CHANGES IN THE APPROACH TO THE AUTOMOTIVE PRODUCTION AND PRODUCT DESIGN & DEVELOPMENT

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ABSTRACT
The automotive sector has been under the uncommon depression since 2008 due to the global economic crisis. The companies must reevaluate their strategies and adapt to oncoming changes. Experts correspond in opinion that the way out of crisis leads through innovation. The best way to eliminate the losses that don’t add value within the process of product design and development is to apply the “lean thinking” philosophy.

KEYWORDS
Automotive industry, product design, lean approach, new product development

INTRODUCTION
The automotive sector has been under the uncommon depression since 2008 due to the global economic crisis, which hit the automotive industry as a first between the industry branches. The main influence of crisis became evident through the reduction of demand and complication of the availability of financing. Additional negative side effects are:

• decrease in demand on new cars purchasing
• interruptions or reduction of automobile production
• intensive pressure on price reduction of materials, components and products
• reduction of new orders, especially for the automotive component suppliers
• canceling or dramatic reduction of investments into research and new projects

Synchronized breakdown on key automobile markets caused that the situation in the beginning of the year 2009 became serious. Since 60 to 80 percent of new cars in Europe are sold through credit, the financial crisis hit the automotive industry extremely serious with 20 percent reduction of production, what represents in the EU more than 60 billions € loss on revenues in the branch. Similar trend is also in the year 2009 and thereafter is expected a slow recovery. The main causes of the critical development are:

1. Rapid decrease in demand on passenger and utility vehicles, in EU and worldwide; adverse conditions for loan obtaining, decreasing stocks and assets prices, uncertainty resulting from worldwide economy environs and recession reflected in very low consumer credence and decreasing spending power – new cars sales radically declined.

2. In particular segments of automotive industry, there were indicated problems with access to financing from loans with insufficient liquidity – the cash don’t flow towards the manufacturers. The situation is particularly serious in the case of small suppliers with lower amount of capital and lower production diversification ratio.

Various expertise examinations ([1], [2], [3]) correspond in opinion that the way out of crisis leads through innovation.

This is the right time not only to think about the innovation, but also to innovate. It is important to keep the costs low and assure the positive cash-flow. However, to focus only on these problems is not enough. Recession means opportunities, as well as threats. The organizations that will succeed are only those which are sufficiently agile and find new and better ways to satisfy the customers. The cost control is imperative, the innovation is obligatory.

AUTOMOTIVE INDUSTRY IN THE CRISIS ETRA
Government support arrangements intended to overcome the crisis, such as the scrappage program, loans for company restructuring, stimuli for “green” automobiles, etc. particularly stabilize the business environment of automotive production. However, the problem of crisis must resolve the automotive industry on its own. Except of influence of the financial crisis other important factors there are acting that combine into synergy (figure 1), mainly:

• Changes of the customer’s preferences. Nowadays, the most preferred is low consumption and running costs, acceptable price and quality
• Radical change of markets. The pivotal increasing moves to new markets referred to as BRIC (Brasilia, Russia, India, China)
• Presence of manufacturing overcapacities estimated to 20 – 30%. The industry in
highly developed countries partially has partially overestimated the potential of market growth.

• Environmental factors that cumulate legal regulations etc.
• Innovations of products and production systems. This factor is permanent throughout whole production history. Presently, the innovation cycles are dramatically abridged.

Even if the influence of the financial crisis will weaken, the other factors will remain on a long-term basis and the industry will change.

The reduction of production volumes and consequent cost reducing of automotive companies led to the employment decrease. According to the branch statistics, the worsening conditions on the market may threaten 15 to 20 % of manpower, whereby as much as every third supplier is vulnerable due to the crisis. The main recommendations can be assumed as:

• Reducing of the variable costs in order to keep positive EBIT
• Assuring of financial fitness until the optimization of financial flows
• Further improvements and enhancement of technological level
• Elimination of outdated modes of production and equipment
• Progressive development of “clean” cars and fuels
• Platform-based and module-based architecture of automobile construction

Other characteristics of innovation strategies in the crisis period:

• Reevaluation of existing innovation projects and reduction of trivial projects
• Utilization of innovation methods in order to reducing the product costs
• Approval of new products preparation for forthcoming years
• Emphasis on new opportunities

• Focusing on creative partnership with other organizations
• Reorganizing of entrepreneurship based on lean concepts
• Risk management and problem solving of products and technologies
• Investments to culture and sustainable relations
• Changes in thinking of employees in order to get familiar with innovation approaches

INNOVATION, LEAN PRODUCTION AND DEVELOPMENT


• Total product cost can be reduced through lower design cost, tooling cost, and plant investment methods.
• Strong, cross-functional chief engineer with obeys; steady cadence; concurrent concepts through prototype; rapid, cheap prototyping with knowledge capture & reuse; and simultaneity to compress lead time.
• No OEM can have competitive factories without competitive designs and process configurations.
• Lean design and supply in combination. To the extent that vehicle technologies change dramatically and new technologies (batteries, drive motors, etc.) come from outside the traditional supply base, the industry may need to de-integrate much further while finding better ways to tightly synchronize its development and production activities with new types of suppliers. To the extent that markets require more variety in lower volume per product, a rethink of product architecture may be required to permit more variety while varying mix quickly and minimizing cost.
• Quality may be “free” but no OEM can provide flexible variety without incurring incremental costs
• Reality is that no known manufacturing system can deal with the dramatic swings in total volume and mix experienced in the past year
In the next ten years, the automotive industry will precede more changes than occurred in past 50 years. The companies are forced to:

- Innovate the production, technologies and production organization
- Apply the next generation Kaizen, Lean Production, and Lean Design
- Rapid and flexible react on changes
- Refine the cooperation within the supplier networks
- Intensive utilization of support resources

The present-day challenge for the innovation break-point is shown on figure 2. It is important to identify the opportunities for refinement of innovation initiatives in the period of economic crisis:

- Elaboration of the scenarios and plans. Forecasts evaluate probable changes and effects of the financial crisis
- Enforcing the status of products and services that utilize innovations
- Reevaluation of the production portfolio. Get rid of hazardous or too wide programs and move the finances to shorter-time horizon initiatives support
- Search the opportunities for rapid testing of new innovation ideas. Proceed in research and development, but with lower cost and lower risk.
- Search for the creative ways, how to extend existing products. Implementation of services with added value for products and provide the customers new experiences.

**PRODUCT DEVELOPMENT RAPID AND LEAN**

Within the automotive companies continuously grows the share of research and development cost. For illustration, between the years 1990 – 2000 the outcomes of worldwide car companies in research and development increased more than 200 percent, what represents 5 – 7 % of revenues. Except normal factors, acting in long-time periods, as inflation, and wage and inputs growth, the pressure on increase of research and development costs is caused by additional factors:

- Advanced complexity of consequent innovations (sophistication of products) and acceleration of innovation cycles
- Growing complexity of innovations (more variants)
- Additional social and legal factors (e.g. environmental, recycling, reliability requirements)
- Development of research itself
- Global character of research and development activities, risks of competitiveness

The best way to eliminate the losses that don’t add value within the process of product
design and development is to apply the “lean thinking” philosophy. Since “lean” business cannot produce “bold” products, the Lean Design and Lean Product Development methods get into concern. Chances to dramatic reductions of costs during the product design are:

- Reduction of direct material costs: platform components and material, simplifying of design, reduction of useless waste, samples, prototypes, etc.
- Reduction of direct costs on experiments and testing: simplifying of design – design for lean manufacturing and assembly, reduction of part count, adaptation of product tolerances to operational possibilities, process standardizing, etc.
- Reduction of operational costs: minimum impact on reconfiguration of manufacturing processes and systems, modular design, standards for modifications according to customer’s demands, better utilization of manufacturing capacities and human resources
- Minimizing development costs: platform of design strategies, lean QFD, Six Sigma, design of experiments, value engineering, and others.

Acceleration of product development process affects three basic lean principles:

1. Preference of projects that have high value for company in terms of long-time direction of business
2. Concentration of development activities: perform the work tasks in the shortest time possible, and minimum moving of project documentation between individuals and departments. That can be achieved with simultaneous solving and strong IT support.
3. Application of knowledge basis from the existing products and technical experiences portfolio in order to support design of new product. It means to make use of appropriate expertise, learn more than until now and update the knowledge base with development-relevant data from suppliers, competitors, customers, and partners.

Example of Lean Design use in the automotive production is the New JIT System Toyota [5], extending the original Toyota Production System (TPS) with Toyota Marketing System (TMS) and Toyota Development System (TDS).

The development process is defined here as process of knowledge creation and management in order to create the continuous flow of high profitable products. The ambitions of new system:

- Four times higher productivity of engineers in development compared to European and American companies
- Despite of 50% faster development than competitors, the highest quality in branch
- Only 25% of competitors’ workers amount in development process
- There are not applied complicated process procedures for development management and all the deadlines of the project are right on schedule
- Self-learning company – all the knowledge gained during the development process is stored for possible use in future projects
- Simultaneous development with number of parallel projects and prototypes
- Teams built on knowledge and experience of the leaders.

CONCLUSION

“Lean” approach means to realize, that any effort makes sense only if it adds value. The lean philosophy must become standard business policy and culture throughout each and every department, division, and employee. It necessarily needs leadership towards responsibility and motivation policy, which will clarify the benefits and meaning of measurements, and help to make the discipline in lean thinking sustainable.

REFERENCES


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