

Programme  
**Integrating and Strengthening the European Research**  
Strategic Objective  
**Networked business and government**

Programme Title

**The Virtual Research Lab for a Knowledge Community in Production**  
Network of Excellence

Acronym

**VRL-KCiP**



Project No  
**NMP2-CT-2004-507487**

**Report**

**Publishable final activity report**

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# Project execution

## 1 Project summary

First of all, let us remind the project summary we defined in the initial annexe I of the VRL-KCiP contract:

*"The globalisation of production systems will result in Europe losing its know-how in the technologies of production. However, high quality products at low costs, accommodating sustainable development and the need for shorter lead times can only be obtained by integrating the production phase in the design stage. It has also been requested to integrate new technologies of production to design innovative extended products. This can be obtained by putting in place a virtual production system.*

*Through the VRL-KCiP network of excellence, Europe will be able to federate many research teams in the field of design, production and innovation and thus preserve the common inheritance of manufacturing processes while carrying out a collaborative system of design integrating a module of virtual production.*

*20 research units, gathering 200 researchers, decided to work together in order to provide a strong integration of their teams and thus break the fragmentation of European research in this area and work more efficiently. A new organisation of the research system can only lead to a clearer vision of the research orientations, an improvement of the quality of research by exploiting complementarities, avoiding duplication, and finally a better impact on our industry for the good health of our society."*

## 2 Project objectives

In the same annexe I, is developed the project objectives of the VRL-KCiP NoE. We just here give a short resume of the main objectives we have defined:

*"In order to keep the key production competences in Europe, it is imperative that the specialists are associated in a network allowing them to **share the competences and the knowledge** that they still hold, and giving them the means of integrating these competences in new design systems.*

*The decentralisation of the manufacturing phase must be accompanied by a **change in organisation**, making it possible to remain in control of such things as cost, delivery, quality, service, customer support and recycling, either by integrating the modelling and the simulation of the manufacturing processes during design, or by integrating the collaborating companies in the context of the extended enterprise. This double integration brings obvious new **communication and information technology challenges** on one hand and on the other, the **sharing of cultures, competences, responsibilities and risks** of a new order. Only focused, collaborative research is today able to bring to the European enterprises the new tools and organisations necessary for the successful resolution of these problems.*

*How can Europe preserve and still enhance its key competences?*

- *Establish a European **virtual laboratory of excellence** in design integration for sustainable production with a durable structure.*
- *Create an Integrated **European task force** in production technology research.*
- *Co-ordinate and **orientate European production research** according to the society's needs.*
- *Create lasting **synergies** between researchers from different disciplines in order to overcome the technical challenges of production engineering.*
- *Promote a **common language** among scientific groups in different countries by developing common procedures and tests.*
- *Create a European dimension of **research careers** in design integration for production engineering.*
- *Establish permanent **interactions** between researchers, industries and end-users and accelerate new discoveries and industrial applications for the extended enterprise.*
- *Initiate a **new training and education programme** in order to support the development of the future generation of European researchers in production engineering.*

- Provide a **permanent vehicle** for the interplay **between scientists, engineers and students** and the expansion of the overall scientific understanding.
- Foster **international exchange** of information on the development and application of production engineering methods and tools for the benefit of all.

*The virtual laboratory of excellence will be a legal structure allowing the partners to construct a European laboratory with decentralised teams, sharing research strategies, knowledge and resources, responsibilities, rights and duties, and able to contract with industry. This ideal organisation of European research in production will permit a better research output than today, leading to a clearer vision of the research orientations and to a better overall quality of research."*

### 3 List of participants

Particip. Role*	Partic. Number	Participant name	Participant short name	Country
CO	1	Caisse des dépôts et Consignations	CDC	F
CR	2	Institut National Polytechnique de Grenoble	INPG	F
CR	3	University of Twente	UT CIPV	NL
CR	4	Franhauser IPK	FhG/IPK	G
CR	5	ITIA CNR	ITIA	I
CR	6	University of Bath	Bath	UK
CR	7	Fundation TEKNIKER	TEKNIKER	E
CR	8	University of Patras	UPATRAS	GR
CR	9	Kungliga Tekniska Högskolan	KTH	S
CR	10	Hungarian Academy of Sciences	MTA SZTAKI	HU
CR	11	University of Ljubljana	UNI LJ	SL
CR	12	Universitaet Stuttgart	USTUTT	G
CR	13	Israel Institute of Technology	TECHNION	IL
CR	14	Ecole Centrale de Nantes	ECN	F
CR	15	Université Technologique de Troyes	UTT	F
CR	16	Universitat Politechnica of Timisoara	UPT	RO
CR	17	Ecole Polytechnique Fédérale de Lausanne	EPFL	CH
CR	18	University of Durham	UoD	UK
CR	19	Delft University of Technology	TU Delft	NL
CR	20	Eindhoven University of Technology	TUE	NL
CR	21	Politechnica Poznanska	PUT	PL
CR	25	Pôle Productique Rhône Alpes	PPRA	F
CR	26	University of Stellenbosch	US	SA
CR	27	Politecnico di Milano	Poli-Milano	I

\*CO = Coordinator  
CR = Contractor

## 4 Logos and website



Here are the logos of the initial VRL-KCiP network of excellence and of the final legal structure: the EMIRAcle association

The VRL-KCiP web site has also been changed to become the EMIRAcle web site, at address:

<http://www.emiracle.eu>



## 5 Work performed during the four year duration of the network

The first two years of the VRL-KCiP network were used to create the tools useful for internal communication: the website and its intranet, the Shepherd tool to manage the data for the Mail Exploder, the Smarteam Knowledge Management System to store all documents and the expertise and competencies of each member based on the ontology about production systems, a financial data base to create official reports and a complete video conferencing system allowing the use of shared applications and streaming files. No doubt that during the third year these tools have evolved significantly, thus providing more facilities to enter expertise and documents or to declare new collaborations, with the capacity to edit dynamic data on the web in relation to the KMS.

The main result of the third year has been the achievement of the statutes for an International Non Profit Association of Belgium Law that has been accepted by the great majority of the actual members. Other great results include the initiation of many common research activities, either in specific areas within the framework of tasks 201 to 205, or involving joint tutelage of PhD students, or forming consortia to apply to the different calls in the FP7. Many of these research projects involve industrial partners.

Of course the 4<sup>th</sup> year has first and foremost been the year of the creation of the EMIRAcle association. 20 members were present or represented for the signing ceremony at the notary office on September 5<sup>th</sup>, 2007, and the EMIRAcle association has been officially created on October 25<sup>th</sup>, 2007. Only three VRL-KCiP members did not reach the association at its creation:

EPFL that cannot legally be engaged in association,

TU Eindhoven and University of Bath for which the teams have been completely changed and whose involvement in the network's activities has been very low in Year 4. The new team in Bath, however, has considered its position again and has requested to be admitted as EMIRAcle full right member. This request has been treated during the first G.A. of the association. In the same GA two further new membership requests, those of ENSAM Metz in France and the University of Mondragon in Spain have been accepted. The fourth year was also marked by a fundamental change in the vision of the Business Plan. We have prepared in a first step a classical Business Plan with the creation of a Business Office in order to disseminate our expertise and results in different offers, mainly taking into account the products that the network is able to create and the services that it can offer. It seems now that it was a minimal vision of our strength, regarding the two opportunities arisen in the last months: the Falun and Rovaltain projects. In these two cases, EMIRAcle has been request in order to manage complex systems in the field of territorial arrangement or in the field of global engineering development. In these two cases also, the European dimension of EMIRAcle, and the capacity to treat holonic and multi-disciplinary systems have been the reason to be called for these projects. We are now convinced that EMIRAcle must go further in this direction: to propose its capacity to manage great project that cannot be treated without such synergies.

## 6 Project goals and major achievements during the four years of VRL-KCiP NoE

### 6.1 Goal 1: Creating a new organization of researchers in order to obtain synergy

Joint Research in the area of Virtual Product Development has been coordinated future research on Virtual Prototyping, on Digital Mock-Up, on Virtual Reality, on the Development of Innovative Products. In the area of virtual manufacturing has been studied research on Manufacturing Process Simulation, on Digital Manufacturing and Performance Evaluation, on Production Management and Scheduling, on Process Design. In the area of manufacturing processes and equipment, we have worked on Composite Processes, on Laser Cladding, on Assisted Machining, on Electro Discharge Machining, on Microproduction. In the field of cross enterprise engineering, the studies were on Collaborative Project Development, on Complexity and Requirements Management, on Managing Views on the Product Life Cycle. And in the field of engineering and product life-cycle knowledge management has been developed the integration of virtual prototyping processes with CAD systems as part of KBE integration in CAD systems and product life-cycle knowledge

management.

A lot of elements of this research allow establishing new collaborations among the members and some of them open on proposals for the calls of the FP7.

It is absolutely clear that a lot of these researches were not possible to be achieved 4 years ago and we can consider as a real success of the network to provide such a capacity of creating clusters of researchers with common goals.

## 6.2 Goal 2: Working as a flexible distributed organization

The business environment of the 21<sup>st</sup> century is intense and competitive. In such an environment, people's ability to work flexibly toward common goals is one of the deciding factors in the success of an enterprise. As a result of this, one of the major management challenges of the VRL-KCiP network was to develop dynamic capabilities for enhancing organizational flexibility. The foundation of organizational flexibility includes:

- management organizational structure,
- organizational culture,
- member motivation,
- participation in change,
- strong IT capabilities.

*Management organizational structure.* One of the most sensitive and decisive characteristics determining the flexibility of an organization has been identified as the management organizational structure, as it is often the determining factor of an organization in its success or failure to adapt to the ever changing business environment. The VRL KCiP network addressed the problem of management in a dynamic environment by developing a distributed, multilevel, matrix-type organization.

The network's distributed leadership has enabled increased member responsibility, participation and motivation throughout the organization. As a result of the matrix, the management structure remains stable even though its composition is dynamic. This matrix structure reduces management complexity and increases its flexibility, thus maintaining management resilience.

Now that the days of the funded VRL-KCiP project have ended and EMIRAcle the selfsupporting association is finally stabilizing its new identity, it has been decided to maintain this same successful management type model.

Within this model, a president (formerly scientific coordinator), a treasurer, a secretary and three vice president (VP) positions dedicated to research, education and the business office (formerly the directory board), as well as the Orientation Board concept have been preserved. The three VPs were assigned specific responsibilities to make it easier for them to focus on the future challenges in these three core domains of the association; however they continue to be involved in all areas. A new position of a treasurer has been installed for the EMIRAcle association in order to guarantee a sound financial operation of the association. The treasurer for instance announces and controls the dates and the amounts of the payments to each Full Right or Associated Member. Furthermore, the functionality of the Integrative Management Team (IMT) will be preserved however it will be adapted to suit the activities of EMIRAcle whilst continuing to ensure that the long and short term goals of the network are achieved.

*Organizational culture.* The VRL-KCiP (EMIRAcle) community ties have been strengthened through the common website that presents the network entities and their intertwined relations, as well as through the VRL newsletters, uniform templates for presentations and documents, common expertise map and multiple joint research projects. The VRL community spirit has been cultivated by participation in the annual general assemblies and in numerous VC sessions that have strengthened members' sense of camaraderie.

In addition an exemplary work environment has been developed, that enables members to cooperate,

collaborate, participate, develop and excel while adapting rapidly to changes in the environment. The work environment includes, work procedures, a sound IT and knowledge management platform and intensive collaboration tools. This environment is essential for members to maintain their separate lab workload, whilst performing their best in pursuit of the common network goals.

Based on the sound IT platform realized for the VRL-KCiP and the cultivated network culture, members are now able to identify potential partners for specific research topics, formulate expert research teams, collaborate, and disseminate results. These teams are temporary, and the roles of individual members in each such project vary. This form of collaboration enables maximum utilization of member competencies, but at the same time requires skilled team players and fair sharing of benefits.

As a result the network has an exceptional capacity to respond to international calls for proposals, especially those of the EU – which is naturally a very difficult task in a multinational, multicultural, multidisciplinary, multilingual population. However the network has evolved into a community of mutual cooperation, collaboration and synergy – a network of partners who collaborate on a regular basis. As a result partners for proposals can be found very quickly, with minimal acquisition and negotiation efforts.

Furthermore, due to the availability of a large and diverse expertise base within the network as well as the network expertise maps that explicate these available expertises, the range of relevant programs and calls that the network can answer well is very broad. This has been displayed in the response to calls to the different FP7 calls during 2007 and 2008.

*Member motivation:* People want to work for an organization that they believe in and that they can be proud of. Leadership must create a sense of purpose and belonging, and communicate a consistent message of respect, trust, caring and appreciation. In addition people need to feel valued, important and an integral part of the group.

The long term and short term goals of the VRL-KCiP were stated clearly from the outset, thus reducing ambiguity. Furthermore, clear quantitative KPIs were introduced in Year 2 to measure the effort and success of all teams in achieving the common goals. The KPIs have proved themselves very successful in motivating teams to fulfil obligations and targets set by the partners themselves. .

*Participation in change:* Emphasis was placed on involving as many labs and individual members as possible in designing changes that would affect them. This was the case in developing each year's new JPA, in formulating the association agreement, in formulating the business plan and in the current process of developing IPR and financial agreements. This active involvement of members assures that the natural resistance of people to changes, which are inherent to a flexible organisation, is minimised.

*IT foundation:* The VRL KCiP NoE has invested large efforts to establish flexibility based upon its solid knowledge framework, which supports rapid adaptability. This framework comprises the VRL KMS, the expertise and collaboration mapping capabilities, the Shepherd contact management tool, the evolving JPA and the basic network agreements signed by all partners. An additional enabler of this flexible strategy is the diverse communication network that has been established, which includes face-to-face meetings, videoconferencing facilities, Skype conversations, AREL sessions, Messenger chats, e-mailing and telephone calls. The knowledge infrastructure and supporting communication network have facilitated the creation and management of an adaptive workforce, capable of adjusting quickly to a changing environment.

All the activities outlined above demonstrate the progress of the network in achieving the goal of becoming a flexible organization.

### **6.3 Goal 3: Obtaining better knowledge about the diverse distributed expertise**

The central aim of the VRL-KCiP was to create research synergy by integrating the research expertise and capabilities of the different member teams to support product life cycle engineering in the modern

manufacturing environment. Hence, obtaining additional and more in-depth knowledge about the diverse distributed expertise in the network was viewed as one of the most essential activities contributing to network success.

During the four years of the network, much effort was invested first in specifying and developing and then in completing the network expertise map. Along the way, three obstacles were identified: (a) how to develop an ontology for the network (to be applied as map coordinates); (b) how to motivate network members to contribute their expertise – to create a win-win scenario in which researchers understand the added benefit of supplying their structured expertise profile to the network; and (c) how to continually update the ontology to incorporate the expertise of new members or new fields of expertise developing in our area.

To date, 78% of the permanent researchers and 74% of the graduate students who are currently network members have entered their expertise profile into the VRL KMS collective knowledge base. Furthermore, over 50% of these profiles now also include the expert's level of expertise in each expertise area.

The resulting knowledge map is available within the VRL KMS. Furthermore, by means of the available wizards developed within the system, the knowledge map can also easily be exported to a member's local computer for further analysis.

The member expertise profiles have also been exported to the VRL website, so that interested parties, whether external or internal, can easily locate experts in any of the relevant areas in our field. The expertise maps are also further supported by a complementary structured CV for network members. This consistent CV structure can provide interested parties improved insight into the experience, current fields of interest and research of the network experts. Among the current network members, 51% of the permanent researchers and 66% of the graduate students have entered their CV details into the VRL KMS collective knowledge base.

The export capability takes objects with the proper authorization and publishes them on the web **in context**, thus providing users with an easily navigated overview of the network, including its members, labs, expertise, collaborations, ongoing research and publications. This capability also facilitates providing external partners with the "highlights" of the VRL world via an easily navigated site incorporated into the official VRL website.

An additional capability—also based on all the material collected in the VRL KMS—has been implemented this year: a topic map capability. This capability makes seeking an expert online more intuitive, while still maintaining all context-related information about the expert. The map is accessible at the following URL: <http://igor.xen.emi.sztaki.hu/~vancza/VRL-TM> (Figure G3.1).

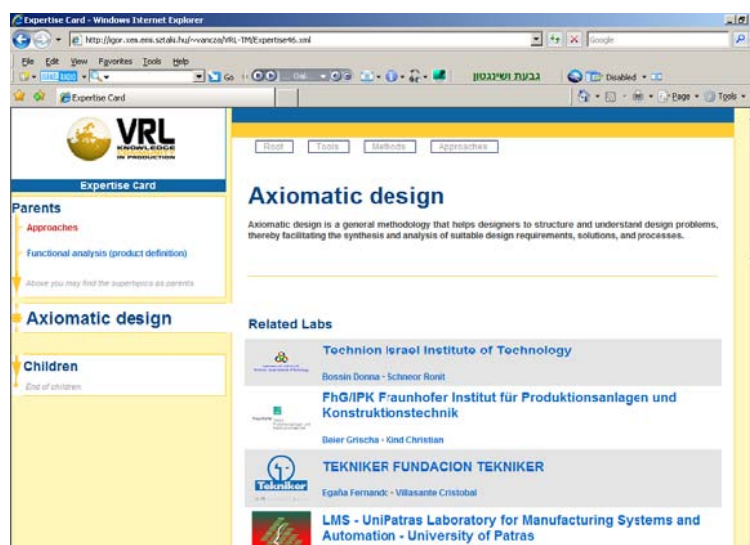


Figure G3.1: The VRL KCiP Topic Map

The process of continual updating of the ontology and of collecting member expertise required a tremendous investment of effort. Further, there was no objective way to evaluate the member expertise profiles submitted by the members themselves. These two issues provided the motivation for a joint project between INPG, Stellenbosch and Technion. The project proposes applying text mining abilities to evaluate member expertise profiles by analyzing the different publications of the members of the network. To this end, a link was created between the VRL KMS—which collects the different articles from the members—and the Organon software developed at the University of Stellenbosch. An initial test showed interesting results, which ignited a new collaborative project between Haifa, Stellenbosch, Grenoble, Twente, LMS, SZTAKI and two industrial partners.

The aim of the KnowNet tool is to provide advanced text mining capabilities to semiautomatically categorize and capture-in-context all digital content. Furthermore, each document will contribute to building a dynamic web-like infrastructure among the different knowledge objects in the organization (among them experts, machines, processes, procedures, materials, products and the like). The dynamic web indicates the type and strength of connections among these objects, replicating the dynamic communications, collaborations and knowledge flow between them. Thus, KnowNet is adaptive; it dynamically manages the semantic knowledge network to reflect its dynamic behavior and to provide up-to-date knowledge with the ability to change not only the content but also the topology of the network.

KnowNet supports the combined top-down bottom-up approach to ontology development developed in the network. KnowNet will ensure that the organizational semantic ontology does not become stagnant, even in rapidly changing and turbulent technological and economic markets. By using the more formal semantic approach in conjunction with adequate reference ontology, KnowNet will facilitate receiving digital data and information and converting these into meaningful ‘in-context’ knowledge, while also continuously improving the reference ontology.

Since the response to this ICT call was very large (200 proposals), and funding is limited, work is underway to find other funding sources for this project.

#### **6.4 Goal 4: promoting the high value of scientific research and knowledge in production**

One of the strategic goals of the network is to promote the high value of the research performed within the NoE.

Special attention and efforts were allocated to the extent of joint research activities contributing to this goal for the fourth year of VRL-KCiP. More specifically, the following actions were taken:

- 1) Work has been continued for structuring, mapping and updating knowledge, as well as for formalizing the accumulated knowledge. The work had started in the third year and kept running during Year 4 in the context of tasks JRA-WP1-T200, IRA-WP2-T19, JRA-WP3-T27, and JRA-WP3-T106, which have contributed to this goal by collecting and transforming the NoE’s knowledge into standard forms, while tools for interfacing the VRL-KCiP KMS and the accumulated knowledge have been considered and studied for future development. Such tools are making the access to knowledge easier and more effective. The published Knowledge Management Book (JRA-WP3-T104), demonstrating case studies on industrial problems, was another significant result towards the promotion of scientific research and knowledge in production, while Knowledge Management Conference that was held in Enschede for the presentation of the book, further promoted this result to the European scientific and the industrial community.
- 2) Work towards the effective management of knowledge was continued in the context of tasks JRA-WP1-T16, JRA-WP1-T18, and JRA-WP1-T200. The VRL-KCiP Knowledge Management System was continuously populated during Year 4, contributing towards the promotion of the VRL scientific and technical research to both academia and industry.
- 3) A set of five Work Packages (JRA-WP4, 5, 6, 7, 8) dedicated to the promotion of joint research were structured for this last year of the NoE. Specific activities dealing with the definition and management of

research synergies among the network members were carried out, each of them focusing on a specific research area and the topics related this area. These Work Packages were assigned to the promotion of collaborative research and to the creation and coordination of synergies of the VRL-KCiP members.

The creation and enforcement of these Work Packages enables the deeper involvement of the NoE members in the specifics of each research area, promotes the creation and launch of synergetic actions among them, improves the results and pushes towards the stronger involvement of industry into the focused research that is performed within the NoE. This collaborative scheme resulted in high quality collaborations among the VRL members, joint training and research activities, as well as in the initiation, preparation, development and submission of project proposals in the EC FP7.

Further to these joint research activities, a set of horizontal activities was incorporated in the JRA-WP9 which dealt with the coordination and management of the relevance and the perspective of the research performed within the VRL-KCiP. This Work Package focused on two main subjects:

- Updating and maintaining the Research Roadmap of the NoE, as well as defining the specific topics of common research interest and of high industrial relevance
- Coordinating, monitoring, assessing the results from the collaborative research performed within VRL-KCiP, and examining the possibilities for the standardization of these results.

The externalization of the NoE's outputs to a wide pool of interested individuals and organizations obtained an outstanding role during Year 4 of VRL-KCiP by the launching of wider communication means. The contributing Spreading Excellence activities are:

- Internal dissemination carried out through training courses and by the establishment of educational synergies that yield encouraging results (SE-WP1)
- Promotion of ongoing research by organizing and performing cycles of distributed conferences and through wider dissemination to academia and industry, taking place in the context of SE-WP2.
- Strengthening the linkage to well-known and well-respected scientific organizations, technological platforms and initiatives like CIRP and MANUFUTURE
- External dissemination activities striving to make the VRL-KCiP knowledge known to the industrial community through the work performed in SE-WP3.

Integrating activities also contributed to the promotion of the high value of scientific research and knowledge by supporting the enhancement of research activities in an organizational framework (IA-WP1-T5), by developing and applying strategies for the sharing and update of knowledge (IA-WP1-T10), and by providing and maintaining the appropriate technical means (IA-WP1-T9).

The results achieved during Year 4 of the VRL-KCiP Network indicate a satisfactory promotion of the scientific research and knowledge value, in view of the official launching and operation of the EMIRacle Association, which will overtake the continuation and upgrade of the knowledge created and accumulated in the context of VRL-KCiP, by following up on the scientific and research activities of VRL-KCiP on one hand, and on the other hand, by implementing a Business Plan that includes specific measures for the promotion of both the applicable research results and the research and scientific innovation.

## **6.5 Goal 5: Providing feedback to the E.C. to support new research**

After the end of our VRL-KCiP network, and with the suggestion of our NMP officers, EMIRacle tries at this time to bring together 3 others networks of excellence working in the manufacturing field: I\*PROM, 4M and INTEROP. The goal will be to federate 90% of the researchers working in manufacturing in order first to apply for a network of excellence of second generation, but also in a second time to be in a good position to apply for a KIC in Manufacturing or an EIT.

In the same time, many members of EMIRacle are very active in the Manufuture platform at the European

Commission level (High Level Group) or at national level (Manufacture national platforms). They are actually engaged for the preparation of the next Manufacture conference in St Etienne, France, 8-9 December 2008. The provisional programme includes in the session 4: "What is the best organisation inside manufacturing R&D communities?", a presentation by S. Tichkiewitch, President of EMIRAcle, about the roles of the network dedicated to manufacturing.

Other feedback to the E.C. about new research can be with the numerous applications that the members of EMIRAcle have proposed for the second call of the FP7 and for which we are awaiting results. The main proposed applications are the projects CORPNET, CORSAIR, EU Cert, iDesigner, KNOWNET, MANITU, NIPP, WebEducMfg and 5M.

## **6.6 Goal 6: Installing an efficient internal communication system**

Internal communication in the VRL-KCiP network is crucial. A seamless and transparent communication between the participating partners of the VRL-KCiP network is considered to be the backbone of the whole project. In the same direction this will be true for the EMIRAcle Association. Hence, the required resources have been provided from the earliest stages of forming the network. The overall goal of providing an efficient internal communication system is to support and facilitate the cooperation among all VRL-KCiP partners as much as possible and to maintain these communication capabilities for the members of the EMIRAcle association. The functionality of the internal communication system mainly comprises the contact management system VRL-Shepherd, the intranet-website of VRL-KCiP, the SmarTeam document and knowledge management database, the discussion forum, a VRL-KCiP calendar, and videoconferencing services.

Particular high effort was put into the maintenance activities of the mail exploder system in order to increase the stability of the functions provided for internal communication. The server has been moved to a more stable platform in order to deliver reliable services on a high availability level to the network members. Further strong maintenance efforts were put on the VRL-Shepherd client based on a MySQL server instance and the internal web portal with access control for NoE members providing internally specific information to the network partners. By this several requests by partners have been met. Also the implementation and management of the online-registration process for the General Assembly in Haifa in March 2008 has been realised internally online.

A portal has been maintained and is operated by task members, giving each partner instantaneous connections to websites of the other members of the network, access to their home pages, the ability to see videos of the laboratories, etc. Improvements have been realised by continuous identification, discussion, and agreement on further internal requirements with respect to video conferencing and software-system for communication support and knowledge sharing and implementation of these.

Moreover, ongoing technical support for the VRL Knowledge Management System (KMS) -SmarTeam has been provided, to enable the completion and implementation of various tasks in internal communication. All resources mentioned above have been maintained during the runtime of the network. The responsible partners put considerable efforts into these means in order to improve the performance of the internal communication system continuously.

There was a close cooperation to task 16 in all development connected with SmarTeam and the VRL-KCiP file management system. Finally, the VRL software demonstration and exchange platform has been generated. The links from the VRL intranet to the several services mentioned above installed and well accepted by the project partners..

An important project of the internal communication was the implementation of a web-based shepherd client. For this, the development of a concept and the implementation of first prototype have been realised in order to evaluate the required functionality, figure G6.1. The main features of this new system have been:

- accessible via internet,

runs on every platform,  
 new data / deletions: real-time update,  
 single-sign on for intranet and shepherd,  
 centrally managed access rights,  
 easy implementation of new requirements, and  
 new technologies allow very fast web-applications (PHP, AJAX, etc.).

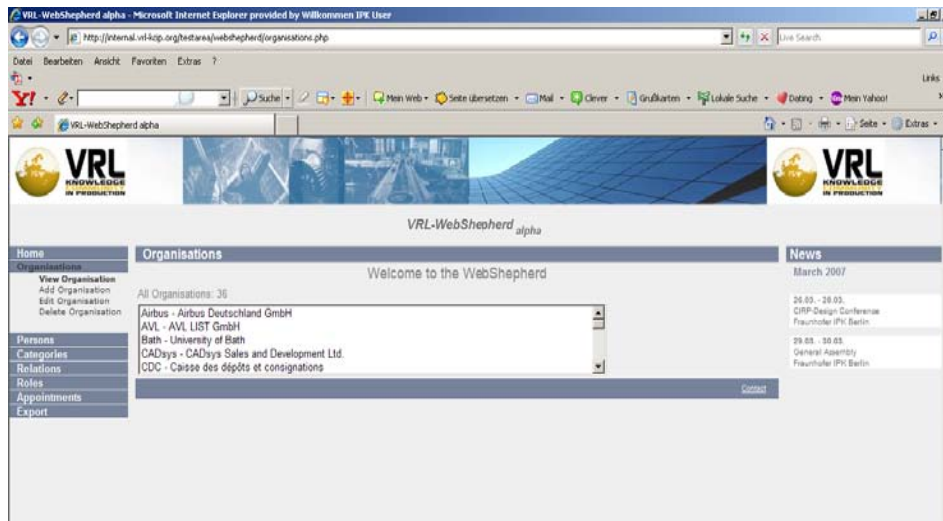


Figure G6.1: First prototype user interface of the VRL WebShepherd

After a short time of studies concerning usability and practicability the extracted expertise was used to improve the first prototype of VRL-WebShepherd. VRL-WebShepherd has now been transferred to EMIRacle Web-Shepherd which provides all functions the “old” MS Access – based version of VRLshepherd Client offered, figure G6.2. The new client proved to be very stable and has an easy to learn user interface.

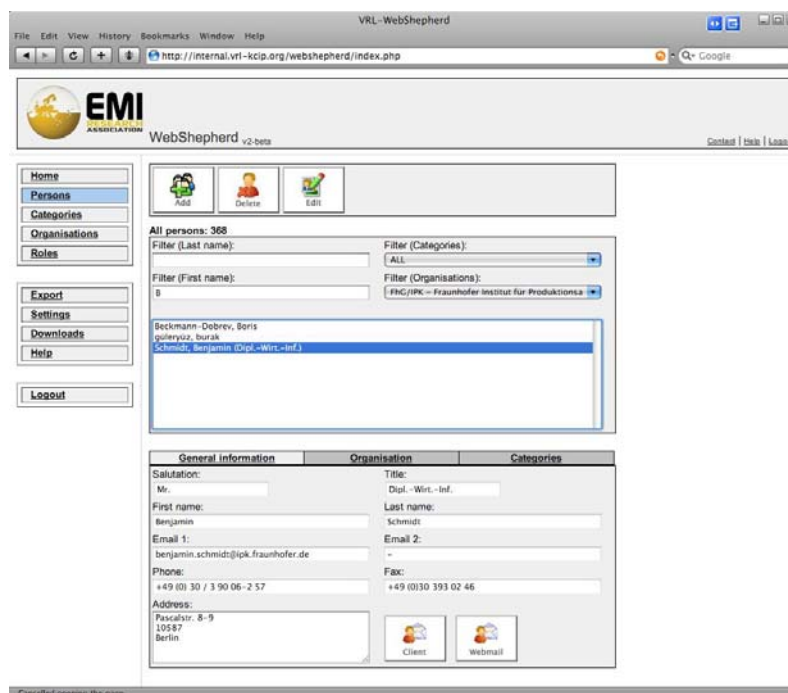


Figure G6.2: EMIRacle Web-Shepherd (V2-beta)

For assigned VRL-KCiP or EMIRAcle members EMIRAcle WebShepherd “V2-beta” is available under: <http://internal.vrl-kcip.org/webshepherd/index.php>

Future work will concentrate on maintaining the internal communication system and constantly providing the required functionality for the association members. In particular, the EMIRAcle Web-Shepherd will be further developed.

### **6.7 Goal 7: Envisioning a new legal structure at the European level**

On 25 October 2008 the creation of the EMIRAcle international association without profit following the Belgium law has been signed. Twenty partners of the VRL-KCiP were founding full right members. The association ran for its first year until 31 May 2008, to be in accordance with the official end of the VRL-KCiP network of excellence. The second year will be the first year open for new members. Academic partners can ask the GA to enter the association as full right members, as industrialists can request to be associate members.

The statutes of the association contain what is mandatory. The EMIRAcle association agreement has been established and will be accepted on 17 July 2008.

On 14 January 2008, the GA of EMIRAcle elected its board, with unanimity:

*President: Professor Tichkiewitch, Grenoble*

*Vice-President Research: Professor Shpitalni, Haifa*

*Vice-President Education: Professor van Houten, Enschede*

*Vice-President Business Office: Professor Chryssolouris, Patras*

*Treasurer: Professor Monostori, Budapest*

*Secretary: Mr Kind, Berlin*

The legal address of the association is: 62 rue du Trône, 1050 Brussels, at the Belgium office of the Rhône Alpes General Council.

### **6.8 Goal 8: Ensuring operational and financial sustainability**

Since the 1<sup>st</sup> June 2008, EMIRAcle is an independent association without financial support from the European commission.

The financial sustainability of the association has been considered on the basis of 4 mechanisms:

- 1) an annual fee that has to be decided by the General Assembly (GA) when the annual budget of the association is voted.

For this second year, the board of EMIRAcle will propose to the full right members to fix the annual fee for 1000 € for the full right members and 5000 € for the associate members (2000 € for SMEs). These fees are limited in the statutes of the association (article 6) respectively at 2000 € and 25000 €.

- 2) some input depending of the resources created by the association that can be sell out. Is concerned by example the diffusion of training using the streaming system, the royalties from specific software at disposal of the members (Production Navigator, Knowledge and competence map, etc.) These resources are declined in the business plan.
- 3) some grants obtained as a result of the applications to the European Commission call. For the first call of FP7, EMIRAcle is already engaged in the EUCert programme (European Innovative Online Training Campus, Lifelong Learning Programme).

For the second call, EMIRAcle is directly partner of submitted applications, and subcontractor of others. These applications are:

KNOWNET (Adaptive KNOWledge NETworking, STREP ICT)

CORP-NET (Cooperative and robust production planning in Support of Networked production, NMP SMALL)

CORSAIR (Collaboration strategies for autonomous multi-robotic handling systems, STREP ICT)

5M (Mediterranean Mobility Modular Master in Manufacturing, TEMPUS IV)

WebEducMfg (Western Balkan Eductaional Center in Manufacturing, TEMPUS IV),

iDesigner (Certified Integrated Design Engineer, Lifelong learning programme)

MANITU (Certified Innovation Manager for Engineering and Manufacturing, Lifelong learning programme)

NIPP (Networked 3D Interaction in Production Planning and Manufacturing System Development, ETRANET)

- 4) the participation in projects as an actor recognized with its international opening and its capacity to solve multi-disciplinary holistic problems.

**Rovaltain:** a community of biologists and physicians specialized in soils transfers has convinced the Rhône Alpes province and Drôme area to launch a very complex programme in eco-toxicology, to study the evolution of bacteria in a very small concentration in natural soils for a long duration (typically 4 years). This study need to build a special laboratory managed to supervise about a hundred of testing machines with automation, control, data acquisition and treatment, each of this testing machines being a metric size. EMIRAcle has been asked to manage the engineering of this lab. One Polish member of the association will be recruited by the French National Research Centre to be at disposal of EMIRAcle for this activity.

**Falun:** Scania decided to transfer a plant from Falun, 300 km in the north of Stockholm, to another site in the south in order to optimize their production. The district of Falun want to install new companies on the free place and has considered far that the need to propose to the potential enterprises some accompaniment in training and research. With the help of KTH, one of our full right members, they have asked EMIRAcle to consider the possibility to install there a representation of our business office. They offer for that to put at disposal 2000 m<sup>2</sup> with equipment. At this time we are already negotiating for permanent recruitment.

These two projects are actually in negotiation. We are convinced that the future of EMIRAcle is to participate to such activities as it is the way of resources allowing the financial sustainability and it is also the best acknowledgment of our capacity to solve complex systems.

## 6.9 Goal 9: Defining and promoting medium and long-term educational curricula to respond to societal and industrial needs

Having special regard for defining and promoting medium and long-term educational curricula in the service of societal and industrial needs, key VRL-KCiP partners responded with a proposal to the first Marie Curie Initial Training Networks Call (FP7-PEOPLE-20071-1-ITN). The proposal, entitled “ManuGlobal,” was based on our conviction that high-level RTD (Research and Technology Development) and manufacturing are connected together in a win-win process. As unanimously suggested by various recent strategic foresight reports and initiatives (MANVIS, FuTMaN, Manufuture) developed with the active participation of our network members, the challenge for Europe is to shift from a traditional economy (land, labour and capital) to a knowledge-based economy (knowledge, reliable networks and capital) and, in turn, from an economy of use and waste to sustainable economy and development. This new paradigm focuses on four strategic objectives:

- (1) competitiveness in manufacturing industries,
- (2) leadership in manufacturing technologies;
- (3) development of eco-efficient products and manufacturing;

(4) leadership in products and processes, as well as in cultural, ethical and social values.

Such a transition process requires the involvement of all stakeholders, from industry to research, education, public institutions and the financial sectors. In the ManuGlobal proposal we had initiated a framework for the necessary transformation of European industry and the related RTD and educational infrastructures. We had argued why research, innovation and education in the domain of manufacturing can be considered as critical success factors that would help change the current education.

Three strategic areas have been specified:

- 1 cooperation and product development,
- 2 distributed design and manufacturing, and
- 3 global value chain.

The partners, together with industrial participants, drafted a research and training program for these areas and elaborated the protocols of a joint curriculum. The whole programme is based on close collaboration between industry and the academic community. Unfortunately, this proposal has not been selected for the first call. We took into account the remarks of the reviewers to propose again this project for the second call, convinced that it is a good project that has to be selected with some modifications. The first version of the ManuGlobal proposal has been drafted from the VRL-KCiP community by INPG (coordinator), PATRAS, TECHNION, TEKNIKER, TWENTE and SZTAKI. The same members are proposing the new version for next September.

In the field of lifelong education and professional certification VRL-KCiP has succeeded in establishing a close collaboration with the European Certification and Qualification Association (ECQA, [www.eu-certificates.org](http://www.eu-certificates.org)). Since January 2008 this collaboration is supported by the Leonardo da Vinci Line of the Lifelong Learning Programme in the EU Certification Campus (EU Cert) Project, which is the result of a common proposal submitted in 2007. EMIRAcle is concerned in this proposal for the dissemination of the on line certification for the existing job role.

Two new applications with the EUcert partners have been proposed this year in the Transfer of Innovation programme (managed in Leonardo) in April 2008. EMIRAcle's target in this collaboration is to define skill sets of modern job roles in manufacturing, like Integrated Design Engineer or Innovation Manager in Manufacturing, and to implement European-wide training and certification for these roles.

# Plan for using and disseminating the knowledge

## 7 Section 1 – EMIRAcle website (www.emiracle.eu)

This website gives users access to the expertise range of EMIRAcle network members. The search can be done directly by expertise field itself (Fig 1) or by laboratories network members (Fig. 2).

Fig. 1: VRL Expertise tree.

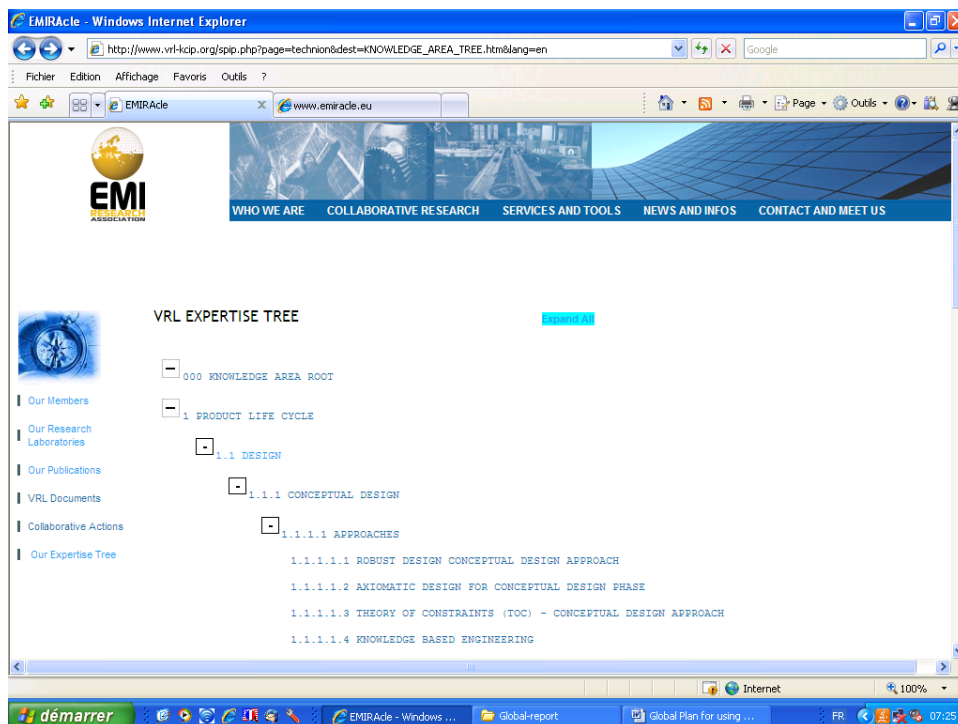
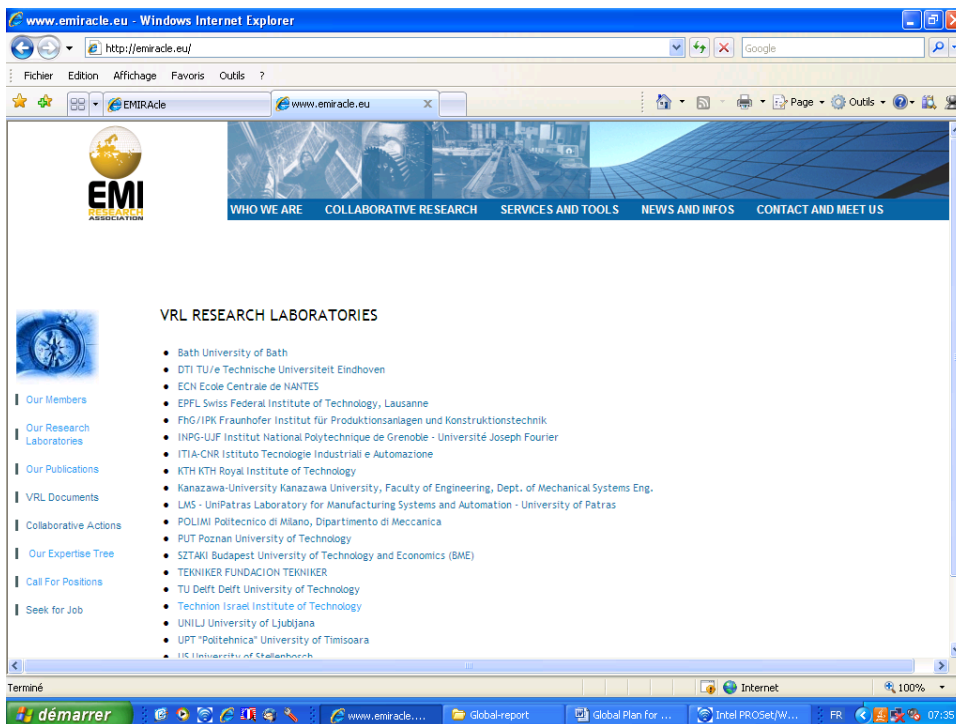


Fig. 2 : Laboratories network members list .



All relevant information concerning lab member's network and expertise areas of researchers are available on this site (Fig. 3-10)

Fig. 3: Lab general presentation (members, collaborations and PhD regulations).

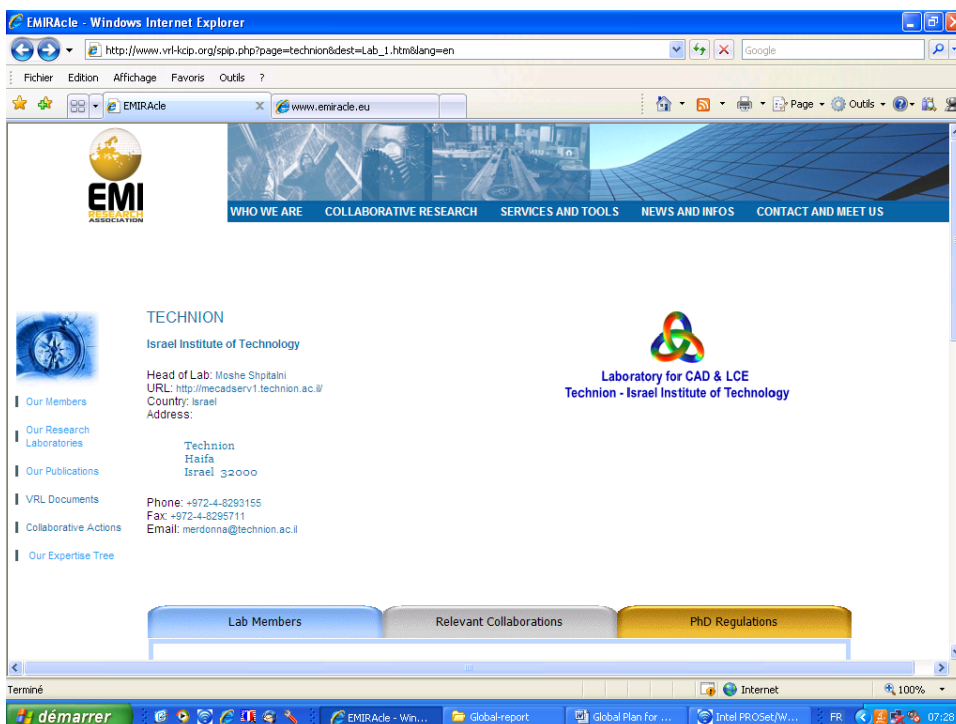


Fig. 4: Individual profil for each member in the lab (Resume, Expertise areas, Collaborations, Documents)..



Fig. 5: Individual profil - Member relevant collaboration.

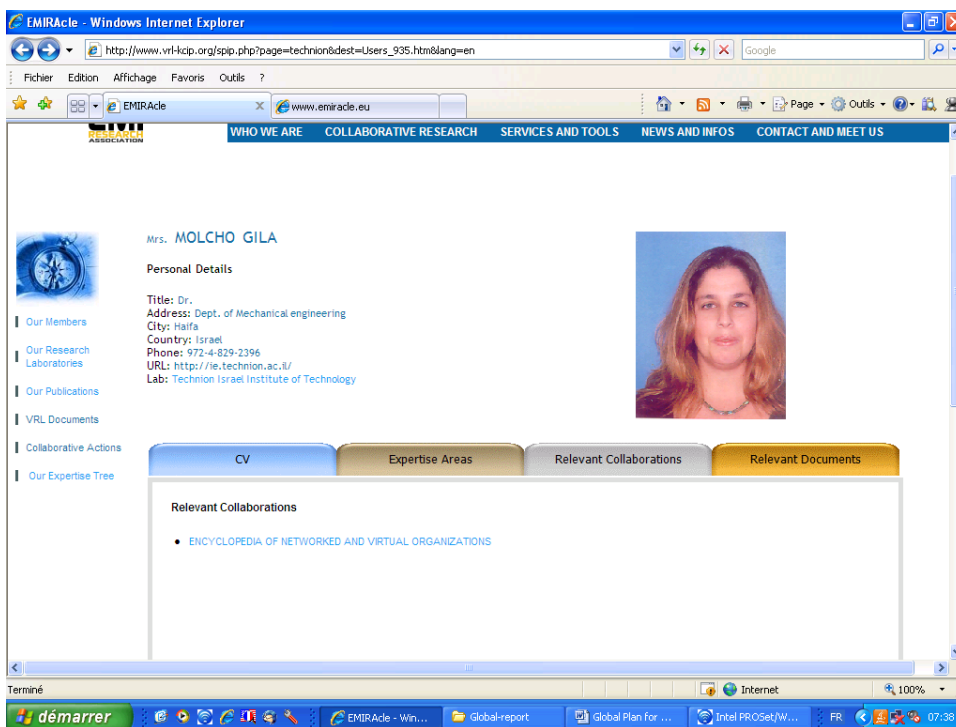


Fig. 6: Member relevant collaboration description.

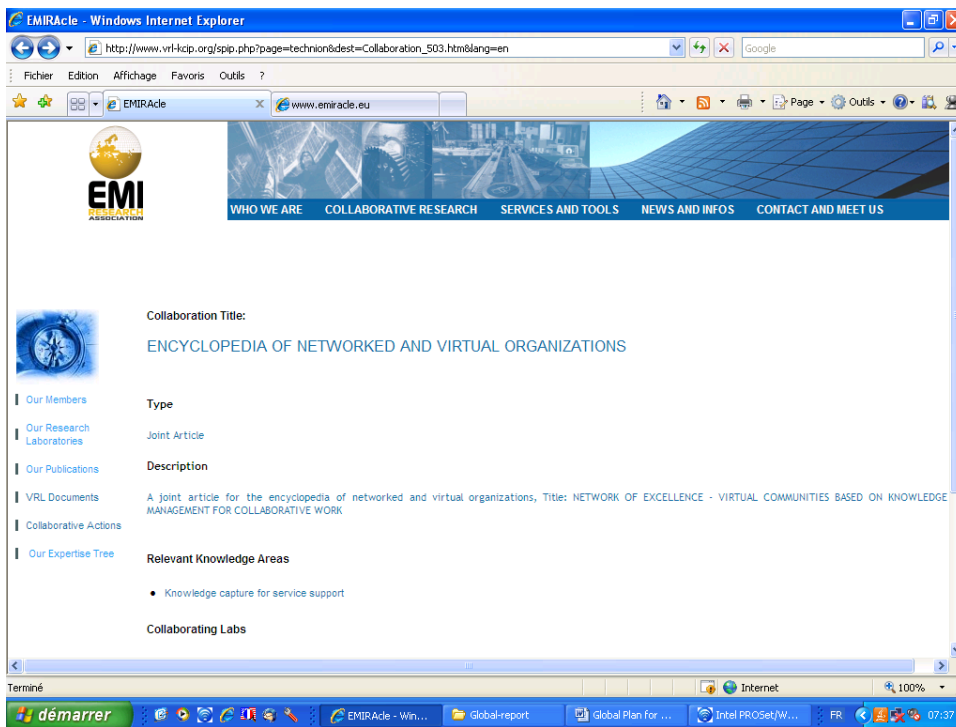


Fig. 7: Member Area of Expertise.



Fig. 8: Member Area of Expertise description.

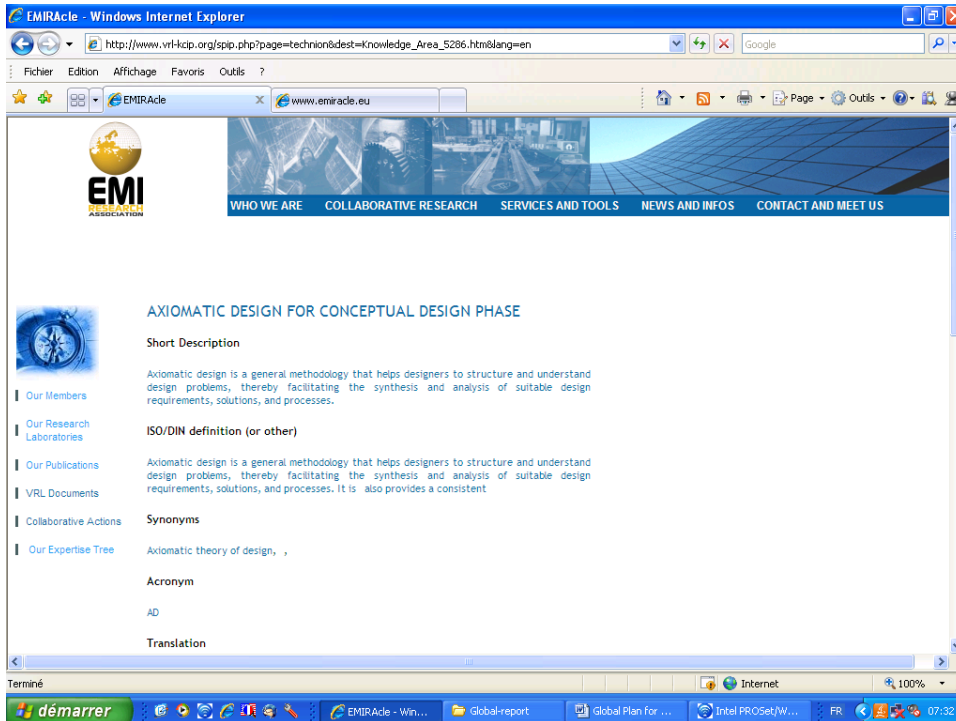


Fig. 8 (bis): Member Area of Expertise description with the list of all experts area in the network (second page).

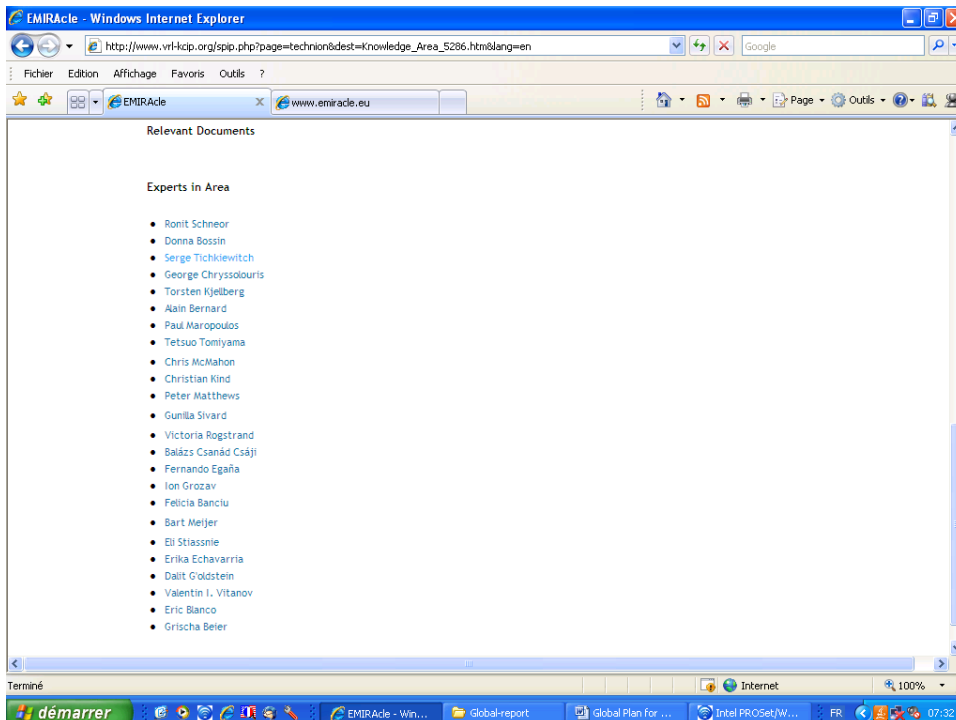


Fig. 9: Member list of publications.



Fig. 10: Member publications description.



All relevant information concerning the network are also available on this site

Fig. 11: List of VRL publications.

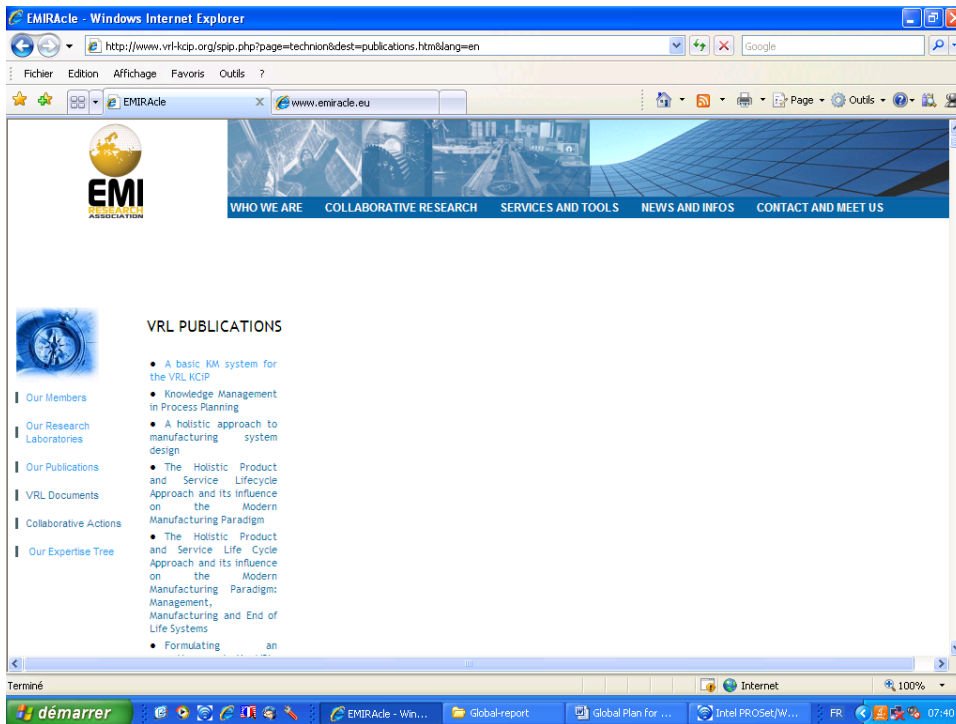


Fig. 12: List of VRL documents.

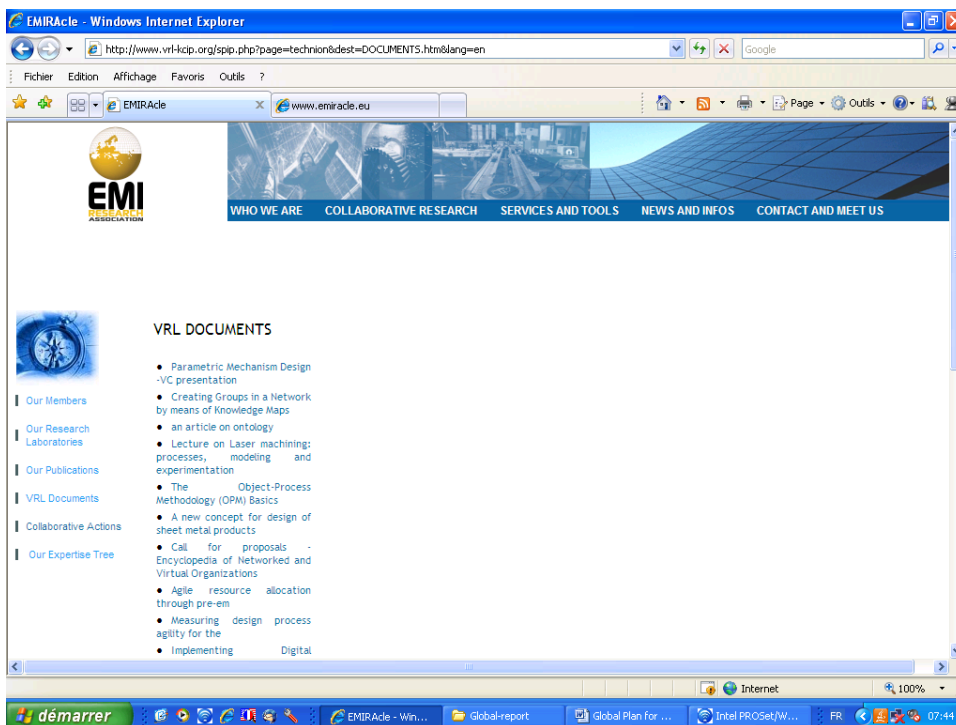


Fig. 13: VRL document description.

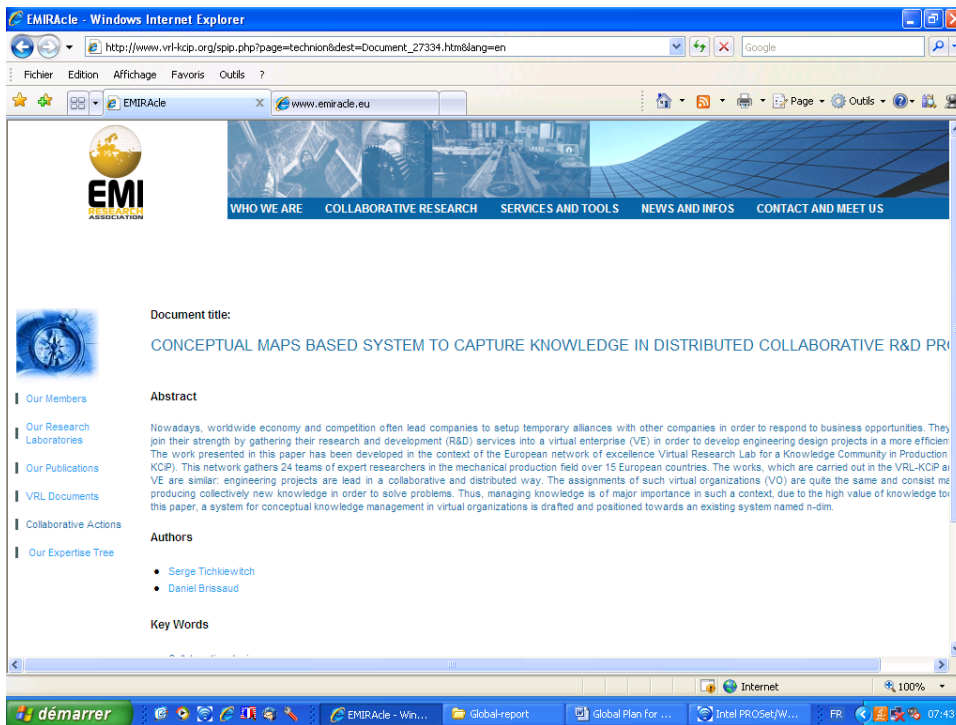


Fig. 14: List of collaborations.

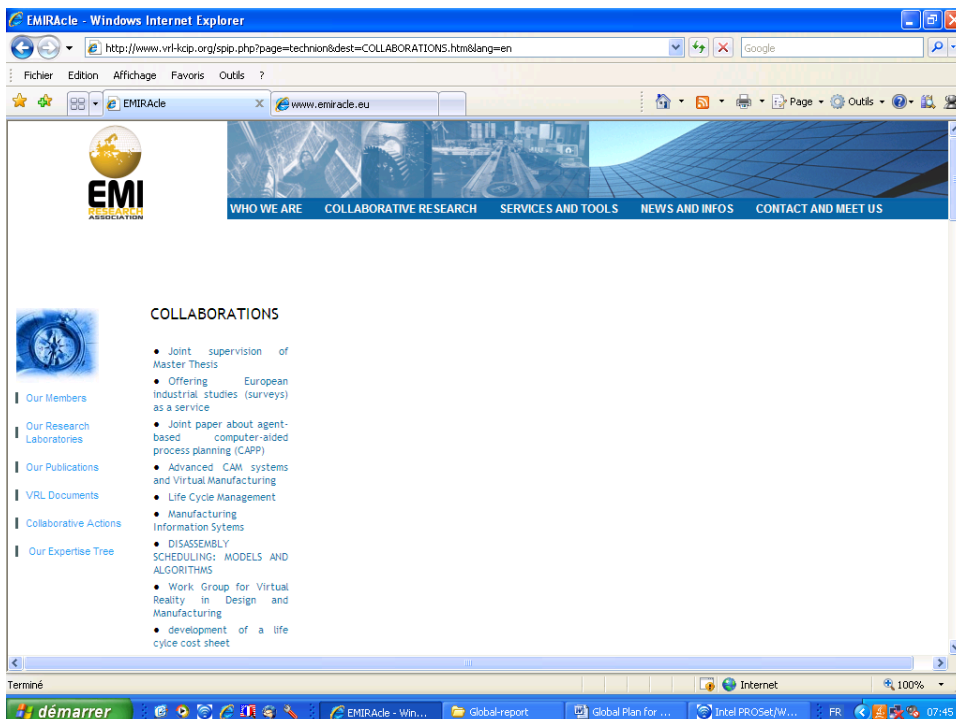


Fig. 15: VRL publications.

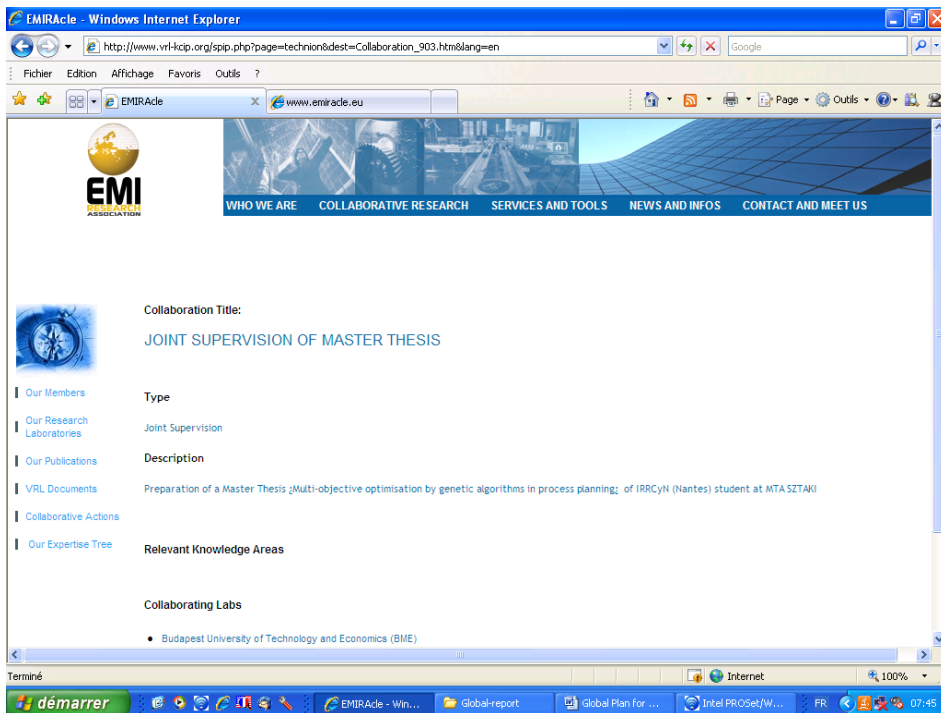


Fig. 16: VRL-Call for Positions.



The vision of the VRL-KCiP was for its members to belong to a new and long-lasting European structure, in order to be more efficient for industry, for the needs of society, and for sustainability. Two vital conditions for fulfilling this vision and creating the necessary synergy between the members were:

- (a) sharing competences and KID (Knowledge Information Data),
- (b) identifying and sharing diverse distributed expertise

As a result of the 4 years, the network can deliver a Knowledge map and a competence profile of current expertise of each member of the network. We also have developed some tools to manipulate this knowledge and to search the best cluster among the members of the VRL-KCiP network in order to answer a problem defined by the requested domain of competences.

We have presented the important issues in ontology building, defining the terms relevant to knowledge mapping. We focused on the objectives and constraints of our network and outlined the activities carried out, summarizing our initial efforts to formulate the VRL-KCiP ontology and collecting the network expertise. After that, we described the process of mapping network expertise and the initial conclusions drawn from this mapping process, entered into the KID base from the network labs. We report also on the progress in implementing the ontology structure in the SmarTeam KMS.

So, the target of the network was to define the knowledge map describing the current expertise of each member in the network and pointing out missing competences considered important for future work in the network. The result is a competence structure representing the intellectual capability of the network to serve as the input for defining the research strategy.

The expertise map was built by assigning the value '1' to all expertise fields that were relevant to each network member. Four expertise maps were then developed:

- a) individual expertise range,
- b) individual expertise,
- c) lab expertise strengths and
- d) lab expertise

The figure 17 represents an example of the expertise for 27 members

The first map allows some insight into missing competencies. The empty patches in the map (visual) represent areas receiving less attention in the network. It is apparent from the current complete map that both 'service' and 'EOL processing' are not the primary focus of the VRL-KCiP research network as it stands today.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
<b>Product life cycle</b>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<b>Design</b>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<b>Conceptual design</b>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<b>Approaches</b>	1					1	1	1	1	1			1	1	1	1				1				1	1	1	1	
Robust design						1										1												
Axiomatic design																											1	
Theory of Constraints (TOC)						1															1					1	1	
Knowledge based engineering							1		1		1		1														1	
What if design																												
Object orientation (OO)							1		1		1			1											1			
Object Process Methodology (OPM)																									1			
Layout Modeling																												
Systematic design							1				1		1															
Iterative design strategy							1																					
Design for Six Sigma																												
Design for manufacturing																												
Design for remanufacturing																1	1											
Design for environment (DFE)																											1	
Decision based design									1																			
<b>Methods</b>	1	1	1	1			1	1	1	1	1		1	1	1	1				1			1	1	1	1	1	
<b>Innovation</b>	1	1	1				1		1				1	1						1						1	1	
Brain storming		1	1	1			1		1				1	1						1							1	
Fishbone		1	1	1			1							1						1								
TRIZ													1														1	
SIT																												
<b>Functional analysis (product definition)</b>	1	1	1				1		1		1		1	1						1			1		1	1	1	
QFD	1	1	1				1		1				1							1			1		1		1	
Axiomatic Design																											1	
SADT							1		1		1		1															
Unified Modeling Language (UML)							1		1		1		1	1														
Object-oriented methodology							1		1		1																1	
Functional analysis tools (FAST)																												
<b>Optimization</b>	1	1	1	1									1		1	1				1			1		1	1	1	
AI algorithms																1	1									1	1	
GA-genetic algorithms																1								1				
Neural networks																1												
Simulated annealing																1												
Analytic Hierarchy Process (AHP)																											1	
Mathematical programming																												
Cost simulation (initial)													1															
Fuzzy logic																												
<b>Life cycle assessment</b>							1		1				1		1									1	1		1	1
Predictive maintenance of mecat							1		1						1									1		1		
Environmental assessment																								1			1	
Multicriteria Decision Aid Method																								1				
Reliability Management Strategy																								1				
Life cycle analysis																												
Object Process Methodology (OPM)																											1	
<b>Tools</b>							1	1	1				1		1					1			1	1		1	1	
<b>Industrial design</b>																											1	
Styling																												
Embodiment																											1	
User system interaction											1																	
<b>Eco design - DFE</b>							1		1				1		1									1		1	1	
Life cycle an							1		1				1											1		1	1	
Statistic analysis maintenance																									1		1	
OPCAT for life cycle concept																								1				
OPCAT for life cycle manage																								1				
Self developed - product conc																												
Self developed - Modeling an																												
Design for remanufacturing																												
REPRO2																												
<b>Optimization</b>																												
Life cycle costing																												

Figure 17: A partial 'Individual expertise map' for conceptual design

With this individual knowledge, we construct 'Lab expertise strength' map as given in Figure 18, map that gives the strength of a team relatively to the number of answer this team procure.

LAB no. of responses	UoD 6	Fhg IPK 8	Technion 10	UPT 2	ITIA 3	EPFL- LICP 6	PUT 3	TUE 11	KTH 2	UTT 5	INPG 7	TEKNIKER 6	ECN 1	BATH 2
<b>Product life cycle</b>	<b>347</b>	<b>192</b>	<b>288</b>	<b>69</b>	<b>110</b>	<b>95</b>	<b>40</b>	<b>41</b>	<b>48</b>	<b>82</b>	<b>121</b>	<b>353</b>	<b>212</b>	<b>112</b>
<b>Design</b>	<b>233</b>	<b>177</b>	<b>201</b>	<b>47</b>	<b>65</b>	<b>70</b>	<b>30</b>	<b>28</b>	<b>24</b>	<b>58</b>	<b>102</b>	<b>238</b>	<b>154</b>	<b>81</b>
Conceptual design	34	43	32	11	13	13		14	10	17	13	42	19	21
Detailed design	168	105	136	35	44	52	30	7	8	25	69	142	104	45
Support	31	29	33	1	8	5		7	6	16	20	54	31	15
<b>Production</b>	<b>82</b>	<b>15</b>	<b>63</b>	<b>17</b>	<b>38</b>	<b>16</b>	<b>10</b>	<b>8</b>	<b>16</b>	<b>16</b>	<b>16</b>	<b>85</b>	<b>49</b>	<b>26</b>
Manufacturing systems	8		9	2	3	3			4		1	8	6	5
Manufacturing processes	30	5	10	10	9	7	4		4	6	7	29	12	
Quality control	10		2	1	2			8		5		17	12	
Operations management	21	5	23	2	6		3				1	4	5	12
Manufacturing support (tools)	2	4	1	1	16	4	3			1	2	14	6	2
Management support	11	1	18	1	2	2			8	4	5	13	8	7
<b>Service</b>	<b>11</b>		<b>17</b>	<b>5</b>	<b>5</b>	<b>3</b>		<b>5</b>	<b>8</b>	<b>4</b>		<b>25</b>	<b>9</b>	<b>5</b>
Monitoring/control				2				3				4		
Diagnosis			2	1	2				2			4		
e-service			1									3		
Maintenance			1	1	1	2		2	1			2		
Support	11		13	1	2	1			5	4		12	9	5
<b>EOL</b>	<b>21</b>		<b>7</b>		<b>2</b>	<b>6</b>				<b>4</b>	<b>3</b>	<b>5</b>		
Sorting	5		1		1	2					1			
Recycling	2					1								
Refurbishing	1				1									
Disposal	2					1								
Support	11		6			2				4	2	5		

Figure 18: A partial 'Lab expertise strength' map

## 7.1 Implementation in KMS (SmarTeam)

The most updated version of the ontology structure has been exported to the SmarTeam KID base. This structure has two central uses: member expertise definition and KID object classification.

- **Member expertise definition**

In the SmarTeam KID base, each member of the VRL-KCiP is linked to all relevant expertise areas. This linking process has been carried out in two phases. For those members who responded to the expertise-gathering form, all expertise will be automatically updated in the KIDbase.

- **KID object classification**

Each KID object added to the SmarTeam KID base can be linked to two different classification structures. The first is related to the tasks and work packages in the VRL-KCiP, and the second is the expertise ontological structure. This dual structure will enable rapid location and retrieval of relevant KID objects required by network members.

Figure 19 illustrates the implementation of the expertise tree in the KMS. The instances are numbered according to their hierarchical level. This structure will further evolve dynamically as the KMS is implemented and the attributes are further developed

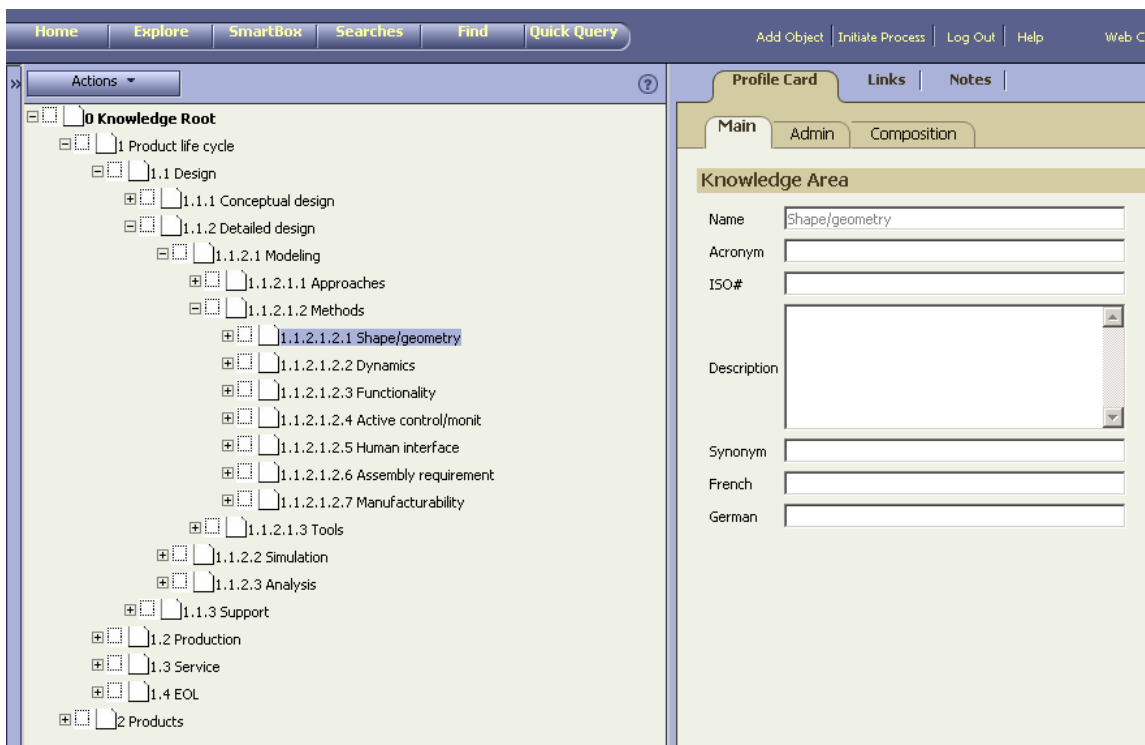


Figure 19: Implementation in the KMS (SmarTeam)

The outcomes of Tasks 19 and 20 have already served as a basis for the initiation of further industrial contacts and working groups. This process will go on in the future and the additional inputs from dialogue with industrialists in the field of life cycle and life cycle costing issues will be played back into the network and the Task 19 and 20 working group.

Another interesting field of industrial collaboration has been established with a major consultancy company to use the network as a source of dislocated scientific cells to supervise European wide studies in various fields. The studies will be industrially driven.

## **7.2 Expertise Tree**

Much effort has been invested in creating a VRL-KCiP expertise taxonomy. This has been realised as a hierarchical tree which includes over 800 instances relevant to Life Cycle Engineering. The expertise tree (both content and structure) has been applied in the VRL-KCiP KMS and is used

- (a) to create expertise maps of the VRL-KCiP members;
- (b) to classify all knowledge objects;
- (c) as keywords for network documentation;
- (d) as the platform for the yellow pages capability realized in the VRL KMS; and
- (e) as the interweaving facilitator of the VRL world published on the VRL website, enabling easy navigation of the VRL knowledge.

Efforts continue to create a profile for each instance in the expertise tree. The profile includes both a short description and a detailed description.

Over 156 profiles have been validated and uploaded to the VRL-KCiP KMS. These profiles offer an excellent and quick look-up capability for all the instances in the expertise tree. In particular, the profiles help in locating good literature references, and also offer additional information, such as the advantages and disadvantages of the instance, additional applications, etc. This knowledge has been incorporated in the official VRL web site and is available as a service for external and industrial partners. In the future how to charge a fee for use of this database will be considered.

In addition, effort was invested in proving the concept of creating a showroom capability based on the KID in the VRL KMS. This showroom will be available on the web and used to market the new association as it evolves. Much effort will be invested in the marketing appeal of the showroom in Year 4.

## **7.3 Expertise Maps**

Based on the expertise profiles of the VRL members collected in the VRL KMS, four different expertise maps have been developed. The maps are available at the level of the individual members or at the aggregate level of the member teams. To date the maps are based on the expertise profiles collected from over 220 permanent researchers and graduate students.

A new wizard has been realized in the KMS to enable online export of the updated expertise maps. These expertise maps provide a good indication of the strengths of the network and can help in identifying areas where the network needs to strengthen its capabilities.

An expert system for creating groups of people to participate in projects is one application already implemented on these exported maps. This SW is available to all network members .

Furthermore, collection of these expertise profiles in the VRL KMS, as well as the detailed profiles of each network member, has in essence created a yellow pages capability. This capability has been enhanced by an inline notification capability which enables direct mailing to the selected experts.

#### **7.4 Detailed member CVs and current areas of research**

The detailed structured CVs of over 50% of the network members have been captured in the VRL KMS, together with about 180 current topics of research. Efforts to collect the remaining information are continuing. This collected input is then used

- (a) for locating experts and gaining improved insight into the background of each VRL member;
- (b) for text mining analysis to enhance and complete the process of building ontology for the network; and
- (c) to trigger new collaborations and joint research.

This knowledge will be made available on the web in a way that allows navigating through the network's expertise fields, as well as locating experts.

#### **7.5 Collaboration mapping**

In Year 3 of the network, a collaboration mapping capability was developed. This capability enables improved insight not only into the expertise of a single member or single lab, but also into the cooperation and collaboration between the labs. These collaboration maps indicate not only the ultimate success of the VRL network and achievement of the VRL goals, but also the current topics of interest and state-of-the-art research.

#### **7.6 The VRL world**

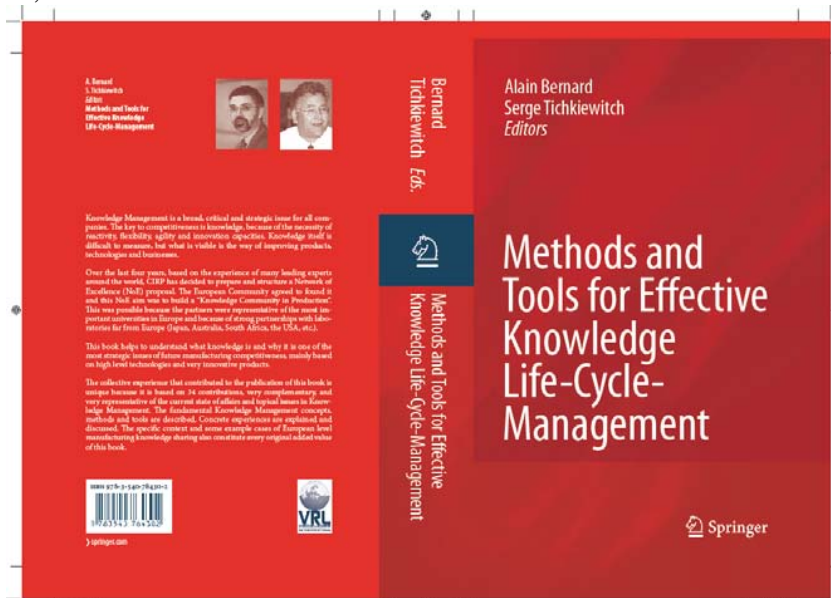
A publishing capability has been developed in the VRL KMS that makes it possible to view system KID labelled as "public" via the VRL-KCiP website. This knowledge is published to web pages and updated periodically. The published KID is interlinked and enables the web visitor an extensive easily navigated overview of the VRL web.

## 8 Section 2 – Dissemination of knowledge

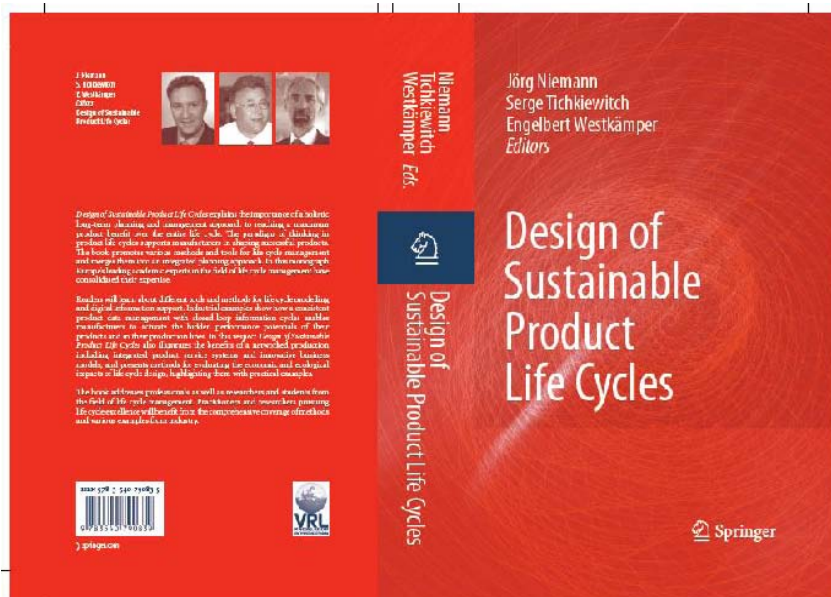
The list of the publications relative to the VRL-KCiP network of excellence is on the web site at <http://vrl-kcip.technion.ac.il/vrl-publications/showPublication.asp>

### 8.1 Edited Books:

1. Methods and tools for effective knowledge-life-cycle-management, Bernard A., Tichkiewitch S., Springer, 2008, ISBN 978-3-540-78430-2



2. Design of sustainable product life cycles, Niemann J., Tichkiewitch S., Westkämper E., Springer, 2008, ISBN 978-3-540-79081-5



3. The Manufuture road, Jovane F., Westkämper E., Williams D., Springer, 2008, ISBN 978-3-540-77011-4



4. Advances in integrated design and manufacturing in mechanical engineering, Bramley A., Brissaud D., Coutellier D., McMahon C., Springer, 2005, ISBN 1-4020-3481-4



5. Advances in integrated design and manufacturing in mechanical engineering II, Tichkiewitch S., Tollenaere M., Ray P., Springer, 2007, ISBN 978-1-4020-6760-0



6. Innovation in life cycle engineering and sustainable development, Brissaud D., Tichkiewitch S., Zwolinski P., Springer, 2006, ISBN 1-4020-4601-4



7. The future of product development, Krause F-L., Springer, 2007, ISBN 978-3-540-69819-7



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### 8.3 Special events

1. A special day has been organized during the CIRP Design seminar in Shanghai, in May 22nd, 2005, in order to have exchanges between the VRL-KciP network and a network of Chinese Universities
2. German-Israel Symposium, Berlin, Germany, July 2005 (Special VRL-KCIP Session)CIRP General Assembly, Antalya, August 2005 (VRL-Working Group – Session).
3. ProSTEP iViP Science Days, Darmstadt, Germany, 28./29. September 2005 (Workshop about Cooperation Potentials between VRL-KCiP and other NoEs).
4. PUT will address the Polish Academy of Science at the assembly meeting November 2005 and April 2006 in order to disseminate the network’s developments
5. The network has been presented during the first industrial partners day, the 31<sup>st</sup> of January, 2005, in Paris.
6. 2005 Israel-Korea Bi-National Conference on New Technologies and Visualization Methods for Product Development on Design and Reverse Engineering – Industrial session involving the following industries  
Yoram Retter, IAI – NoE VRL associate member  
Danny Shacham, Nextec  
Dr. Tamir Shalom, CogniTens Ltd.  
Prof. Moshe Shoham, Kahn Medical Robotics Laboratory  
Dr. Gabriel Sirat, Optimet – NoE VRL associate member

## 9 Section 3: Cooperation with industry (SE)

Toward the industrial partners, the network has also been presented during the first industrial partners day, the 31<sup>st</sup> of January, 2005, in Paris.

A number of contacts have been established with associations of various industrial sectors, chambers of industry and commerce, individual enterprises and IRC (Innovation Relay Centres).

We can find:

- Asociación de Fabricantes de Máquinas-herramienta (AFM)
- Federación española de asociaciones empresariales de moldistas y matriceros (FEAMM)
- Gamesa Eólica
- Greek IRC
- Federation of Greek Industries (FGI)
- Foundation for Research and Technology - Hellas (FORTH)
- Federation of Industries of Northern Greece (FING)
- Hellenic Organization of Small and Medium Sized Enterprises and Handicraft S.A.
- ProSTEP iViP Verein
- VDI - The Association of German Engineers
- Chamber of Industry and Commerce Berlin
- The Demonstration Centre “Virtual Product and Production Creation (DZ-ViPro)”
- IRC Northern German
- TSB Technologiestiftung Innovationszentrum Berlin
- Industrial Circle at “Berliner Kreis”
- Wielkopolska Chamber of Commerce and Industry (Poland)

Questionnaires distributed to NoE members and following industrial partners:

- Israeli industry responses: COGNITENS, OPTIMET, NEXTEC, PTC, MATERIALIZE, METRIS, Israel Aircraft Industry – IAI, RAFAEL, JetTech
- European Industry responses: DOMUS, FRIGOGLASS, PHILIPS Electronics, OCE, PLASTOR Oradea, ELBA Timisoara, ESSER Timisoara

Following one of the major goals of the network, the NoE has significantly increased its synergies with industry in Europe during the third project year. In view of the official launching of the EMIRAcle Association at the beginning of the fourth project year, such a development was essential for enabling the potential “customers” to get a closer view on the possibilities for future cooperation.

Over 300 industrial cooperation activities have been recorded during the third year. More than 60 of these were events organised by network partners with industrial participation. The target group of the NoE activities covered a large number of industrial sectors in Europe and more than 300 individual industrial companies. An indicative list of some well known industrial companies, involved in the aforementioned synergies, is provided hereafter, the extensive list is provided in the accompanying document as stated above.

Sector	Indicative list of companies involved in NoE – industry synergies
Automotive	DAIMLER, VW, RENAULT, FIAT, AUDI, BMW, SCANIA, VOLVO, DAF
Aerospace	AIRBUS, EADS, ROLLS-ROYCE, EUROCOPTER, THALES
Information	DASSAULT SYSTEMS, SAP

Technology	
Engineering/ OEM suppliers	THYSSEN KRUPP, BOSCH
Electronics / consumer goods	PHILIPS, SIEMENS
Machinery	DANOBAT, MANDELLI
etc.	

In addition to big enterprises, numerous national and international European SMEs of several types, among them high-tech providers, OEM suppliers, consultants, etc., as well as from different sectors such as IT, machinery, tooling, etc., make up a major part of the NoE-industry synergies.

## 10 Section 4 - Publishable results

Some of the deliverables were declared as Public on the DoW. As soon as these deliverables are accepted by the European Commission, we put them on the external part of the web site in order to give an open access to them. These deliverables are :

### 1A

- D11: Demonstration of software tools & making available thru Internet to other partners
- D12: Project presentation
- D21: Knowledge management and engineering tools
- D22: Demonstrations of Web
- D23: State of the art and research priorities in the general area of early design and process evaluation, modeling and knowledge management
- D24: Early demonstrator for web based model driven manufacturing system development using capability representation
- D29: Literature review on the eco-efficiency characteristics of production processes
- D30: Definition of economic, environmental, technical and social criteria to evaluate the end-of-life treatment of products
- D39: Models and methods for knowledge life-cycle
- D41: State of the art in integrated design and simulation
- D47: Synthesis of integrated knowledge per thematic field
- D56: Interactions with international initiatives

### 2A

- D7.1 Communication network & tools: Visio-conferencing system aid
- D7.2 Communication network & tools: Collaborative engineering system aid
- D7.3 Communication network & tools: Collaborative tools activity report
- D7.4 Communication network & tools: Exercise report
- D8.1 Tools for external communication.: Communication plan
- D8.2 Tools for external communication.: Communication plan deployment report
- D16.1 Knowledge management and engineering tools
- D16.2 Demonstrations of Web
- D17.1 Demonstrative internet-based knowledge toolbox
- D17.4 Dissemination of best practice in Digital Enterprise Technology
- D17.5 Report detailing best practice in Digital Enterprise Technology
- D18.1 Commercial project management tools capabilities
- D18.2 Implementing project management capabilities in the NoE
- D21.1 State of the art on product development processes and good management practices
- D22.2 Annual Report on T22
- D23 Models and methods for knowledge life-cycle
- D24.3 Synthesis and validation of integrated knowledge per thematic field
- D25.1 Synthesis of integrated knowledge per thematic field
- D104.2 Book about Knowledge Management D29 Curricula synergy
- D30.1 Interactions with international initiatives
- D36.2 Industrial workshops and projects – Events, Proceedings, Proposals

### 3A

- D16 Updated report on SmarTeam knowledge management capabilities
- D18 Report on the project management case study
- D200 Collaboration mapping in a virtual network based on an updated expertise map and VRL ontology
- D20 Creating a common viewpoint in a virtual network. The topic in focus “life cycle costing”
- D21 State of the art on product development processes and good management practices
- D22 Annual report on potential manufacturing RE & RP processes
- D29 Curricula synergy
- D30 Interactions with international initiatives
- D33 Operational framework of the VRL-KCiP Business office

### 4A

- D6 Report on the creation of the EMIRACle association
- D16 Updated report on SmarTeam knowledge management capabilities
- D200 Updated report on knowledge mapping
- D200 Collaboration mapping in a virtual network based on an updated expertise map and VRL ontology
- D19 Compiling a book in a virtual network – overview of supporting processes and tools. The topic in focus “Unified life-cycle knowledge map”
- D20 Creating a common viewpoint in a virtual network. The topic in focus “life cycle costing”
- D21.1 State of the art on product development processes and good management practices
- D21.2 Study on quantitative potentials of software tools
- D22 Annual report on the evaluation of the potentials for integrating RE and RP in the rapid production process in industry
- D27 Virtual Communication Unit
- D106 Demonstration of text mining methods over fixed-form scientific essays A topic map over a selected engineering design area
- D300 Updated knowledge repository in the area of Virtual Product Development
- D301 Updated assessment report on the launched common research activities in the area of Virtual Product Development
- D302 Updated knowledge repository in the area of virtual manufacturing
- D303 Updated assessment report on the launched common research activities in the area of virtual manufacturing
- D314 Updated knowledge repository in the area of engineering and product life-cycle knowledge management
- D315 Updated assessment report on the launched common research activities in the area of engineering and product life-cycle knowledge management
- D316 Research Roadmap for EMIRACLE Association
- D317 Report and guidelines for the standardization and exploitation potentials of the EMIRACLE research results
- D29 Curricula synergy
- D30 Interactions with international initiatives

## 11 Section 5: Joint research activities (JRA)

Below is a short overview of the joint research activities performed during the third year.

<b>title</b>	<b>type</b>
1 Joint paper about agent-based compute...	Joint Article
2 Surface Reconstruction of Freeform Ob...	Joint Article
3 A Decomposition Method to Support Eva...	Joint Article
4 Reconstruction of Volumetric Freeform...	Joint Article
5 Effects of welding speed, energy inpu...	Joint Article
6 CIRP Design Keynote 2006	Joint Article
7 A ROADMAPPING AND CONCEPTUAL FRAMEWOR...	Joint Article
8 Improved utilisation of organisationa...	Joint Article
9 ENCYCLOPEDIA OF NETWORKED AND VIRTUAL...	Joint Article
10 Joint paper about life cycle costing	Joint Article
11 ARTICLES - A.Fischer	Joint Article
12 Contribution to keynote paper	Joint Article
13 Handbook: Introduction of teleservice...	Joint Article
14 Life Cycle Management	Joint Article
15 Advanced CAM systems and Virtual Manu...	Working Group
16 development of a life cycle cost sheet	Working Group
17 Work Group for Virtual Reality in Des...	Working Group
18 Workgroup for manufacturing education	Working Group
19 FP7: IMPROVE: Intelligent Monitoring ...	Working Group
20 test group GA Nantes	Working Group
21 Expert forum of life cycle costing	Working Group
22 Integrating expertises during the des...	Working Group
23 COPRONE FP7-ICT-2007-1 STREP Proposal	Working Group
24 Life Cycle Costing study	Working Group
25 Knowledge Management for Innovation M...	Working Group
26 European Life cycle costing	Working Group
27 Participation in FP7 Research Proposals	Working Group
28 Formula Student Car	Working Group
29 Offering European industrial studies ...	Industrial Project
30 Automatic Generation of Control Softw...	Industrial Project
31 Smart Synthesis Tools	Industrial Project
32 COOPERATION WITH INDUSTRY - A.Fischer	Industrial Project
33 DiFac Project	Industrial Project
34 Research in forging for welded and st...	Industrial Project
35 Darwin Project: EVOLVABILITY	Industrial Project
36 Joint supervision of Master Thesis	Joint Supervision
37 Joint supervision of Master Thesis St...	Joint Supervision
38 Welding process simulation using Fini...	Joint Supervision
39 Product life cycle costing	Research Grant
40 DiFac: Digital Factory for Human-Orie...	Research Grant
41 Collaboration with the European Quali...	Research Grant
42 ESCM, An internet-based education/tra...	Research Grant
43 RESEARCH GRANTS - A.Fischer	Research Grant
44 DECUPLE Project	Joint Research
45 KM Book	Joint Research
46 Advanced Reverse Engineering Methods ...	Joint Research
47 IOP IPCR Design for Usability	Joint Research
48 European Innovation and Certification...	Joint Research
49 Innovation Management Training with EQN	Joint Research

50	IOP IPCR Synthetic Environments	Joint Research
51	Innovative Design Methodology in Mini...	Joint Research
52	IOP IPCR Automated generation of cont...	Joint Research
53	IOP IPCR Smart Synthesis	Joint Research
54	FAMOUS	Joint Research
55	PLM Book	Joint Research
56	IMPROVE	Joint Research
57	IRERIS Proposal	Joint Research
58	Study about the relevance of life cyc...	Collaboration Discussion
59	Technical Meeting on Production Plann...	Collaboration Discussion

Of these 59 collaborations, 43 are relevant to the working groups pursuing the implementation of the NoE research agenda.

In addition to these joint activities a number of actions have been taken by several core partners in order to involve the network in the FP7 activities. Eight laboratories have particularly strong involvements for the network in the continuing development of FP7. They reported on more than 70 different activities and position papers, as well as 30 interactions with Technology Platforms. These actions have resulted in 13 first call proposals finally submitted by VRL partners, listed in the table below.

Below is a short overview of the joint research activities performed during the last year.

	<b>title</b>	<b>type</b>
1	and innovation management	Joint Article
2	Contribution to keynote paper	Joint Article
3	Joint paper about life cycle costing	Joint Article
4	Life Cycle Management	Joint Article
5	subdivision surfaces	Joint Article
6	Advanced CAM systems and Virtual Manufacturing	Working Group
7	COPRONE FP7-ICT-2007-1 STREP Proposal	Working Group
8	European Life cycle costing	Working Group
9	Expert forum of life cycle costing	Working Group
10	Formula Student Car	Working Group
11	Environment	Working Group
12	Integrating expertises during the design of products	Working Group
13	Knowledge Management for Innovation Management	Working Group
14	Life Cycle Costing study	Working Group
15	Participation in FP7 Research Proposals	Working Group
16	Work Group for Virtual Reality in Design and Manufacturing	Working Group
17	Workgroup for manufacturing education	Working Group
18	Automatic Generation of Control Software for Mechatronics Systems	Industrial Project
19	COOPERATION WITH INDUSTRY - A.Fischer	Industrial Project
20	Darwin Project: EVOLVABILITY	Industrial Project
21	DiFac Project	Industrial Project
22	Offering European industrial studies (surveys) as a service	Industrial Project
23	Research in forging for welded and stamped piston rods	Industrial Project
24	Smart Synthesis Tools	Industrial Project
25	Joint supervision of Master Thesis Students	Joint Supervision
26	Collaboration with the European Quality Network (EQN)	Research Grant

*Publishable final activity report*



27	DiFac: Digital Factory for Human-Oriented Production System	Research Grant
28	Product life cycle costing	Research Grant
29	RESEARCH GRANTS - A.Fischer	Research Grant
30	Knownet	Joint proposal
31	Advanced Reverse Engineering Methods for Simulation and Collaborative Design	Joint Research
32	DECUPLE Project	Joint Research
33	European Innovation and Certification Learning Systems Research Project	Joint Research
34	FAMOUS	Joint Research
35	IMPROVE	Joint Research
36	Innovation Management Training with EQN	Joint Research
37	Innovative Design Methodology in Minimally Invasive Surgery	Joint Research
38	IOP IPCR Automated generation of control software for mechatronic systems	Joint Research
39	IOP IPCR Design for Usability	Joint Research
40	IOP IPCR Smart Synthesis	Joint Research
41	IOP IPCR Synthetic Environments	Joint Research
42	IRERIS Proposal	Joint Research
43	KM Book	Joint Research
44	PLM Book	Joint Research