Continuous Innovation Process and Knowledge Management

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In the global era of hypercompetition, telecommunications and accelerated information/knowledge sharing, the innovation process has to become a systemic property of a company and its organization. All individuals work in and are part of some key corporate processes; all of these processes are subject to both continuous and often discontinuous improvement. That means that continuous (quantitative) and discontinuous (qualitative) innovation drives must be embodied in each individual and embedded in the system of their daily interaction and work. An effective and company-wide innovation cycle is the prerequisite for maintaining strategic competitiveness in a fast-moving, turbulent era. The whole company, with all its employees, whether production or service oriented, must become an Innovation Factory.

Professor Milan Zeleny, Innovations 2005

1. Market Changes and New Business Concepts

After many years of streamlining of the business and manufacturing processes many managers are now asking how to increase the competitiveness of their companies. Many cost reduction strategies led in many cases only to a temporary success. The previous problems are back and the improvement potential is decreasing. Like the Yo-Yo effect in a slimming programme. New buzzwords, medical cures, healers and medicines are coming. BPR, BSC, Lean, Six Sigma, TOC, and other new miraculous methods are applied. Sometimes successfully, sometimes not. A new wave is coming in recent years – innovations and knowledge management.

Fig.1.: Mass Customization – the engine of business development in the recent years

Henry Ford kicked off the trend when he stated customers could order their cars in "any colour, as long it is black". His focus was to filter out variability in the production process and increase efficiency. Product variety was limited; complexity reduced and customers were able
to buy only the cars he produced – and, for a while, they bought them. Now, automotive businesses around the world are being influenced by customer demands for both greater product variety and reduced delivery lead times. This poses a dilemma for the industry because responsive delivery is usually based on standardisation, whereas product variety requires flexibility and innovation.

Individualization of the markets and mass customization have influenced also many projects in the European automotive industry. Automotive companies are preparing radical changes in the whole supply and production network - from the "stock push" and "mass production" thinking to a stockless "build-to-order" (BTO) production strategy. This will require the re-invention of the complete automotive value stream from the material producers to the end consumers of the cars, through a cost optimized system delivering what the customer really wants without delay. Within the full framework of the "EU 5-Day Car Initiative", the Integrated Project "Intelligent Logistics for Innovative Product Technologies - ILIPT" focuses on the following:

1. Product configuration for build-to-order supply chains addressing new product technologies with the tools and management methods.
2. New concepts in delivering flexible production networks addressing collaboration across complete value streams and interoperability of these processes.
3. Novel methods and tools to assess and validate this radical business model for the European automotive industry.

This stockless vehicle supply system to deliver a customer ordered vehicle in 5 days is based on a radical new concept including a tremendous level of modularity, the joining methods and novel integration approaches. This concept aims at a groundbreaking renewal of current thinking from the traditional concept of supply chains, toward high-added value networks (Fig.2.).

Fig.2. Five Day Car Concept – Project ILIPT
Is really “the 5 Day Car Concept” so important for the customers? How many customers are not able to wait for their car more than 5 days? A typical customer needs sometimes a few weeks or months to make his final decision. But when he is definitely decided, he wants to have “his” product immediately. The producers able to satisfy him, will win. But this is not only the question of customer satisfaction. 300 billions Euro is lying in the whole supply chain network in the automotive industry. Flexibility and short delivery times mean also better cash flow and higher profitability for the automotive companies.

This example is not exceptional. Similar change processes are running in many other businesses under the slogan “give your customer what he wants – but faster than your competitors”. The essential question is – what does the customer really want? What is the customer value?

There are three fundamental business concepts focused on the customer value:

1. Lean Management
2. Theory of Constraints
3. Six Sigma (Fig.3.)

Over the last decade, many companies have tried to copy Toyota principles. They are applying methods for waste elimination from production and business processes, they compare benchmark indicators like value added index or working hours per product. But the essence of Toyota’s excellence is not captured in the „common sense“ methods like 5S, Kanban, value stream management or manufacturing cells. Toyota has been developing this system consistently for over 50 years. Toyota has developed a system of knowledge which creates reusable knowledge, maintains it, and leverages its use in the future. Nobody from Toyota employees wrote a handbook of Toyota Production System, this is a business of other management gurus. The values and principles of Toyota Production System are developed in the minds and daily jobs of all the employees. All the knowledge gained throughout the design or production process, what works and what doesn’t work, could be captured and consistently applied for all future projects. Toyota doesn’t call its system “lean”, but it is lean, Toyota doesn’t speak about knowledge management, but it does it!

Lean concept originated in Toyota is oriented on waste identification and elimination from the whole process chain (Value Stream Management). In other words – lean focus is maximisation of added value in all the production, logistical, administrative and development processes (Fig. 4.). TOC (Theory of Constraints) is based on the identification and elimination of the system’s constraints with the goal ongoing throughput improvement. The throughput is defined as the rate at which the organisation generates money through sales. In other words throughput is the added value in the process chain per time unit. The Six sigma philosophy specifies the value in the eyes of the customer (Voice of the customer) and identifies and eliminates variation from the value stream. Six Sigma, Lean and TOC continuously improve knowledge in pursuit of perfection and involve and empower the employees. The main problem of these most important business concepts is that they have tools to give to the customer exactly what he wants (without waste and quickly), but they don’t have systematic approach how to create a new value for him.

Many companies are oriented on low cost strategies. But some cost attack programmes and transfer production facilities to the low cost countries showed that it is not the right and strategic solution. In the recent years many West European od US manufacturing firms have moved their production plants to the low cost countries. Over time, they recognised that they
had lost some competitive advantages because some departments were physically separated (e.g. product design, production engineering, production, logistics) and the communication and co-operation between them was limited. Also many cultural differences reduced the effects of the low cost location. Not even massive implementation of lean management, Six Sigma or other world class concepts bring sometimes any radical improvement. Company success is not only in optimisation of current processes (doing right things right) but first of all in innovation (looking for new – but as fast as possible). The productivity world will be replaced by the world of creativity, the world of the perfect planning will be replaced by the world of the experiments and generating new ideas and opportunities. Not perfect planning of the change but fast realisation of the change is the way towards success.

Fig. 3. The main business concepts – Lean Six Sigma and TOC

Fig. 4. Lean Concept
2. Innovations and Customer Value

The purpose of innovation is to add value. The purpose of good innovation is to eliminate tradeoffs (M. Zeleny, 2000).

„Innovation is back at the top of the corporate agenda. Never a fad, but always in or out of fashion, innovation gets rediscovered as a growth enabler every half-dozen years.“, wrote R. Moss Kanter in Harvard Business Review 11/2006.

“A focus on cost-cutting and efficiency has helped many organizations weather the downturn, but this approach will ultimately render them obsolete. Only the constant pursuit of innovation can ensure long-term success.”, wrote Daniel Muzyka from University of British Columbia in Financial Times, 09.17.2004.

Fig.5.: Changing of markets and competitive factors

The father´s world of the business has been changed radically in the recent years. The old world of compromises (e.g. quality OR price, customisation OR delivery time) has been replaced by the new world where the tradeoffs are not accepted. When you have two options – take both! This is the new rule of success on the market. “The basic economic resource is no longer capital, nor natural resources, nor labor. It is and will be knowledge.”, said Peter Drucker.
M. Zeleny defines innovation as the change in the hardware, software, brainware or support network of a product, system or process that increases the value for the user or customer. From this definition it should become clear that not every invention (a discontinuous, qualitative change) is an innovation, and so not every improvement (a continuous, quantitative change) is an innovation. Innovation adds value — claims Zeleny.

“To grow, companies need to break out of a vicious cycle of competitive benchmarking and imitation.”, say the authors of Blue Ocean bestseller - W. Chan Kim and R. Mauborgne.

Customer value distinguishes the innovation from the simple change. But the innovation is not to be only a breakthrough technical solution. Generation of technical changes on the product or technological advantage in the production process have not necessarily led to success. Many companies have a perfect product, produced by an excellent technology. They have the only limitation – the customers don’t buy them, because they don’t see any reason to buy them. They did not find the customer value. Innovation must generate “something new” for the customer life – simplification, risk elimination, convenience, better price, fun, image and emotions, style or environmental friendliness.

<table>
<thead>
<tr>
<th>Customer Benefits $\uparrow$ (Higher)</th>
<th>Costs (Constant)</th>
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<tbody>
<tr>
<td>Customer Benefits (Constant)</td>
<td>Costs $\downarrow$ (Lower)</td>
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<td>Customer Benefits $\uparrow$ (Higher)</td>
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<td>Customer Benefits $\uparrow \uparrow$ (2 x Lower)</td>
<td>Costs $\uparrow$ (Higher)</td>
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<tr>
<td>Customer Benefits $\downarrow$ (Lower)</td>
<td>Costs $\downarrow \downarrow$ (2x Lower)</td>
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Fig.6.: Customer Value Improvement
There are four basic areas for customer value creation.

Fig.7.: Four Areas of Customer Value Creation

The new customer value can be generated by
- New value
- Different Value
- Higher Value

D. Mann defines two ways of thinking regarding innovations:

<table>
<thead>
<tr>
<th>Trade-Off Thinking</th>
<th>Breakthrough Thinking</th>
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<tbody>
<tr>
<td>High Quality OR Low Cost</td>
<td>High Quality AND Low Cost</td>
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<tr>
<td>Affordable OR Customized</td>
<td>Affordable AND Customized</td>
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<tr>
<td>First Cost OR Life Cycle Cost</td>
<td>First Cost AND Life Cycle Cost</td>
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<tr>
<td>Flexible OR Rigid</td>
<td>Flexible AND Rigid</td>
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<tr>
<td>Big OR Small</td>
<td>Big AND Small</td>
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<tr>
<td>Adaptor OR Innovator</td>
<td>Adaptor AND Innovator</td>
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<tr>
<td>A OR B</td>
<td>A AND B</td>
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All systems contain contradictions - something gets worse as something gets better (e.g. strength versus weight). Traditional approach usually accepts a compromise or a trade-off, but this is often not necessary. Powerful, breakthrough solutions are the ones that don’t accept the
trade-offs. Such solutions are actively focused on contradictions and they are looking for ways of eliminating the compromise.

Fig.8.: Overcoming tradeoffs through contradictions (Linde)

The WOIS approach developed by H.Linde has been successfully used in breakthrough product, process and business innovations in many companies (e.g. BMW, Braun, Hilti, Viking, etc.).

The main elements of the WOIS innovation methodology are:

1. Definition of the strategic orientation
2. Definition of contradictions. Answers to the questions -What and Why?
4. Concurrent innovations in product, processes, organisation, resources and marketing.
5. Implementation and evaluation

The basic conditions and principles of successful innovation using WOIS are:

- The innovation project starts with deep analyses - market analysis, product trends, analysis of technological trends, process analysis, analysis of production and assembly trends, trends in sales and service systems, analysis of the product as a system and its environment, analysis of system functions, analysis of existing solutions (patents, competitive solutions, solutions of other areas, generation of solution maps, benchmarking), analysis of system generations and evolution.
- Integrated, team based design and development process – marketing concept, product and process are designed by the same multifunctional team (marketing, design, process planning, production, logistics, controlling, customer).

- Use of the knowledge of the system evolution and system generations – strong orientation on the past and future development trends. Not only a new products or processes are created, but also the knowledge and strong learning effect is generated through the innovation process.

- Culture of creativity, acceptance of failures, space for experiments, prototypes, testing new ideas.

Fig.9.: Contradiction based innovation strategy WOIS (Linde)

Example

Project: Innovation of hospital bed
Project duration: 6 month
Project team: designer, production engineer, external consultant, logistic expert, process engineer, service, marketing, customer
Project inputs: Target price, target markets, product life cycle, production volume
Project goals: New product with higher customer value (new functions, better parameters, lower costs)
Project steps: Fig.10.
1. Market analysis
   - Customer requirements
   - Competitors
   - Development trends

2. Product analysis
   - Structure
   - Functions
   - Parameters
   - Costs

3. Innovation process
   - Add required function
   - Eliminate not required functions
   - Improve required parameters
   - Solve contradictions

4. Implementation
   - Product design
   - Testing
   - Production
   - Marketing/ Sales
   - Evaluation

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**Fig. 10. Innovation project – hospital bed**

**Fig. 11. Market and customer analyses**
Different market and market segments were analysed, five important customer groups and their requirements were identified (interviews, analyses and observations in the hospitals) – Fig. 11.

From the customer requirements the design contradictions were defined and the evolution trends and new solution alternatives were generated (Fig. 12, Fig. 13., Fig. 14).

**Fig. 12. Design Contradiction Matrix**

**Fig. 13. Evolution trend analysis**
Project results

Product sale increase: +20%
Number of parts: -15%
Production costs: -30%
Production time reduction: -40%
New functions +10%

3. Knowledge Management and Corporate Potentials

Innovation adds value through knowledge. The knowledge management is a set of processes, policies, and tools that link knowledge of employees to new sources of value (products, services, processes) in order to create innovative solutions.

Some stakeholders and managers are focused only on the results, not on the analysis and systematic measurement and improvement of the corporate potentials. The biggest competitive advantage is not saved in the manufacturing or information technologies, but in the ability to manage the company potentials in four areas:

1. Mental – corporate strategy
2. Physical – processes and resources
3. Emotional – people development and knowledge management
4. Spiritual – corporate culture
Each company has two basic functions:

1. Production and development products and services – this is the prerequisite for earning money, making profit and growing company.

2. Self reproduction - creating knowledge and development of people – this is the prerequisite for long term mastering of the function 1.

The difference between an excellent and a good company is not in the machines, the software or the organisational structure. The difference is in the co-ware – co-operation, creation and dissemination of knowledge through the company (Fig.16.).

The companies should be able to solve the following important questions regarding the knowledge management:

1. How to reach and keep the best talents and individuals?
2. How to share, communicate and develop the best corporate practices in the organisation?
3. How to transfer knowledge between employees on the projects and actions in the company?
4. How to increase and measure knowledge?
5. How to change knowledge into innovation as fast as possible?
Conclusion

There are some new paradigms on the beginning of the 21st century. Companies which will be able to use these opportunities will have a higher chance to survive.

<table>
<thead>
<tr>
<th></th>
<th>Yesterday</th>
<th>Tomorrow</th>
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<tbody>
<tr>
<td><strong>Corporate strategy</strong></td>
<td>Productivity</td>
<td>Innovation</td>
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<td><strong>Corporate processes</strong></td>
<td>Standardisation</td>
<td>Improvement</td>
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<td>Best practices, benchmarking,</td>
<td>New Practices – Blue Ocean, create new customer value</td>
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<td></td>
<td>increase customer value</td>
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<td><strong>Employees</strong></td>
<td>Focus on the “employee’s</td>
<td>Focus on the employee’s heart</td>
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<td>muscles” (peformance – physical</td>
<td>(self motivation, emotional</td>
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<td>intelligence) and brains (kaizen</td>
<td>intelligence) and soul (moral</td>
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<td></td>
<td>– mental intelligence)</td>
<td>and ethics – soul intelligence)</td>
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<tr>
<td><strong>Competitive factors</strong></td>
<td>Hardware, software</td>
<td>Brainware, co-ware</td>
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<td><strong>Corporate culture</strong></td>
<td>No mistake and error culture</td>
<td>Culture of trials and experiments</td>
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<tr>
<td>**Intercorporate</td>
<td>Competition, fight</td>
<td>Co-operation, partnership</td>
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<tr>
<td>relationships**</td>
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<td></td>
<td>process and project management</td>
<td>company as a living organism</td>
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References

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