the problems are tackled comprehensively. The questions encompass aspects which cannot be demonstrated numerically. Another advantage is that higher number of colleagues may be attracted to cooperate.

Beside the advantage, the aforementioned method has also some disadvantages. Many different standpoints are gathered in a simple way; however the processing of the said proves to be complicated. The reason lies in the fact that the opinions frequently conflict and the analysis is lengthy due to descriptive answers which do not allow simple comparison (Likar, 1998).

All things considered, collection of numerous answers is recommended which should subsequently be regarded according to appropriate statistical process. This may only be a "consolidated text" of opinions or a summary of all answers, or a combined method of answer evaluation, which is presented in the "Assessment of key success factors".

5.4. Assessment of key success factors

This method focuses on those factors which are the most important for success (Key Success Factors or KSF) and on the basis of which the ideas are evaluated.

The more precise the selection of factors is, the more comprehensive picture is obtained. Similar to the method "Assessment with questions", the answers frequently turn out to be of subjective nature and collection of many answers is thus recommended which should then be appropriately considered.

The first step is the selection of the most important factors. It is important that they are selected before the beginning of the assessment process. Individual factors are weighted with factor 0-1 (poor-excellent) according to their importance and the mean value – its potential usefulness (values 0-5) is established for each of the ideas. Selected factors and weights need to reflect the objectives which we wish to reach by introducing our invention (for example higher motivation of employees, lower number of claims and similar) and actual situation in the company (the price shall be an important factor in case we have poor financial resources).

Example

The company which records relatively well standing financial position wishes to change its strategy and become a leading company in the segment of panelling girder. In the framework of a new strategy we wish to develop a new

market product, for which the idea already exists. Novelty needs to be patented since high value added is expected as well as an entry on foreign markets. Our research and development department fails to have enough apt staff. The existing production programme shall be topical only in 2 years time.

Many ideas are available as a result of one of the techniques of idea creation and we wish to assess the aforementioned ideas. However, the criteria need to be defined firstly (Table 11).

Assessment criteria		
Criterion	**Criterion description**	**Weight (0-1)**
K1	efficiency of the solution for concrete product (good solution means high value)	0.7
K2	long-term fulfilment of strategic objectives of the product (good solution means high value)	1
K3	price (high price means poor solution and low value)	0.4

Table 11: Assessment criteria

Idea assessment	**K1**	**W1**	**K2**	**W2**	**K3**	**W3**	**Total**
Idea	**1-5**	**0-1**	**1-5**	**0-1**	**1-5**	**0-1**	**K1 × W1 + K2 × W2 + K3 × W3**
Find a connection with the university and order a development which shall take more than half a year and which shall be relatively expensive.	5		2		2		6.3
Apply for a joint 1 year R&D project which shall be EU financed and is expected to bring solution to problem	5	0.7	4	1	5	0.4	9.5
Send our employee to obtained further education at the university.	2		4		4		7
Purchase a licence which solves the same problem in a different manner	5		1		4		6.1
Lease a commercial service from the company which has a technical solution for the concrete problem	5		2		3		6.7

Table 12: Assessment results

According to the selected criteria and weights (Table 11), we decide on a joint R&D project – we have plenty of time, we expect the establishment of long-term cooperation, and the project shall be financed by the EU.

5.5. Forecast techniques

5.5.1. Trend extrapolation

The technique is based on presumption that a certain technology shall develop with the same trend or mathematically speaking congruent to the shape of the curve as it did in the past and shall thus continue also in the future. The technique is valid for various types of curves; however, the forecast is only reliable in stable conditions. This means that the trend shall surely change with the influence of unforeseen factor and the extrapolation shall not forecast it. The aforementioned may be avoided by combining the method with other methods and by altering the results of the extrapolation accordingly.

Typical example is the development of civil aviation. Civil aviation has been developing on the basis of military aviation findings. Knowledge on the speed of military planes has enabled the predictions on the speed of civil planes for many decades since the latter has followed the speed of military planes after a certain time.

5.5.2. Delphi technique

This technique was developed with a purpose to surpass the weaknesses of methods, for example extrapolations of trends which are based on the principle of individual member assessment who most frequently negatively influence the objectiveness of the work with their personal views. Persuasive individuals often influence on the decisions of others. Furthermore, the authorities regularly influence on the group members with their incorrect conclusions. Delphi technique eliminates the aforementioned problems to great extent. In some aspects, it may be compared to a difference between brainstorming and brain-writing. The latter eliminates the influence of individuals' opinion and authority.

Delphi technique is composed of the following phases:

- first phase: problem description with a questionnaire being sent to all group members;
- second phase: answers are analysed while the members are informed on all "average or mean" answers and asked to reconsider the said answers. The members whose answers exceptionally deviated are asked to explain their opinion (they might have additional information or substantiated opinion, or just an inaccurate opinion);
- third phase: answers analysis from the previous phase together with an explanation of extreme standpoints are again sent to participants who are asked to reconsider and send an answer.

If the answers remain inconsistent, the phases may be repeated.

The technique proves to be one of the most widely spread techniques of forecasting and is thus appropriate for assessing inventive and development solutions where the effects of eventual innovation shall be long-term and hard to forecast (for example potential market successfulness of mobile telephone sets with a possibility of picture transmission). Like in brainstorming, we need to be careful when selecting group members and questions (Likar, 2001).

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Nikas – winning market share by the new product development

Eugenia Kanellakopoulou

Nikas is a leading food company in Greece, with a focus on processed meat. The company was founded in 1971 and was run as a family-owned business until 2004, that a professional management was introduced and undertook a serious restructuring effort, focused both on streamlining operations but on setting an aggressive growth strategy.

The management decided to implement this strategy by increasing the company's leading market share with aggressive introduction of new products and their focused marketing. Exploiting the strong brand visibility from its core business—processed meat—that the company enjoyed in Greece, Nikas started entering new niches in the Greek food sector by **launching new products** such as frozen foods (pizza), cheese products and fresh meat.

Within these efforts, Nikas developed a modern Parizaki with good taste & high quality standards. It is addressed at young people and company's expectation is to become young people's favourite. The new product was launched to the market on Mid September 2005 and gained market leadership in less than 6 months.

For the 2005 nine month period, Nikas' consolidated turnover increased by 7.8 % compared to the corresponding period of 2004, mainly **due to the introduction of new products such as "Sto Piato", Parizaki "Filaraki", pizza and cheese "Ek Domokou"**. Currently, as much as 32 % of the company's sales derive from these products, something hardly imaginable in a traditional industry of food products.

So, the managements' efforts proved to be successful and Nikas today has been transformed into a corporate entity with an international orientation and is set to become a dominant player in South Eastern Europe. Nikas' goals for the next years are set on achieving organic sales growth of more than 10 % annually through constantly offering innovative products and strong support of the Nikas brand name.

5.6. Other methods

Beside the aforementioned methods of assessment and selection of ideas, there are also many others, for example:

- methods for exact simulation of business processes (also in the form of computer programmes),
- SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis – see detailed description in Chapter 3 "Need analysis tools supporting innovation",
- comparative method with a help of matrix or a method of comparing in pairs (non-numerical method of idea assessment, where each idea is compared to all others),
- decision-making tree (an analysis of various scenarios),
- Pareto's analysis (focusing on core elements according to the formula 80% – 20%),

- Ishikawa diagram or fish bone diagram (related primarily to the definition of problem) – see detailed description in Chapter 4 "Techniques of idea creation",
- multivariate analyses (which support a comprehensiveness of analysis by interlacing numerous aspects and their quantification)
- and others.

It depends on the type of a problem, availability of data and requirements on the precision of result which of the methods we opt for.

5.7. Final decision-making

5.7.1. Influential data acquisition

An important aspect before the phase of idea assessment is collection of data. It is particularly important since all the following implementations, calculations and comparisons are based on the collected data. The principle is similar to cooking. The quality of dish depends on the input ingredients. Even the best of chef cannot make a delicious pie from rotten eggs and apples. Even the most careful baking and final decorating of our pie cannot leave a good impression. It is similar with data. If they prove to be inconsistent and inaccurate, the final results shall prove to be just as imprecise.

Objective data are a result of standardised procedures of data acquisition and processing. The results are repeatable and independent from the collector. The objective resources are for example measurement results, official reports of an institution, undisputed opinions of experts and similar. Such results represent firm grounds for further analysis. In the phase of data collection, we often try to use reachable data from the so-called secondary sources. These data are of internal nature and have been collected earlier and processed for our own needs. These may be data gathered during similar projects or those which relate to regular operations (accounts, stock, production, costs) (Kotler, 1996).

Expert data from books and journals also prove to be most valuable. Yet type of source needs to be taken into consideration. Reviewed sources are the most reliable. The data gathered from the daily newspapers are frequently attractive yet less useful. Beside the aforementioned three sources, the organisations prove to be an important source of data since they collect data systematically according to particular fields and update them periodically – they may be obtained via specialised databases, which are often payable.

5.7.2. Making final decision

When assessing the effects of invention, we need to pay attention to all aspects, not only firm facts but also "soft" data and various opinions which cannot be expressed in figures. Reliability of data also needs to be considered together with data selection and knowledge on the characteristics and limitation of individual methods applied. The decision is of course left to a person who shall decide on the basis of facts, knowledge and experience. If the scales fail to tip on any side, the intuition, person's character, anticipation, well-considered boldness and other characteristics prove to be the most important. The data gathered in the American surveys on problems of competitive capabilities of companies show that economic data can explain only a half of these problems while the other half is presented by non-economic effects (Likar, 1998).

On the long-run an analytical approach towards solving problems in the decision-making process presents a step towards more reliable results as previously offered by a mare manager's instinct. Many years of experience have shown that the sixth sense of an average manager may be a source of many mistakes. (Smith and Reinersten, 1991).

6.Idea development

Vassilis Tsaggaris

6.1. Own research and development activities

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (Frascati, 1992).

No general guidance can be given on managing R&D and defining the R&D tasks because the work to be done varies greatly with the type of company and its circumstances. Some of the work is reactive to events, but most is concerned with creating the future, and this must necessarily start with decisions about where the company wants to go and how much it wants to invest in trying to create technology that it will be able to own and use to the exclusion of others.

In almost all industrial companies R&D is considered as a vital department that contributes to sustain and grow of a company's businesses. Within firms, decisions about the magnitude and nature of R&D performance are mainly guided by consideration of economic returns. Studies show that the rates of return of R&D to firms, although difficult to measure precisely, are high and that returns to society, from lower cost, improved, or new products and services, are even higher.

Naturally, firms will usually engage in R&D only when the results are appropriable and offer rates of return exceeding those of other available investment options such as acquisition of new machinery, advertising and marketing investments, or asset purchases.

Thus, managers of R&D must develop methods for integrating R&D into business operations, while simultaneously ensuring that the necessary research is accomplished. That means they must translate R&D results into terms that business managers can understand and support. Furthermore, R&D managers must establish procedures for selecting, planning, executing, and transferring R&D effectively, while at the same time nurturing a climate that promotes creativity. Therefore they must educate R&D people about using their skills for the company's benefit, while preserving the excitement of discovery within their organization.

According to R&D strategic significance on company's structure, the work undertaken by company's own R&D department could be categorised as:

- *Incremental R&D* is work intended to bring about a definable modest improvement in a particular product or a process
- *Radical R&D* is work which promises to produce a new product or process
- *Fundamental R&D* is work which is not intended to produce a specific business benefit, but is intended to produce scientific and technical information; this information might for example lead to a decision to try to develop a new line of business
- *Compliance work*, which is undertaken to meet environmental or other legislative requirements
- *Customer support work*, in which R&D staff work on the problems of existing products

According to OECD definition (Frascati, 1992) the term R&D covers three activities: basic research, applied research and experimental development.

- *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.
- *Applied research* is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.
- *Experimental development* is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

Human resources are the principal asset in R&D work. They comprise people with different skills and levels of training who are involved in a wide range of activities. Qualified scientific personnel are the key component of an R&D establishment and they must be supported by technicians, specialist services and engineering facilities, and they must draw on many external contacts.

Like any other aspect of a business, carrying out research and development into new products, services or business processes needs efficient management. It is essential R&D and business managers to work together in managing R&D, to ensure that R&D people are creative and able to manage their projects effectively. R&D shouldn't isolate itself from business functions, and business shouldn't let R&D isolate itself. This allows company's manager or owner to

reduce the risks of failure and allow as many ideas as possible to come to fruition. Company leader should make sure staff involved in research and development understands the business' overall strategy and what is commercially realistic. It is becoming important to build close working relationships between marketing, research and development teams.

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Joinery manufacturing

Arne Kullbjer

Joinery industry in wood processing sector is defined as the combination of wood with other materials. One of the important sectors for this is windows where wood and aluminium is combined to give a better performance of the windows. One thing is that they are better withstanding the weather and also do not need to be repainted etc. as most of the visible parts on the outside is covered with aluminium. They also have a better thermal resistance.

The problem Swedish producers in the industry were facing was how to make the production as efficient as possible, as the idea of aluminium cover of wood constructions is old but not as easy to implement in complicated constructions such as windows. Obviously, the solution has been found in close cooperation with the aluminium producers.

This type of windows is now very well established and widely used on the Swedish domestic market, but the majority of products are exported, not only to countries having cold weather, rain etc but also to those with hot climate where this type of windows proved to have an excellent performance as well.

The cooperation of two different sectors, wood and aluminium industry, enabled development of new technologies that resulted in new products which more or less dominated the market in a short period. The window segment of wood processing industry in Sweden is now dominated by two companies Elitfönster and SP-fönster (Fönster = Windows) with a turnover on 200 Million Euro.

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6.2. External sources – technology transfer

6.2.1. National and European research programmes

Participation in European and national R&D projects is a good opportunity for businesses to gain advanced knowledge. A company participating in a project could offer its current knowledge and expertise on specific project tasks and get a benefit from the experience and know-how of the other consortium partners to other complementary fields.

EU has developed a range of services for enterprises in order to facilitate their participation in common European projects and national initiatives. Cordis (http://cordis.europa.eu) is the official Community Research & Development Information Service where interest parties could find all the available and foreseen initiatives and business opportunities partially funded from EU. Also, Cordis has an extended database of partners (http://cordis.europa.eu/partners-service) that facilitates partner search either in the context of EU-funded Research and Development projects or within a broader search for technology-orientated partnerships. More about Cordis services can be found in the chapter 9.2.

6.2.2. Outsourcing

Outsourcing is the delegation of non-core operations or jobs from internal production within a business to an external entity that specializes in that operation. Outsourcing is a business decision that is often made to reduce costs or focus on competencies. Outsourcing is usually preferred for undertaking tasks and business functions such as data analysis, research process, information technology operations, engineering design, medicare, legal support services and software development. The main advantage of outsourcing lies in the fact that it helps companies lower costs, stay ahead in the competition and concentrate on their core competencies by spending time and efforts at them.

On the other hand, the company that outsources can get into serious trouble if the service provider, subcontractor refuses or is unable to provide business due to bankruptcy, lack of funds, labour etc. In addition to that outsourcing requires the control of the process being outsourced to the service provider. Thus the company may loose control over its process. However, we should stress out that both supporters and criticisers of outsourcing agree that a company should outsource only the non-core competences.

Consequently, if R&D is not a core competence, a crucial function of your company, it is recommended to find a subcontractor to perform the related to R&D business tasks for you. Hence, you should make an extended market research to find a reliable and experienced partner and minimize the risks that outsourcing bears.

6.2.3. Selecting a business partner

One determining factor of a project success is the quality of the partnership. Selecting business partners is as essential as project planning. No matter how well a project is broken down on different tasks and activities, it will not be successfully implemented if the collaborating bodies are not reliable or expert in their business field.

When selecting partners, financial viability and work experience the potential partners bear are essential components. Try to gather as much information as possible and if possible take recommendations on potential partners from others you can trust.

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Building new knowledge in the University-Industry cooperation

Janez Kopač

Recent years have shown a sign of a real need for cooperation between technical faculties and production companies. Intense production within the Slovenian environment has been performed mainly in the automotive industry. The said industry is further divided into two characteristic areas. The first one is mass production of automotive parts with the batches from 100,000 units to one million and more. This production encompasses material processing, such as Al-alloy, grey casting and steel. Value added per unit amounts from one to a few euros, however, multiplied by a number of units in the batch, the value of production may reach sky-scraping amounts. The second characteristic area is tool-making where high-quality three-dimensional engravings are produced and which make a part of the model for injecting Al-alloys or plastic, i.e. products produced for automotive industry. The future shall bring emphasis to mass production – processing of products made of grey casting.

Modern flow of information and connections enable companies to swiftly find providers who are able to solve the problems which they face in the

production process. Regardless of the excellent knowledge on the grey casting as a basic material of automotive parts, numerous technical problems arise during the processing when new modern materials are introduced into high-speed cutting.

The present article describes the connection among the experts within a company where the processing is performed and the Faculty of Materials and Metallurgy as well as the Faculty of Mechanical Engineering in Ljubljana.

In order to review the problems and the research, experts on working material and cutting tools, processing machinery and cutting technology were involved. After having studied the reasons which caused the mistakes occurring during the working process, a new "recipe" was drawn up indicating which tool and which parameters should be applied to improve the working process. Special emphasis was given to the time of working process which should not be prolonged. Innovative suggestions were implemented as regards not only a new cutting geometry of the tool but also considerably altered parameters of cutting.

When preparing all the anticipated and necessary novelties and approaches to the working process, the testing was first preformed on the samples. After having analysed the precision of measurements, assessment of new products, which were produced according to the new – innovative – technology, was performed and compared with previous products. The results proved surprisingly positive from two points of view: the required and higher quality of the product as well as the precision of measurements were achieved. Moreover, considerably shorter time of technological working process was achieved.

After introducing the new technology into the regular working process, all three partners engaged in another analysis, i.e. management of implementing the innovation. The objective was to establish the advantages of cooperation and thus warn about certain deficiencies and faults. There was a need for establishing the reasons for such a long response time, i.e. the time from the point when the idea was created to its introduction into the production. Administration and initial arrangements in particular (such as order forms, drawing up and concluding a contract, signing a contract) proved to have contributed to the longer implementation time. At the same time, the appropriate providers and key persons need to be defined, who have the possibility to act innovatively and also implement the idea. Yet it was discovered that problems arose when an umbrella contract needed to be drawn up.

At the moment one of the biggest shortcomings of academic institutions remains the organisation of ordering process which does not run according to the system "top down" but the individuals, i.e. researchers from the faculty make arrangements with the contractor individually and independently. This is also the reason why the companies started establishing their own R&D institutes. These institutes need less time to respond to company's needs since they activate all their knowledge and time to solve the problems which

occur in the company. Academic structure is primarily dedicated to training and only the remainder of time is dedicated to solving problems arising in the industry.

Finally, it may be established that the relations between the academic institutions and production companies may prove to be very successful. It ensures innovativeness and modern approaches. However, it may sometimes be too slow given that it imposes on companies to create their own expert teams which on the other hand may also prove to be an advantage since thus established connection enables transfer of experts with Masters and PhD degrees into production companies.

7. Entrepreneurship and Business Planning

Arne Kullbjer

7.1. Entrepreneurship, creativity and innovation

7.1.1. Implementation of ideas

Before we look more into the development of a *business plan*, which is always needed when implementing a new innovative product or service, let us just define the differences and relations between entrepreneurship, creativity and innovation.

The most important thing to the entrepreneur is to use the outcome of a creativity and innovation process to solve problems and to make it available on the market. *Creativity* is the process of developing new ideas and to find new solutions while the *innovation* is the process of applying new ideas to solve problems and to give new business opportunities. Creativity and innovation are in this sense very closely related and form an integrated part of entrepreneurship.

Creativity is something open almost to anybody to learn how to develop. It concerns how to behave and to work in different situations, and how to use the correct part of the brain. This is also the reason why all people within an organisation must be involved in and take part in the development of new ideas and innovations. The entrepreneurs are special people in the organisation that enhance and take care of the creativity within the organisation through employees and to some extent also of themselves.

The entrepreneur can stimulate the creativity in many different ways in encouraging people, by tolerating mistakes and giving support etc. but also in being open minded, recording ideas etc.

7.1.2. Strategic management

A strategic plan needs to be developed to show how the new innovation is secured to be valuable on the market, and to recognize competition from others.

It is essential to find out if the new innovation could create a competitive advantage on the market, otherwise it will not be worthwhile to continue even you possess of the "best innovation" ever made.

The process of the strategic planning needs to be made in different steps. The strategic plan should be quite short and easy to understand and needs employee involvement.

Below are listed some steps/items that should be included and considered when forming the strategic plan;

- A mission statement is the most important step. This is the vision of the new innovative product or service that has been developed.
- Competencies/resources needed for the product.
- What are the strengths/weaknesses/opportunities/threats? SWOT analysis.
- Competition from others?
- Success and failure factors? Which is/are the most important success factor(s)?
- Goals and objectives of the business opportunities the new product/service can create.
- An action plan that is related to the strategic plan and that gives a more concrete description of actions to be taken, time plan etc.

There are probably also other items that need to be considered depending on what product/service to be taken to the market.

The strategic planning should not be seen as a one short process but more as an ongoing process where the responsibility lies on the entrepreneur within the organisation.

7.1.3. Marketing, business and financial planning

An important part of the business plan is the *marketing plan* that actually focuses on the expected customers and their needs and willingness to accept the product/service. The marketing plan should be based on a market research to give a view of the market of the product/service offered.

The market research must not be complicated but needs to show what you want to know and to collect and analyse data from different sources available. Need analysis tools can be used, but even other available data. The result should give a clear picture of the customers to the product/service.

World Wide Web must then be mentioned as an important tool for marketing. Presence and visibility on the web at an early stage are important factors for any new product/service offered. An extended number of customers make Internet search to find new products and services. It is thus of great importance to make the tool attractive, easy to navigate etc to give a quick message to the customer using this tool to find a product or service.

A *financial plan* is crucial to the success of the new product/service. It is not only to define the need of new financial means or other economical support but also to show how it could be profitable in the long run. How are income related to expenses? Will the new product or service create cash flow problems during its life cycle? When will the break-even point occur? Will it happen when the company starts to make profit on the product/service? The financial plan could be presented in different diagrams that could later on be compared with actual results and adjusted when needed.

7.1.4. The international entrepreneurship

Global or international are leading words for most business nowadays. To the large number of companies it is not enough to stay domestic but at the same time it is not easy to get established on foreign markets.

There are many obstacles such as visibility, currency problems, local representatives, licensing, different political and cultural barriers etc.

The visibility is of course again possible through the World Wide Web, but how to approach other problems? In most cases you cannot exclude the foreign market but must accept it and tackle the problems it causes.

E-commerce is now creating new business opportunities which connect producers, sellers and customers through technology independent of national borders. E-commerce is a tool the entrepreneur must take into consideration when executing the market plan and overall business plan.

The Manna Culinary House

Nada Matičič

This best practice example encompasses a comprehensive and multidisciplinary approach in designing the "Culinary House Manna" in Trnovo, Ljubljana.

The creation of the Manna concept fuses together with its slogan "heavenly dishes on earth", which takes the work of the creators into designing a concept of the culinary offer with a story. This was achieved with interdisciplinary approach that encompassed cooperation of different branches of design which contributed to the optimal solution of integrated image of the venue and its culinary offer.

Starting-point and inspiration for the created ambience as well as the created patterns, selection of colours and wall paintings are the paintings made by the painter G. Klimt (1862-1918) who was one of the leading artists of the Viennese Art Deco. Uniquely drawn up concept thus intertwined the cooperation of architects, an interior designer, an expert on feng shui, a textile fashion designer, a painter, a visual communication designer and at the very end of the project also a decoration designer. On the basis of the plan designed by the architect and the interior designer, the existing building obtained a thematic concept of a new integrated image, ground plan rearrangement of rooms with a new layout, setting and selection of equipment, tables, chairs, floors, lighting and textile patterns. The freshly designed concept of patterns (flower motif) and colours may thus be admired on all fabrics (tablecloths, place-mats, covers, chair upholstery, cushions …). The said concept is also used for the flooring in the form of carpets which create different atmospheres in different rooms. The pattern –

flower motif is repeated again on the copper fence, various décor and glass. Fashion designer used all the aforementioned when designing waiters' and cooks' uniforms.

Integrated graphical corporate image (logo, business cards, menu, web sites …) also reflects the concept.

Carefully selected furniture, antique pieces of furniture, mirrors and paintings as well as Murano lights give the place the desired image.

The presented concept of a trendy restaurant is not a novelty in our environment yet it enables unique solution which places a particular ambience and its contents among designer masterpieces. After the success experienced by the interior and integrated image of Manna among its customers, it may be established that such type of carefully-planned and expert-grounded links enable prolific and successful work of the entire designer segment. Manna is also a good example in praxis, i.e. the future of Slovenian design lies in creating unique products – ambiences or only products in smaller numbers which can so remain exclusive.

7.2. Business plan development

7.2.1. General aspects

If you do not have a clear business idea and a new product/service to offer the market then it is of course not easy to make a successful business. In such a case business idea needs to be firstly developed, then tested and in the end financed in order for us to create a realistic and viable business plan.

Very often a *reference group* or management group needs to be established including persons with different backgrounds and experience, well suited to the new product/service developed. If extra means are needed to finance the new product one of the most important things is a good business and marketing plan. Most investors, within or outside the company, often have very high demands to feel sure the investment will in some way be profitable. The reference group is in this respect very important.

Most new business ideas need to be developed in several phases, one likely model would be:

- Further development of the innovation business idea
- Business plan development
- Production start-up

Further development of the innovation and business idea is to analyse and to document the product and the possibility to produce it, market and sell it.

Business planning is crucial for showing and working out how the new business will be organised, how marketing will be done, management, implementation, risks and threats and last but not least how financing and resources could be obtained. It is important to create an overview of the realisation of the new product, try to find different scenarios. Production, marketing and target group for the product are important aspects. What are the risks and threats when you prepare for entering the market with the new product?

The last phase is to *start the new production/service* and to establish the business on the market according to the planning. From this phase it is more important to look at issues like management, establishing production line, visibility and advertisement, market issues, threats and further development of the product or new products.

7.2.2. Business idea

Most of creative thinking and new innovations are done by persons who have some experience from the industrial sector which the new product/service is related to. But the innovation and the business idea is worth nothing if it is not developed in cooperation with other actors.

The "idea" must be analysed before implementation. Is it realistic and will the market swallow it? Does the product already exist? Are there others who have already developed this idea? There are many questions to be answered. A discussion with different type of people, experts, customers and other possible stakeholders must take place. Try to establish a reference group already during the development of the business idea. This analyse phase will not happen in one or two days, more likely is a time span of months or maybe a year, depending on how concrete and how high the risks.

The analysis should not result in very technical conclusions but more how "entrepreneur-like", telling how extraordinary the product is to the potential

customers, how big the potential market is, how the product could be marketed and distributed. This is much more important to investors or those within or outside the company who have to supply the new product with capital.

The expression "innovation" that you have come across several times in this book is mainly used to define and to develop new products within the existing production and might also be marketed through existing marketing channels.

When developing new innovative products the customers are always in focus where the usability lowers the costs and/or other advantages for the end user. Always keep this in mind when you are developing the business idea.

The end of this phase should be a formulation of a business idea, which is simple to read and to understand and much focused on what you are going to establish. All people involved in this phase should read, scrutinize and give input to the business idea.

The business idea should contain the following information

- Type of product/service
- The need of the customer/target group
- What is the potential market?
- What is the innovative part of the product and how unique is it?
- Will it be profitable in the future?

The business idea should initially be kept secret, which might include writing agreements with potential investors and other stakeholders. What about intellectual property rights and patents and other types of protection? This is further discussed in Chapter 8.

7.2.3. Marketing plan

An integral and important part of the business plan is the market plan. The market will not to 100 % be predictable but ought to be analysed and some kind of estimation should be established using merely common sense. The better you know your target group the easier it will become to predict their reaction to the new product/service. So the marketing plan should always start with a phase where you (1) *investigate the market*.

During this phase you might also look for possible competition and what your strengths and threats are in relation to the competitors. This could be done through a (2) *SWOT-analysis*, already described in Chapter 3.3.

Even if you do not meet with any competition for the moment you must always be aware that in the future similar products or products that can substitute your product, using better price/performance, can arise. There will always be opportunities to duplicate your business idea, being only a question of time and resources. Compare with what the Asian companies have done in car industry and electronics!

After this you are in a better position to choose and focus on the target group which is the main focus of your product/service. This is also called (3) *customer "segment"*, which you can concentrate on in the further marketing. The segmentation could happen due to many different criteria, young people, people living in own small houses, people interested in fashion, etc. It could be geographical, demographical, buying style or situation influenced, and is of course dependent on if you are offering a industrial product or a consumer product.

The success of an innovation often depends on if the segmentation has been done, and that the marketing and production are not coherent with the target group of the product.

(4) *Positioning* is another important aspect as concerns your success in relations to competitors. You must offer a unique possibility to the customer segment you target, it must be improved, have a good visibility, and be something extra and attractive. The customer should easy discover the usefulness and feel comfortable with the product.

Now you are in the position to produce a (5) *marketing strategy* which includes concrete information about the product, costs, marketing and distribution. The marketing strategy is often mentioned as the 4 P in marketing, *Product*, *Price*, *Promotion and Place*.

The *Product* is a description of the product and if it is adapted to the special segment you are targeting. The *Price* is dependent on the strategy you follow, low price to easier take a market share or high price to make a bigger profit from start. The *Promotion* is how you communicate with customers through advertisement, media communication, Internet, exhibitions, telemarketing etc. The *Place*, P number four in the marketing, is how the distribution of the products to the customers will be done. It can vary a lot through shops, franchising, post, Internet orders etc. E-commerce is getting more and more important to the selling process as a whole, orders, invoicing, payment, distribution. This does not however exclude other types of marketing by other means, but the buying and distribution is handled through Internet. Dell is a good example using this strategy. They advertise their products through different kind of media but the purchase happens mainly on Internet and their

products are assembled once they have received the order and directly being delivered to the customer.

The marketing plan should give answers to questions like the *size of the market, growth and also about the competition.* Which market share is realistic to expect from this analysis? If the product is a brand new one, then it is more difficult to analyse the customers and the customer segment. It might include that you make a need analysis or market research through questionnaires or other tools mentioned in Chapter 3.

7.2.4. Business system

When there is a marketing plan it is important that your organisation is ready to deliver the product. The process within the organisation/company is called *business system.* This is mainly a description on how the internal work should be coordinated. It also takes into account if the product should be totally produced by you or made through subcontractor(s). One of the most important aspects to consider when designing the business system is what you plan to do within your company and what are you going to buy/subcontract.

The business system should take into account following aspects;

- Development (which includes creativity and innovation given focus in this book)
- Marketing
- Logistics
- Production
- Distribution
- Customer follow-up

Business systems nowadays are very often supported by integrated software systems, offered by special software companies taking all these aspects into account. Anyhow, the general business system must often be transferred to the own situation and adapted to your own product(s). When doing business with other companies, for instance as subcontractors, it is getting more common that you do this through other software specialised for *Business to Business relations*, often referred to as *B2B.*

7.2.5. Organisation

Organisation has to do with people in the organisation/company. It is important to make a simple and easy structure of responsibilities. Already at the beginning, when you organised the reference group or management group for the new product/innovation, you discussed competencies required for different parts. As a minimum you need at least persons responsible for *Production and Logistics*, *Marketing and Economy*. Probably also some kind of administration is needed to handle the new product or service offered.

The organisational aspect also includes decisions on where to establish the new business, whether it should be in a new company or organisation or just stay within the organisation where the new innovation was made. How big part of the production should be done by you, and how much should be subcontracted? Would it possible to establish a partnership with other companies on a win-win basis? On the other hand it could be risky if the partner in some way fails to fulfil his obligation through not delivering their parts of the product.

7.2.6. Management

We have already mentioned that a reference group or management group is important for the success of the new business.

The management group is the one who can support in all different tasks that have to be solved, from technical problems, economy, marketing and organisation. For investment needed in the new innovative product and business the management group is crucial.

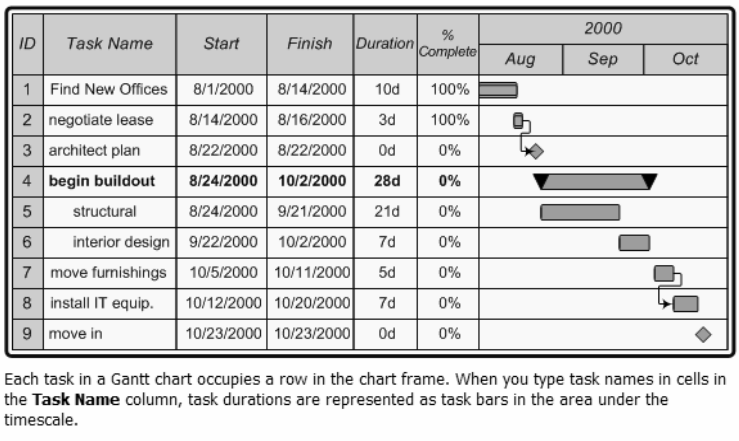
The management group should be a well composed involving people that can work effectively together, and who have complementing competencies and contacts. It is important that they all share the same vision.

The competence profile should be carefully considered to include persons covering all types of competence needed, like financial, marketing, techniques, production etc.

The reference or management group should be established as early as possible in the business planning process. If needed it can be complemented or exchanged with other persons during its life cycle, but the continuity is also an important factor, and that those who really are devoted to the new product also should be involved in the whole process.

7.2.7. Implementation

When the Business idea and the marketing plan are decided upon you need to make a working plan which can be divided into different working packages (Figure 8). Working packages define tasks, responsibilities and deadlines as well as describe sequential and parallel activities. Contents and time milestones need to be included since they very often relate to larger, completed packages. A delay in one work package could influence on several other work packages and the project as a whole. A Gantt Scheme is the normal way to proceed, and there is software available to assist in the construction of the Gantt scheme. MS Project is one example.



ID	Task Name	Start	Finish	Duration	% Complete
1	Find New Offices	8/1/2000	8/14/2000	10d	100%
2	negotiate lease	8/14/2000	8/16/2000	3d	100%
3	architect plan	8/22/2000	8/22/2000	0d	0%
4	**begin buildout**	**8/24/2000**	**10/2/2000**	**28d**	**0%**
5	structural	8/24/2000	9/21/2000	21d	0%
6	interior design	9/22/2000	10/2/2000	7d	0%
7	move furnishings	10/5/2000	10/11/2000	5d	0%
8	install IT equip.	10/12/2000	10/20/2000	7d	0%
9	move in	10/23/2000	10/23/2000	0d	0%

Each task in a Gantt chart occupies a row in the chart frame. When you type task names in cells in the **Task Name** column, task durations are represented as task bars in the area under the timescale.

Figure 8: Simple Gantt Scheme

Demonstrates basic tasks and subtasks, anticipated starting and final data, time envisaged for activities, data on feasibility of the assignment and graphical presentation of tasks and interrelations (Visio® 2002).

Try to make the Gantt scheme as realistic as possible. Overly optimistic planning or pessimistic planning could have a negative influence on the project. Available resources are crucial both in the aspect of man power, economy and equipment. Overly optimistic planning might create resource problems and overly pessimistic planning might result in delivery problems on a growing market.

7.2.8. Risks

Try to make a risk analysis and include it into the business plan. Risks are events that might occur in the future. Thus they cannot be exactly presented. Typical examples of risks are related to unforeseen reaction of the market, competition, subcontractors unable to deliver the required work, technical problems etc.

In the business plan this is often handled in the way that starting from the presented plan you make a best case description and a worst case description. What will happen if selling becomes much lower than expected?

Your business plan should answer questions about risks and how you will handle those risks if they happen and how they influence the business. What will happen in the worst case scenario?

7.2.9. Financing

If you made a solid business plan it will probably also be possible to see how much financing you need and when you can expect to reach break even and make profit on the product. The financing could of course be found internally in the company or happen through different external financing sources like banks, private loans, and national or international sources etc.

Even though the financing is secured there could still be problem regarding cash flow. You have to pay much money during the first phase of the project and will generate no incomes. In the business plan you must include an analysis of cash flow. The capital to generate the new business will probably not be fully available at the very beginning.

The Business plan should as a minimum include following plans;

- Estimated results and balance sheets
- Cash flow analysis
- Long term analysis up to and after the financial breakpoint when the product will generate profit.

Everything is made on estimations and worst case analysis should be included. Also a best case analysis could be made and presented in the same format to give an easy overview of the risks (and opportunities).

Try to make a calculation on return on investments, which is very interesting for external financing sources, especially if the plan to be highly involved in the future as owner or long term financing source.

The financial part of your business plan needs expertise in economy to be correct and convincing presented (see Chapter 6.2).

8. Intellectual property

Arne Kullbjer

Intellectual property relates to the results of created and RR work, new solutions, inventions, new technology or technological development, software, new design of industrial and other products and others. A part of aforementioned categories could be protected through *copyright laws, patents, trademarks and industrial design.* Any know-how involved in the product could of course also be kept secret within the company, through internal agreements, to others.

The needs for copyright and related laws have become more and more evident especially through the opening up of the Information Society. Music and software are examples on this. The intellectual property rights have changed over time but the main objectives have always been the same to encourage the inventing of new products and services to the benefit of the end-users. The word *copyright* is mainly used to protect the rights of writings or production by an author but nowadays also includes the software development. Copyright only protects the "expression" from the author and not the idea behind it. More and more products even in the mechanical industry nowadays have software included directly to the product or in the production of it which might be interesting for the company to protect.

Borders for marketing of goods and services are disappearing in a European and global market. Copyright based services and goods should be and are available and marketed especially within the European Community.

The need for intellectual property rights and related laws is to protect innovative products and services and also to secure companies and persons on the investment they have made to be able to marketing and distributing them to end users not to be copied by others. The intellectual property rights are becoming increasingly important as they often cover huge economical values.

On the other hand not everything can be protected as it should prevent the free competition on the market and the laws for intellectual property are in that sense very complicated and differ from country to country. Certain type of inventions, for instance results from academic research, can not be protected. Inventions that have not been protected could be copied and reproduced.

Intellectual property and related rights are, as mentioned, based on national laws and legislations. Within Europe there is a tendency now to adjust the national laws and legislations through a common European legislation.

A typical example on the needs of intellectual property rights is when a company wants to market a new product based on some technical invention. The company wants the product to be exclusive and easy to separate from other similar products and also be protected as far as possible from reproduction by competitors. In that case the company could think of *patenting* the technical solution behind the new product combined with some protection of the design (based on artistic rights) as well as a *trademark* of the product. In addition some protection for the marketing of products, similar in form and design, could be secured through the marketing legislations available. It is for instance not allowed to market a product which is very similar in its design as another well known product to benefit from the good will that product might have.

Intellectual property rights have a growing economic importance and will in many companies be the most valuable asset. Most important issues of the intellectual property rights seem to be patent and trademarks, especially within hi-tech production like electronics, biotechnology and medicine production, but it becomes increasingly important in mechanical industry.

8.1. Patent

A patent is regarded as a property right which can be issued nationally and/or in other countries where the company wants to protect its solution. The patent gives the company exclusive right to manufacture, to use and to sell the product within a limited time period (20 years; can vary from country to country). As it is a property it could be sold or licensed to others or be subject to contracts and/or other agreements. Once a patent is issued it is possible to make profit on it especially for the person(s) who is the inventor. The patent can not be global so it must be protected in the countries where you want to market and to sell the product. If there are many countries where the patent is needed, it might be a costly and administrative procedure. International Patent Application (PCT Application) exists (see Chapter 8.5), but it is more a matter of an application system which will not give a global patent but a number of national patents.

It is not possible to reward a patent to every invention. An invention must, in general, fulfil the following conditions to be protected by a patent. It must be of *practical use*; it must show an element of *novelty*, that is, some *new characteristic* which is not known in the *body of existing knowledge* in its technical field. This body of existing knowledge, called "*prior art*", could be checked using

information discussed in Chapter 3.6 (e.g. patent databases, general and technology-specific search engines). The invention must show an *inventive step* which could not be deduced by a person with average knowledge of the technical field. Finally, its subject matter must be accepted as "patentable" under law. In many countries, scientific theories, mathematical methods, plant or animal varieties, discoveries of natural substances, commercial methods, or methods for medical treatment (as opposed to medical products) are generally not patentable (WIPO, 2006).

You have to apply for the patent through a special application procedure given by the national authorities responsible for patents and patenting. It must be written in a manner that a technical person in the filed should be able to understand and to use the invention in research and development or in industrial production. In most countries it is possible to make a pre-application and after that has been judged and looked upon from the possibility to be rewarded, a final application will be made.

A normal patent application could in Europe be done in three possible ways;

- National patent application which can be rewarded by the national patent organisation
- International patent application (according to the international patent application- PCT-system) which are sent to international organisations that have been given the right to handle these applications. At the end the national organisations in the country/ countries involved will be given the final reward.
- European patent application, where the European organisation for patents, European Patent Office-EPO, could reward a patent.

The procedures are costly and take long time, often some years, and less than one year is very rare. Consulting organisations are the main actors on behalf of the company or individual that wants a patent. The more countries you want your patent rewarded in, the more costs you will have for consulting, translation and different fees.

Especially being a researcher it might be interesting to publish what you have discovered. Be careful here, a patent is in itself a publication describing the invention and in return you will be given a protection to non authorized use. If you publish it on your own first in a scientific journal or similar it will prohibit having it patented in most countries in the world. However it is possible to publicize the results if the publication does not give sufficient information so that it could be duplicated or manufactured from the information given in the article. Consult your national regulations in advance.

One important source for more information about patent is the IPR-Helpdesk funded by the European Commission which is a service free of charge with the aim of supporting creativity and innovation in Europe (www.ipr-helpdesk.org).

CaseStudy CaseStudy CaseStudy CaseStudy

Intellectual property creates new market opportunities

Borut Likar

Small yet successful Danish company (A) was specialized in developing and industrial designing of office furniture. The company cooperated successfully with the Department of Industrial Design at the University. Numerous chair designs – ergonomically upgraded, attractive design-wise and user-friendly – were developed through the cooperation in development projects which were supported and financed by the European Union. Not only were the said chairs made from ecological materials but were also easy to make. Since the batches were smaller and exclusive, the company together with the subcontractors launched a production of smaller quantities and marketed the products via the existing sales networks. The investments made into knowledge and fresh ides, which were regularly presented at the exhibitions and fairs, contributed to the positioning of the products among the high-price segment.

In his bachelor thesis one of the students developed an interesting form of a retaining beam used in construction. The subject was not directly connected to the company's activities yet the company decided to cooperate in the project due to a small investment and interesting product. The form of the product was original enough to be tested with computer program, which simulates static loading. Consequently, it was soon discovered with the help of experts in wood constructions that the beam meets all the standards using 10 % less material. The company patented the solution internationally (PCT application) with their own financial sources, which amounted to some ten thousand euros.

Given that the company's business strategy was oriented towards industrial design, the company decided to begin negotiating with a larger German company (B) on initiating business cooperation. The idea was that the company A implements the first phase of the production together with its subcontractors, while the company (B) undertakes the second phase of the project and marketing. Since the patent application was perfectly prepared, the developers (A) approached the negotiating process without any fear and thus also disclosed all other technical features. In consequence, the problems arose. All of the sudden the potential partners (B) started to be less cooperative yet not as far as their interest in the patent is concerned. As revealed later, the company (B) continued to search for other options on how

to circumvent the patent and implement the entire business without the company A. Since the company B was unable to implement its plan, they decided to offer a ridiculous compensation for the patent which the company A was not prepared to accept given the expected business results (value added EUR 0.3 million/year for the company A). Already animated dialogue between the companies exploded during one of their meetings when company B uttered the following threat: "It is true that your patent is well-written. Also the court shall probably rule in your favour. Yet you need to be aware of the fact that this is a matter of international lawsuit, which tends to be expensive and related to expert opinion, lawyer's services, international travel and similar. Our lawyers shall make sure that the proceedings are going to be long-lasting which shall increase the costs even further. We have checked your business operations and since you do not have 0.5 million euros of reserves earmarked for court proceedings, you will not be able to afford such lawsuit. We are thus offering you EUR 50,000 for the entire patent".

They broke up the negotiations with that cynical offer yet the company A started to search for a new solution. Given that they had nothing else to loose, they established contacts with numerous new potential purchasers. Among them was also a company (C) which was prepared to purchase the entire patent for EUR 0.3 million and pay out additional 0.7 % per each product sold. They also undertook the entire production and marketing. Since the company C was an international company, the company B was forced to renounce to any attempt of extortion.

The company A thus successfully completed the business – especially thanks to perfectly prepared patent and fast reaction since the patent could probably fall through without any additional financial investment into its renewal. In less than three years the company A thus generated EUR 1.3 m.

CaseStudy CaseStudy CaseStudy CaseStudy

8.2. Utility model

It happens quite often that someone has made some kind of simpler technical invention, but getting a patent is not possible (lower innovation level) or it would be too costly and time-consuming to make a patent application, especially this might be the case for SMEs or for individuals.

One alternative for making a patent application is to have it classified as a "Utility model". The utility model protects a technical invention that fulfils the criteria of novelty, invention and application, but the invention is more broadly

defined than what is needed for a patent. The requirements regarding novelty differ from country to country.

To receive a utility model protection is much easier and means more or less a registration procedure. A national body examines the requirements of the application and if fulfilling the requirements it will be granted as a utility model. The time compared to an application for a patent is considerably shortened, and the process might take half a year or even less. The protection of the rights to the utility model is shorter than for patents, in most nations it is about 10 years or less.

The utility model protection is valid only at a national level and so far not adopted in Europe, but the European Commission is working on the possibility of introducing it also at a European level.

More information on the utility model could be found on the IPR-helpdesk.

8.3. Trademark

A trademark is different from copyrights and patents as it is a symbol or name or combination of name and symbol regarding a special product or service to make it well known and to differ from other similar products and services. A trademark can be registered or it can also be protected through the use of it so that a big part of the target group knows about it. No one will then be able to use the trademark or a trademark which is very close in its design.

The trademark does not include a time limit even though it should be registered again every ten year. But it could be repeated as many times as feasible.

All types of trademarks, of a product or others, should be possible to produce in graphical form. A question which has been much discussed is whether a sound could be registered as a trademark, and a decision has now been made meaning it can if following some basic rules.

Trademarks could be registered in more than one country.

The use of trademarks is very important to all types of products and services, even if it not registered. Most companies but also organisations, associations and schools etc. use their trademarks at all time in their communication.

The application of a European wide trademark covering all European countries could be made through the Office of Harmonisation for the Internal Market (OHIM) located in Alicante.

8.4. Industrial design

New products and processes – innovations – are often results of R&D – Research and Development activities. These inventions are, as mentioned, protected through patenting. The development of new products could also be build upon the invention of new forms often mentioned as "design". It could be on an esthetical basis but also on the usability of the product depending on a certain design. The legislation concerning design is to protect the design of a product. As in the case of copyright this will be given to the designer and it will not be allowed for others to use the new design in their products.

The protection could be done at a national level or at European level through the Office of Harmonisation for the Internal Market (OHIM).

8.5. Patent protection abroad

As already mentioned it is possible to protect a product also internationally even if always coming back to national patent protection. The international patent protection (Patent Cooperation Treaty – PCT) or the European patent protection (European Patent Convention – EPC) represent an opportunity for an international protection.

At the same time, patent protection in particular country is also possible yet costswise, the procedure for more than five countries fails to prove reasonable.

8.5.1. PCT application

PCT is based on agreements between more than 100 countries. The main idea is that the application could partly be made through a single application and you need to define the countries where the patent should be issued.

The application could be done through the national patent registration office or, which often is the case, through the World Intellectual Property Organization (WIPO – www.wipo.int) in Geneva or the European Patent Office (EPO – www.epo.org). Application forms are available.

The PCT application process starts with an international search and gives the applicant a possibility to see what option there is to receive a patent. After that an examination is made by an expert who gives his opinion of the possibility to receive the patent. The international phase is then being followed by national phases in the countries where the patent is sought. The WIPO website gives more details about the PCT-application and the different time frames and phases.

8.5.2. Application for European Patent – EPC

According to a European agreement it is possible to receive a patent covering 30 European member states of European Patent Convention as well as some other countries. The application must include a list of countries where it should be designated and if being approved it will be validated in those countries. It is done through a translated version of the patent to all national offices. The European Patent will result in national patents in designated countries.

The application could be sent directly to the European Patent Offices in English, German or French languages. Application forms are available from the European Patent Office.

As in the PCT-application the process starts with a search to find out any obstacles to the patent. If the applicant wants to continue, then the assessment of the application will be done. When it is ready for approval translation is needed in the three languages; English, French and German. It will also be published in the European Patent Bulletin.

The European Patent is actually not a true European patent but a number of national patents. For that reason it still has to be validated in all countries which also will include translation to national languages.

8.6. Other forms of protection

Another way of protecting an invention or novelty is just to make it secret. The novelty could be hidden in a new product or a new production process can be kept secret within the company which is using the new process.

9.Innovation and R&D support system

Vassilis Tsaggaris

9.1. An overview of the innovation trends in Europe

World-wide competition to attract research and innovation investment is growing. In addition to attractive locations such as the US and Japan, new competitors have emerged, such as China, India and Brazil. For the EU to remain competitive and sustain its model of society, far-reaching reforms are needed urgently. Moreover, the scale of competition is such that no Member State can succeed in isolation. Transnational synergies should be fully exploited. This is the only way to boost research and innovation performance and to turn it effectively into more growth and jobs in the EU. A high level of R&D spending and a good innovation performance contribute to more and better jobs. In addition research and innovation are needed to make the EU economy more sustainable, by finding win-win solutions for economic growth, social development and environmental protection.

To achieve sustainable global competitiveness, the EU has no choice but to become a vibrant knowledge economy. That is why, in launching the new Lisbon partnership for growth and jobs, the European Council singled out knowledge and innovation for growth as one of three main areas for action.

Nearly all Member States have set targets, which – if met – would bring research investment in the EU to 3 % of GDP by 2010. However, instead of rising, EU research intensity is more or less stagnant. In most Member States, increases in public and private research investment and the range and ambition of policy initiatives fall far short of what their national targets, let alone the EU target, would require. Private investment is particularly low. At the same time, European innovation performance has not increased enough.

Looking into Member State challenges to innovation and best practice policies, we identify similarities in the innovation challenges, while the best practice policies tend to focus in different directions according to national needs. We will outline some issues of the four national policies of the states participating in the I-model project.

Greece

In spite of a slight catching up trend in innovation performance, the Greek innovation system remains one of the weakest in the EU and economic growth is not strongly based on innovation. Developing lifelong learning programs, the very low business R&D expenditure and the extremely low tendency to protect R&D results through patenting are significant barriers. In response, policies supporting researchers in transforming their ideas into business activities, expanding eligibility of SMEs for funding and supporting private investors in developing incubating activities are some of the attempts to answer the innovation challenges.

Slovakia

Industrial restructuring and economic growth in Slovakia in recent years has not been mirrored or supported by a step-change in the innovation potential of the country. EIS2004 results indicate that Slovakia is falling further behind in a number of key indicators. Specific challenges include raising public and private rates of expenditure on R&D and boosting the rates of new product development and raising the technology content in the service sector. Innovation policy is still not well formulated in Slovakia and the response to the challenges is fragmented. One organisation active across the country in supporting enterprises is the National Agency for Development of Small and Medium Enterprises, which supports business development, technology transfer and innovation through a network of centres. It also runs a number of funding programmes and initiatives such as the INTEG programme which supports innovation and technology transfer through technology incubators and cross border economic co-operations.

Slovenia

Slovenia's position in terms of innovation is in many respects enviable with respect to other new Member States, to the extent that it performs above EU25 average for six indicators. The weaknesses of the Slovenian innovation system relate notably to insufficient commercialization both in terms of patents and in terms of new-to-market products. Limited access to specialized finance is one factor, which explains the low intensity of innovation activity amongst SMEs. The country has been a front-runner in developing support for innovation and industrial development through cluster initiatives. A recent evaluation of the programme launched in 2000 suggested this initiative has had some notably success in boosting competitiveness.

Sweden

Structural changes during the 1990's enabled the Swedish economy to grow at rates close to the EU average. Yet, evidence suggests that this growth has not been 'employment-rich' nor based on the creation of new smaller innovative firms. The overall performance of the Swedish innovation system is extremely good compared to the EU25. Yet, a number of trends give cause for concern including problems with recruiting students to S&E disciplines, SMEs innovating in-house and rates of non-technological innovation. Business R&D remains dominated by a number of large industrial groups and there is a financial bottleneck to creating new innovative firms. In response, VINNOVA, the national innovation agency, has launched the VINNKUBATOR programme and is studying a Swedish version of the US SBIR scheme (which provides for a percentage of all research funding to be allocated to new small business initiatives).

The following paragraphs will introduce some basic support mechanisms offered by the European Union.

9.2. CORDIS Technology marketplace

The Technology Marketplace Service (http://cordis.europa.eu/marketplace) is a central resource for connecting with the latest news and information about exploitable technologies and research results. The service can be used to find ideas for new or improved products or services, to help you exploit your own technologies or to keep in touch with developments affecting European citizens.

Technology Marketplace includes a wide range of up-to-date Technology descriptions (or Offers). These offers originate from interesting and relevant exploitable research results, mainly from EU-funded research (nearly 55,000 research projects sponsored by the EU, under its research and technological development framework programme are shown). The Offers are organised by themes (Business, Science and Society) and domains (Biology/Medicine, Energy, Environment, IT-Telecommunications and Industrial Technology). Each Offer includes a brief and relatively non-technical overview of the technology and its possible applications.

Technology Marketplace also includes a host of special features and tools including: 'Business Tips' that provide basic briefings to answer a variety of technology and business questions; 'Helpful Links' that access a range of sites from all over the world dealing with technology transfer and the exploitation of research. RAPIDUS, CORDIS' e-mail alerting service can be used to help users keep up-to-date on new exploitable result information, as it becomes available.

To help establish a European Research and Innovation Area, the Technology Marketplace provides for interactive facilities, which allow the owners of the research results (from non-Commission funded research projects) to submit offers. Those projects are carried out in universities and private labs in Member States and countries associated to the framework programme. The service should become one of the most comprehensive resources of exploitable technology across Europe.

9.3. IPR-Helpdesk

The main objective of the IPR-Helpdesk (www.ipr-helpdesk.org) is to assist potential and current contractors taking part in Community funded research and technological development projects on intellectual property rights (IPR) issues. The IPR-Helpdesk also advises on Community diffusion and protection rules and other issues relating to IPR in international research projects. Another more global objective of the action is to raise the research community's awareness of IPR issues, by emphasising their European dimension.

9.4. Gate2Growth

Newly established companies today, in particular those in technology field, will be a tomorrow's source of successful global businesses, establishing new workplaces and spreading innovation among traditional industries. But the company founders usually do not possess all the necessary knowledge and skills for the rapidly growing businesses. Beside that, they encounter problems in provision of financial sources and support. Centrally organized networks can provide a useful help to such enterprises. The Gate2Growth initiative (www.gate2growth.com) builds networks of investors and business service providers. Their main targets are the hi-tech companies requiring from €10,000 to €4 million of financial sources. The Gate2Growth services include:

- business plan formulation tools,
- EU-wide database of investment opportunities, business plans and financial sources,
- consulting of investment experts,
- local support networks,
- discussion forums and workshops.

9.5. Business Innovation Centre network

The Business Innovation Centre network (BIC) network (http://cordis.europa.eu/incubatorshttp://www.cordis.lu/incubators) is a regional support for entrepreneurs and innovative SMEs. BIC is focused to local, not international technology transfer. It offers comprehensive support, evaluation of innovative business ideas, business planning aid and support after the start-up of an enterprise. 150 BIC offices are spread all over Europe.

CaseStudy CaseStudy CaseStudy CaseStudy

Wood Processing Industry in Sala-Heby – A Pathfinder project

Arne Kullbjer

A group of 30 SMEs employing altogether about 400 people, located in a small region in central Sweden, joined with a purpose to establish a business association in order to respond more efficiently to their customers' – predominantly large companies and governmental institutions – needs. The business association would have good knowledge about the companies, how to make them competitive and how to use new technologies.

However, in order to further extend the association's performance, they decided to raise its ICT capabilities. The business opportunity was seen in Internet commerce and administration costs reduction through EDI (Electronic Data Interchange) solutions. Besides, the big companies and organisations should start regarding the SMEs as business partners and not only as suppliers of a product, which often is the situation. The SMEs can be flexible and can through quick interaction also adjust and change their delivery according to customer's needs. EDI is here an important technology.

The project was organised in right time as the big companies were in the process of implementing new purchasing methods, sending digital drawings etc. The association even managed to receive about 60.000 Euro from NUTEK, the Swedish Business Development Agency fond aiming to increase branch specific knowledge and IT-use through skill enhancement in the purchasing process and e-commerce.

The project was an example on how the competitiveness in small companies can be increased through involvement of quite simple but effective ICT tools. The administrative costs in the companies have substantially decreased with the EDI solutions implemented. The project has created more and better business opportunities and better competitiveness. No one of the SMEs can show any figures on how many more contracts being established or similar

results, but they all agreed upon that without this project their competitiveness should have been on a much lower level.

9.6. Trans-European support to rapidly growing companies

The European Union provides assistance to SMEs from Member States and often from candidate countries. They are available in different forms such as grants, loans and, in some cases, guarantees. Support is available either directly or through the European Union's Structural Funds, managed at national level. SMEs can also benefit from a series of non-financial assistance measures in the form of programmes and business support services.

The assistance schemes have been divided into the following four categories:

1. Funding opportunities directly available to SMEs

This funding is mostly thematic with specific objectives – environment, research, education – designed and implemented by different Departments of the European Commission. SMEs can directly apply for the programmes, generally under the condition that they present sustainable, value-added and trans-national projects. The support of the European Union consists of subventions covering generally 50% of the costs of a project.

2. Structural funds

European regional development funds are a major funding source for SMEs, through the different thematic programmes and community initiatives, implemented in the regions. The beneficiaries of structural funds receive a direct contribution to finance their projects. Note that the programmes are managed and the projects selected at national and regional level.

Structural Funds intervention are designed to help reduce disparities in development of regions and to promote economic and social cohesion within the European Union. Thus, the European Commission co-finances regional and horizontal operations in the Member States, through programmes in the fields of agriculture, regional policy, employment and social affairs. Note that the

programmes are managed and the projects selected at national and/or regional level.

3. Financial instruments

These financial tools are managed by the European investment Fund (EIF) and the European Investment Bank (EIB). Note that they do not invest in SMEs directly, but usually work through financial intermediaries.

4. Other types of support

They consist generally of non-financial assistance, mostly in the field of internationalisation.

10. Conclusion

Borut Likar

It is obvious that a comprehensive management of innovation processes in the company requires a clear strategy of innovativeness (Collins, 2001,; Collins, Porras, 1997; Mulej et. al., 1987; etc.) and with the latter related further activities. The companies that wish to be or become more successful in their field need to set reachable yet high and ambitious objectives. The aforementioned encompasses ongoing development of existing activities with a help of small incremental innovations and at the same time support offered to every attempt made to achieve a breakthrough with a larger innovation (Sorensen, 2001). The companies which set "comfortably reachable" objectives become resistant to changes; the innovation processes slow down or even stop. Audi for example requires the aim to be set in such a way that there is a 50 % possibility to actually reach the set goal (Anic, 2001).

One of essential first steps is an appropriate training which is also one of the priorities of the EU programmes. Further steps are related to establishing an appropriate organisation and organisational climate. We believe that excessive innovation expenditure, shortage of financial sources and thus economic risk are only a consequence of ignorance and inappropriate activities and definitely not a fundamental cause.

The company which invests resources in an inappropriate manner and lacks personnel to manage invention-innovation chain and if at the same time its organisational structure is inflexible; such company shall face reduced results of implemented innovation. The funds earmarked for development and innovation activity shall melt away while the economic risk shall increase.

The conditions thus need to be prepared in order for the inventions to actually become innovations. The first step is thus modernizing the management of innovation activity. Individual phases which need to be implemented are illustrated in the book. It is particularly important that the innovation activities are harmonised and balanced which is also a prerequisite why a country fails to reach appropriate economic results despite relatively high innovation index (see Ch. 1).

Unfortunately, there is no uniform recipe for various types of companies which differ radically. A comprehensive and systematic approach is required since the innovation presented on the market is only the last link of the invention-innovation chain. We believe that the creative thinking is an essential value as stated by Mulej (Mulej and Ženko, 2004) and in connection with knowledge and determination the most important factor.

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