DESIGN 2006

NPD IN CROATIA: A CASE STUDY

H.H.C.M. Christiaans, J.C. Diehl, H. Kuipers, M.C. Karstkarel and O. Stanic

Keywords: new product development, Croatia, small and medium-sized enterprises

1. Introduction

In 2002, the Dutch and Croatian Ministries of Economic Affairs agreed to launch a capacity building project in Croatia to improve the competitiveness of Small and Medium-sized Enterprises (SMEs) and to prepare them for the competition of the European Market. Under the umbrella of this initiative, three in-company demonstration projects with regard to New Product Development (NPD) and innovation took place in Croatian SMEs. This paper describes one of these projects, conducted with the company Adriacink.

This company, located in Split Croatia, produces for the metallurgy industry and offers services. Its current production mostly consists of manufacturing and galvanizing semi-finished products for the business-to-business market, for the local market in Croatia as well as the foreign market in France and Germany. At the start of the project Adriacink had arrived at a turning point in their business strategy. Due to increasing competition, rising steel prices and the prospect of Croatia joining the European Union, the company had decided to shift their focus from manufacturing and galvanizing semi-finished products for clients to designing, manufacturing, and galvanizing their own end products.

In order to obtain knowledge, skills and capacity on product development Adriacink joined a benchmarking project set up by Senter, an agency of the Ministry of Economical Affairs in the Netherlands. The second phase of this project was partly focused on innovative product development, which was run by staff members of the faculty of Industrial Design Engineering (IDE) of the Delft University of Technology (DUT). The aim of Adriacink in this project was to learn from this design methodology approach ('IDE-approach') and to create awareness among the company changing the attitude of their employees [Roozenburg et al. 1995].

2. Approach

The IDE-approach was a combination of theory, through workshops, and practice: a full product development trajectory was conducted by a Master student of Delft University using the Delft design methodology, thus showcasing the potential and effectiveness of the IDE-approach and, being a graduation project, the student's skills and abilities [Karstkarel 2005, Bujis et al. 2000, Christiaans et al. 2003]. The assignment was to develop a complete product that is produced with roughly the same technology that Adriacink uses at the moment, for a market, which offers long term potential (sustainable growth, little competition etc).

The project took eight months during which the graduation student worked full-time at the company's engineering department. This situation offered him opportunities to be seen as an employee establishing a close social relationship with other employees and direct access to relevant information. Contact with the Delft supervisors was maintained via email, phone and several reports. In addition, the mentors visited the company several times at important stages in the design process, for instance

after the analysis and conceptualization. The methodology used led the project through the following phases:

1. *Analysis*. The innovation process started with a systematic analysis of the company's internal and external status quo. Data from benchmarking, SWOT analysis and portfolio analysis provided insight in the actions to be taken by the companies.
2. Product *conceptualization*. Depending on the direction in which the innovation should be looked for, the company developed innovative ideas during this phase. Several creativity techniques were used to facilitate this process. The efforts resulted in clear product and process concepts. At the end of this phase decisions were made on which of the concepts would be further elaborated and detailed.
3. *Elaboration* and *detailing*. During the third phase the company worked out the concept in such a way that at the end of this phase it would be available for feasibility testing.

During the project the activities changed from gathering and selecting information, defining design criteria, towards a stronger focus on designing a specific new product. Each phase started with a workshop run by the DUT supervisors to evaluate the outcomes of the foregoing phase and to introduce the next one.

3. Analysis

3.1 Internal analysis

In order to get a complete overview of the company and to establish the best course of action for realizing a successful project the first stage of the project was an analysis of a great number of aspects of the company itself, such as production capabilities, logistics, sales, product portfolio, financial situation, etcetera. The analysis resulted in a list of strengths and weaknesses of the company. The galvanization capabilities turned out to be the main strength, while the main weakness of the company the lack of identity was due to the product diversity. Also a selection was made of products that Adriacink currently produces, which have the best potential of becoming part of an extensive product portfolio in a specific market. By concentrating on this selection in the external analysis, the direction of the design process was steered towards a product that strengthens the company's identity and utilizes precious customer contacts.

In addition this analysis verified the company's need for a new innovative product, thus legitimating the project. According to its strategy, Adriacink wanted to produce products with added value and identity (e.g. innovative end products) for the domestic market. The simplest and safest way to achieve this goal is to expand and improve the current product portfolio to markets where these "product values" are most important and implement "proven technology", e.g. incremental product innovation. As a result a list of constraints for the new product was defined:

The new product must be…

- a consumer product;
- produced with the technology currently available to the company;
- a series-producible product, not customized;
- made of galvanized steel;
- part of a market in which there are also many customized constructions needed;
- an expansion of the current product portfolio.

Using these constraints, a selection of products that Adriacink currently manufactured were selected to form a basis for the external analysis.

3.2 External analysis

In the external analysis firstly the economic situation in Croatia in general was analyzed to provide a wider perspective. In addition, the metal product manufacturing market as the "overall" market in which Adriacink operates was analyzed to give a complete view on the market situation and Adriacink's competitors. Furthermore, those sectors in which the selected product categories of

Adriacink are located, were studied. In order to do that, reports by various institutes and ministries have been investigated and many experts were consulted to create this macro market view. The sectors of tourism, public space, infrastructure and agriculture, animal growing and fishery were analysed. Of each of these sectors trends, competitors, clients, technology, products and market growth both in Croatia and abroad in past, present and future were mapped and assessed using the following questions:

- Does it fit the technology?
- Does it fit the current product portfolio?
- Does it have a future?
- Who are the competitors?
- Who are the customers?

The external analysis verified and justified the product development direction Adriank had already taken. It provided extensive background information for the company and explored the (long-term) potential of various other product development directions. It resulted in a number of specified directions within these sectors, a number of opportunities for Adriacink to consider:

- Public furniture
- Road infrastructure
- Train and bus transport
- Mobile communication
- Waste management
- Viniculture
- Nautical tourism
- City tourism

There are a number of important threats that are likely to harm Adriacink and that must be tackled by new products and innovation strategies. Already apparent from the internal analysis was the fluctuating raw steel price. Second, the external analysis showed a number of big competitors to reckon with. Croatia joining the EU will result ino supplementary competition, which makes it even more important for new products to benefit from the strengths of and opportunities for Adriacink. Lastly, the poor financial climate of Croatian business causes delays in payment from everyone, government, clients and customers.

3.3 Searchfield analysis

Next, the opportunities and threats were combined with the strengths and weaknesses of the company in a so-called SWOT (Strengths, Weaknesses, Opportunities, Threats) matrix, in order to generate even more specific fields of research, the so-called searchfields [Bujis et al. 2000]. Because of the previously listed constraints for the new product, especially the fact that the product was to be manufactured out of galvanized steel, the direction of the product development process focussed towards two areas: public furniture and equipment for marinas. This first searchfield group utilized the potential of several of the above listed opportunities, while the second mostly relied on the most promising and growing sector in Croatia, nautical tourism.
In order to make a fair judgement in the searchfield selection process, the searchfield public furniture was split up into several smaller, more specific searchfields, such as seating related public furniture, waste collection products, etc, on the same level as the equipment for marinas searchfield. As the to be analysed product categories became more specific, a new, more detailed list of design criteria was used to assess each searchfield, again concentrating on products, clients, competition, technology, identity, etc. The assessment was done using Harris-profiles, giving a visual representation of the advantages and disadvantages of each searchfield (see figure 1).
It could be concluded from the searchfield research that equipment for marinas best fit the company and this project. The main drawbacks of the other searchfields were the number of competitors, the necessary technology investments and the sales to clients. The most positive aspect of the public furniture searchfields, that they overlap and thus have great potential to create an extensive product portfolio, just did not weigh up to these disadvantages.

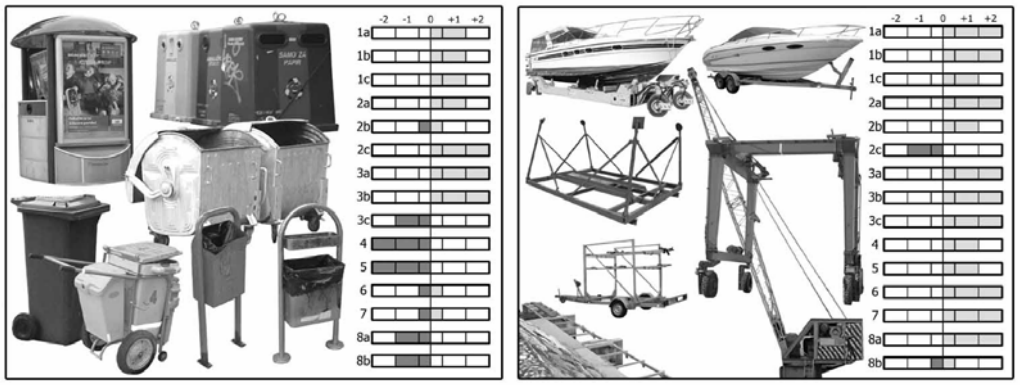

Figure 1. Product examples and Harris profiles of two searchfields

To sum up, the equipment for marinas searchfield was chosen because it is a fast growing market which will not diminish in the coming years (long term strategy), Adriacink is perfectly located in the middle of the Adriatic coast (short supply lines and close contact to customers), there is little to no domestic competition, it will take minimal technology investments, the sales are directly to companies operating on the marina premises, new products will be an expansion of the current product portfolio (strengthening the identity), the equipment in marinas have a strong identity (strengthening the company identity) and there is room to develop innovative products (interesting products to design). Also, manufacturing these products gives Adriacink the opportunity to offer services such as maintenance and storage and will open the door for contract for customized constructions in marinas.
Adriacink is able produce customized products, such as constructions, piers, pontoons, restaurant overhangs, fences, lighting posts etc. Furthermore, Adriacink can provide equipment for marinas already in existence, so these marinas can get up to date with the increasing demands of tourists and new regulations of the government and the European Union. These products can be equipment to assist in the current situation of the marina (extra products that are adjusted to the equipment already in use in marinas) and equipment to cope with new regulations regarding the environment and security. Finally, Adriacink can manufacture equipment for new marinas, taking into account the demands and regulations for the most sophisticated of marinas that are fitted for more tourists and larger vessels.
After identifying equipment for marinas as the most promising searchfield, once more information was gathered. Visits to marinas were made, experts in the field were consulted and data on marina capacity, available equipment and new legislation was collected. In this way, the problems in marinas in Croatia and surrounding countries were localized and product ideas to solve these problems were generated. The problem area with the most potential for Adriacink to solve with an innovative product was selected by looking at technology investment, identity contribution to the company and competition. Product ideas:

- Electricity-water-waste water hub
- Portable septic tank
- Travel lift
- High capacity boat crane
- Movable cradle
- Hydraulic trailer
- Boat cradle

Of all the product ideas, (movable) cradles for boat storage were the most promising. Other equipment such as hydraulic trailers or travel lifts would require a bigger technology investment and there are already competitors operational on this market. Cradles are low-tech products which can be manufactured with Adriacinks current in-house technology. They can be series-produced as large orders are likely to be placed. This would contribute more to the identity of Adriacink in the field of marina equipment than a small number of boat cranes. The cradles would be ‘an advertisement’ saying: “Adriacink produces marina equipment”, thus boosting sales of cranes and customized

constructions in this field. Furthermore, there is no competition worth mentioning at this moment, although as boat cradles are easily produced by any steel construction company, the potential competition is threatening. At last, the demand for this product is likely to grow as more berths are planned according to nautical tourism policy. When a marina increases its capacity, it may need one extra travel lift, but it will need a great number of extra boat cradles.
With the to be designed product established, the now very specific product group of boat cradles was investigated. Existing models (used in Croatian marinas and abroad) were analysed and benchmarked [Cooper et al. 1995], the use of the product was extensively documented in photo and video, users were interviewed to pinpoint the exact problems related to the use of boat cradles, and the different types of boats that are stored on boat cradles were analyzed. This resulted in a list of critical design factors:

- Price
- Adaptability
- Stability
- Accessibility of the hull
- Time
- Durability
- Weight distribution
- Strength
- Surface space
- Storage volume
- Small loose parts
- Compatibility with travel lift / hydraulic trailer

With these critical design factors a full list of demands and wishes was made to cover the major aspects of new boat cradle design, such as dimensions, strength, production, use and price.

4. Conceptualization

4.1 Ideas

Based on the information gathered in the previous research, ideas on various solutions for different partition functions of a boat cradle were sketched and 3D modelled using computer software. These partition problems were the frame, length and width adjustment, height adjustment, hull supports, keel supports, trailer supports and stability. Figure 2 is a morphological map, a collection of all the ideas generated in the idea phase. The most feasible solutions for the partition problems were selected using the list of demands and wishes, to compose two concepts. The selected ideas have been highlighted in dark grey for concept 1 and light grey for concept 2 to show which solutions have been chosen for which functions.

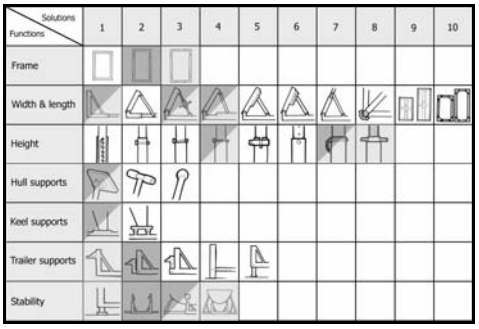

Figure 2. Morphological map of partition problems and solutions

One of the most important problems to be solved in the design of the new cradle was adaptability to different boat sizes. The basic solutions designed in the idea phase were the following three:

1. A series of fixed cradles of different dimensions;
2. A cradle of adjustable length, width and height;
3. A modular cradle.

The first solution is used the most in marinas today and research proved it to be not an ideal solution. Therefore solutions two and three, the adjustable cradle and the modular cradle, formed the basis for the two concepts designed. The most important aspect of the concepts is the way the various parts of the construction are arranged. This has been done in such a way, that as many options for adjustability and modularity as possible are left open. This becomes apparent when one looks at the different options (extra arms, front support, trailer supports etc) that are possible on the same basic construction. This was the main train of thought when developing both concepts and it is their most important advantage.

4.2 Concepts

Both concepts are a package of well thought through solutions to current problems with boat cradles. The concepts are suitable for a wide range of motor and sailing boats, due to either a fully adjustable frame or a modular frame.

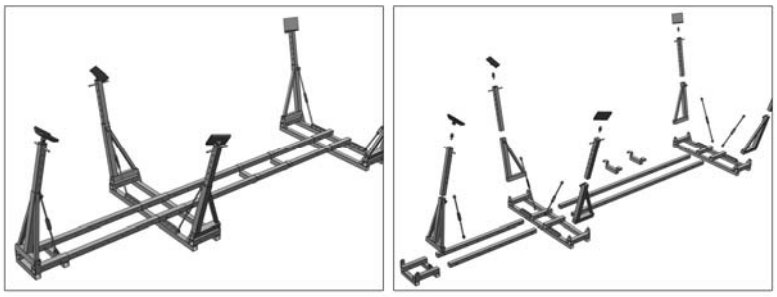

Figure 3. Concept 1, assembled and exploded view

The basic build-up of concept 1 consists of two frames with each two arms, two connecting longitudinal profiles that make up the keel support, and an optional separate front support frame with arm. The longitudinal profiles adjustable in length from 4 to 2.5 meters. The width of the base is 2 meters. Box profiles of different dimensions are used.

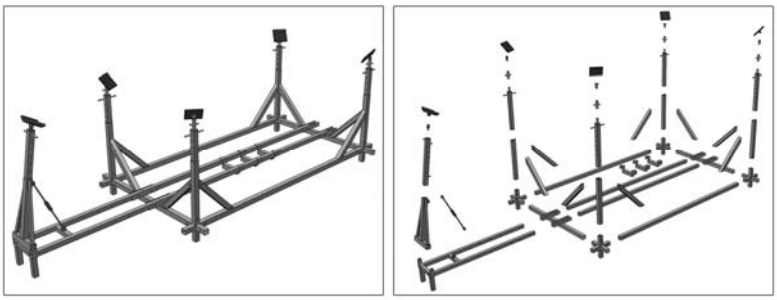

Figure 4. Concept 2, assembled and exploded view

The frame of concept 2 consists of four identical corner pieces with connecting profiles, vertical profiles, diagonal profiles and an optional separate front support frame with arm. The customer can select the length of the width and length profiles when ordering the cradle, or order extra profiles of different lengths so a cradle of any desired dimensions can be assembled. The standard dimensions for this cradle when one wants to transport it with a hydraulic trailer is 2 meters wide and 4 meters long, with a front support of 2 meters long.
Both concepts offer a number of extras, such as beams to increase stability, extra arms for the support of long boats and a front support. Furthermore, the concepts are very compact when stored and transported. The frame build-up allows Adriacink to produce a standard cradle, to which various custom made options can be fitted. This enables the company to please every client without the need

for a complete redesign for every job, thus releasing pressure on the engineering and production departments. For instance, a fairly small customized support can be fitted on several places in the concepts' design, enabling the boat cradle to be transported by a great number of means of boat transport, such as hydraulic trailers.

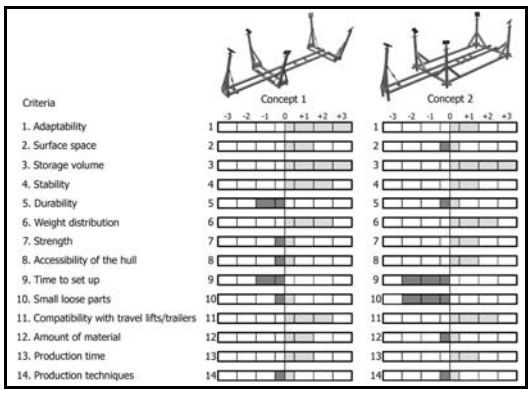

Figure 5. Concept selection using criteria and Harris profiles

Again using design criteria, the best concept was selected. The score for each design criterion was made visual in Harris-profiles. Because of the importance of ease of use, the deciding factor in selecting the best concept was the adaptability; concept 1 proved better fit for various boat designs and sizes and easier adjustable. Due to the modular nature of the adaptability of concept 2, it has to be taken apart to be able adjust it, which is a cumbersome job. One also has to have parts of the desired length available at that moment. Concept barely needs other parts and can be quickly adjusted to the correct length, width and height without the need for disassembly.

5. Elaboration and detailing

Of concept 1 two 1:1 test models have been manufactured to exhibit on the Croatia Boatshow in Split (April 5-10 2005). Building a test model provided great insight in the practical working of the design. By exhibiting the test models on the Croatia Boatshow, reactions and interest of boat owners, charter companies and marinas were probed.

Figure 6. Prototypes assembled and in storage mode

One test model was fully assembled and one was packed for transport and storage to show one of the biggest advantages of the design; its compactness.
The building of prototypes proved especially helpful for the engineers and production employees, for whom it was a first to create this product. A great many things were learned about tolerances, material use, production techniques and practical working of the design, for instance when assembling. Some final minor dimensions were adjusted, no major changes to the overall design were needed. The final result of the project was the boat cradle design in figure 7.

Figure 7. Renderings of the final design

6. Conclusion

The success of an international collaboration to achieve a common goal, in this case an innovative product, depends largely on good communication. Due to previous experience in similar projects, the Faculty of Industrial Design Engineering stressed the need for on site presence of a student [Bujis et al. 2000]. This vastly improved social interaction possible and kept the lines of communication as short as possible. In addition, by organizing workshops on key points in the design process, when important decisions had to be made, moments of reflection were possible and knowledge, experience and insight of the mentors was utilized.

The result of the project was a new innovative product, but more importantly, a transferal of knowledge between the methodology taught at the Faculty of Design Engineering of DUT and the methods employed by Adriacink [Boschloo 2005]. Due to the intimate way the student and the employees of Adriacink have worked together on this project, its worth and meaning has far exceeded that of any knowledge taught in seminars, workshops or books alone. It has given all departments of the company the insight and motivation to steer towards a more integral process of innovative product development.

References

Roozenburg, N.F.M. and J. Eekels, Product Design, Fundamentals and Methods. 1995, Chicester: Wiley & Sons.

Karstkarel, M., IDE in Croatia: Product Development for Adriacink. Design of an Innovative Boat Cradle for the Croation Market, M.Sc. Thesis in Industrial Design Engineering. 2005, Delft University of Technology: Delft.

Buijs, J. and R. Valkenburg, Integrale Productontwikkeling. 2000, Utrecht: Lemma.

Christiaans, H.H.C.M. and J.C. Diehl, Knowledge transfer from univeristy to industry, in International Conference on Industrial Design Engineering. 2003, UDSM: Dar es Salaam.

Cooper, R.G. and E.J. Kleinschmidt, Benchmarking the Firm's Critical Succes Factors in New Product Development. Journal of Product Innovation Management, 1995(12): p. 374-391.

Boschloo, R., Out of context. International implementation of innovative product development - three case studies in Croation context, M.Sc. Thesis in Industrial Design Engineering. 2005, Delft University of Technology: Delft.

M.Sc. J.C. Diehl
Delft University of Technology
Landbergstraat 15, 2628 CE Delft, Netherlands
Tel.: 0031 614015469
Fax.: 0031 614015469
Email: j.c.diehl@io.tudelft.nl