

Entrepreneurial research model, CIC marGUNE: A case study

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This paper presents an entrepreneurial research model, CIC marGUNE. Technological research agencies and universities work with Basque industries in CIC marGUNE under sponsorship of local government for developing and refining contemporary industrial manufacturing processes. Proposed paradigms and functional structure will benefit other developing regions of similar size, population and industrial economy.

Keywords: Design institutions, Industrial products, Manufacturing research

Introduction

In 2003, Basque Country (population, 2.5 millions) invested in scientific and industrial research an amount of 700 million €, which is 1.5% of GDP and 4.1% more than 2002 (672 million €). Country-wide investment in R&D of industrial manufacturing is > 2.5% of GDP in Sweden, USA, Denmark and Germany, to intermediate levels at 1.5-2.5% in France, Norway, and UK and lower levels in the Czech Republic, Ireland, Italy, Spain, Portugal and Greece. Spending level in Basque Country is slightly higher than that of Italy, but lags behind that of other countries with a similar per-capita income. Industrial products made in Basque Country fall under medium level of technology¹ (Fig. 1), so the risk of becoming less competitive if technology does not progress fast enough is high.

There are success stories in collaborative research work between different players in the chain of science, technology and industrial entrepreneurship, which can be used as models for many other countries. Collaboration² of 189 firms and 21 universities are briefly reported in USA. Cooperative Research Centres (CRCs) in Australia, established in 1990, has seen the creation of 158 centres of this type³. Collaborative research in biotechnology is also reported⁴. Other examples include more than 100 associations in Germany, Kplus and Kind/Knet in Austria, RRITs in

France and Competition Centres in Sweden (Table 1). In a similar way to the Basque Country, Spanish government in 2007 has set up new projects for strategic national consortia on research and technology. Proper orientation of common alliance of research and action requires a continual technological monitoring of databases on scientific papers⁵ and patents⁶, and of trade affairs such as those about machine tools like EMO and Euroblech in Hannover, JIMTOFF in Japan and IMTS in Chicago, and national fairs such as Metav in Germany, BiMH in Spain, Bimu in Italy and application based fairs such as Euromold in Frankfurt (Moulds and dies), Le Bourget Fair in Paris (aeronautics), K fair of Düsseldorf (plastics).

This study presents a model, CIC marGUNE, for collaborative and cooperative R & D of advanced manufacturing systems in Basque Country.

CIC marGUNE

Collaborative Research Centres (CICs)

CIC is a platform for multi-industry collaboration with a view of developing capacity in strategic economic and social areas for the Basque Country in the medium and long-term development. CICs are dual organizations comprising a core physical component and a virtual component. Autonomous Community of Basque Country is a region of high performance manufacturing, covering a wide range of sectors in both a vertical approach based on the value chain and a horizontal approach based on the diversity of end products produced. Creation of CIC

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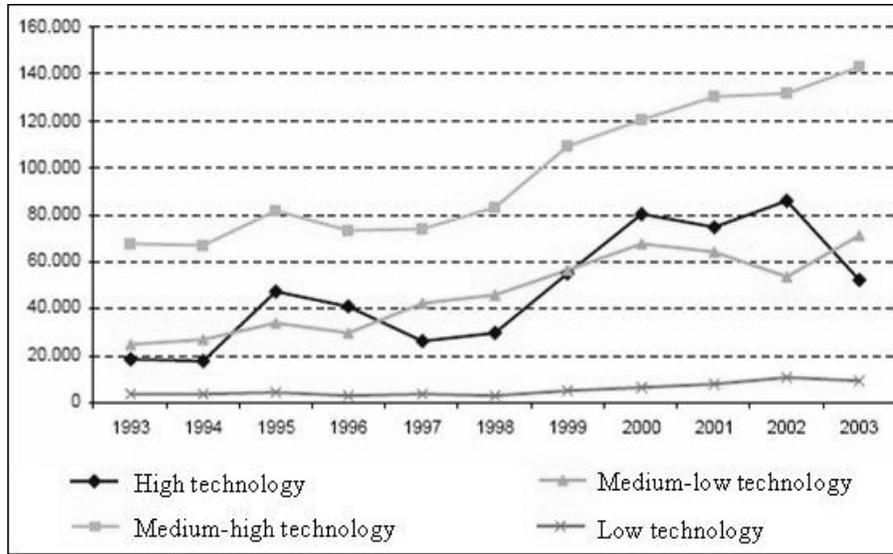


Fig. 1 —Technological level of the products manufactured in Basque Country

Table 1—Collaborative research in the world

Acronym	Country/area
CIC Biogune	Basque Country (Biotechnology)
CIC Microgune	Basque Country (Microtechnology)
CIC Biomagune	Basque Country (Biomaterials)
European Research Association for Sheet Metal Working (EFB)	Germany
Cooperative Research Association for Mechanical Engineering (FKF)	Germany
Kplus	Austria
Competence Centres	Sweden
Cooperative Research Centres (CRC)	Australia

has been encouraged as a key element in bringing together and making use of synergies existing in main strategic lines of industrial manufacturing of products. CICs aims to optimise science and technology (S & T) capacity and generate new ranges of industrial design end products with the help of entrepreneurial research in the Basque Country.

Members of CIC marGUNE

CIC marGUNE has most potential in bringing together research characteristic of universities, with approaches more closely linked to actual industrial practice and characteristic of technology centres, with the help of existing industrial corporations. The participation of intermediate innovation organizations (Foundation INVEMA) insures that results will be properly transferred to the fabric of industry in the

Basque Country. Number of active members of CIC marGUNE has grown steadily since its founding in November 4, 2002. Membership now includes following representatives of the leading industrial players at different levels of the value chain in manufacturing technologies: I) *Universities*: University of the Basque Country (Faculty of Engineering of Bilbao), Faculty of Engineering of the University of Mondragon (MGEP) and the University of Navarra (Tecnun); ii) *Research Centres*: Ideko S. Coop., Fatronik, Labein, Tekniker, Koniker S. Coop., Aotek S. Coop., Lortek and Azterlan Metallurgical Centre; iii) *Corporations*: Danobat Group S. Coop., Goratu SA, CIE Automotive SA, ITP SA, SAPA SA, Loire Safe, Ona Electroerosion SA and Mondragon Industrial Automation; and iv) *Intermediate Innovation Organizations*: Foundation Invema.

CIC marGUNE core

Functions of CIC core are as follows: i) General coordination of the research activities laid down in the plan of action; ii) Performance of part of the research; iii) Performance or hosting of benchmark training activities in its specialist scientific and technological area; iv) Direct management, transfer and exploitation of the results of activities in the common framework; and v) Ownership of all equipment and infrastructures acquired for the performance of activities and projects.

Virtual CIC marGUNE

Virtual component comprises the body of researchers through which technology partners take part in projects.

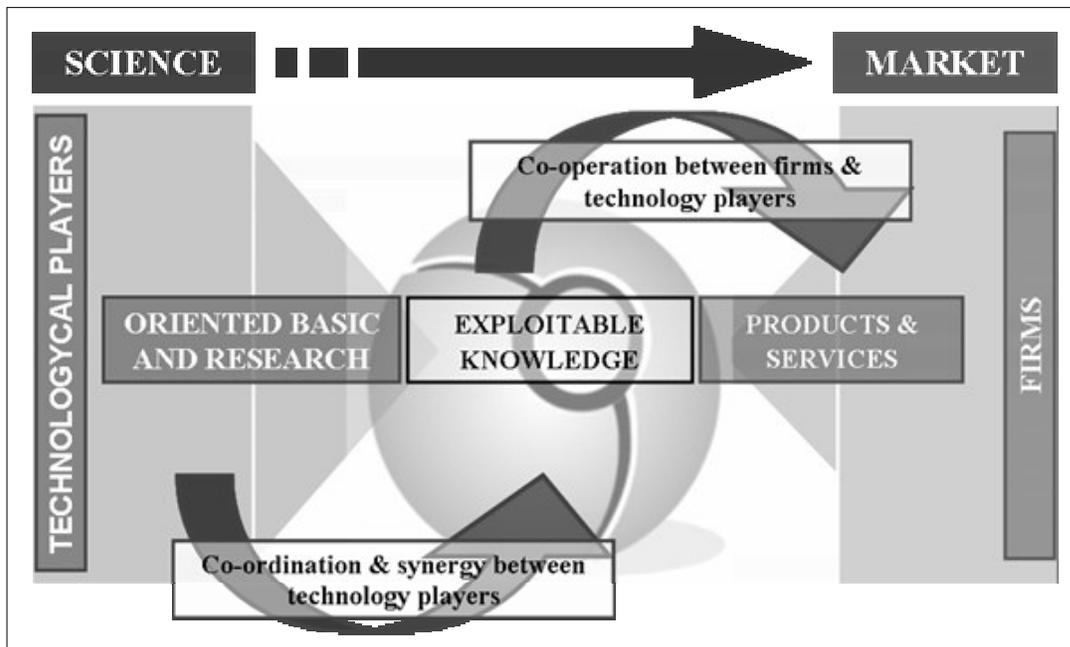


Fig. 2—General layout of research and its transfer

CIC marGUNE was set up as a CIC in high-performance manufacturing with the remit of making the firms in its area more innovative by introducing manufacturing processes that are energy efficient and developing excellence in industrial research. High-performance manufacturing is an especially significant process that covers a wide range of sectors from both a vertical approach based on the value chain and a horizontal approach based on the diversity of industrial design end products. In 2005, basic workforce of virtual CIC was 78 researchers with different skills and professional experience. This number grew up to 90 in 2007.

In accordance with the strategic frameworks established by public organizations and concepts of basic and industry oriented research⁷, CIC marGUNE seeks to carry out research in two areas: i) Basic research where prevailing need is for a greater knowledge of fundamentals of scientific processes, making use of research potential of universities involved, supplemented by the work of technology centres; and ii) Industrial research where knowledge acquired is applied.

Organisation of CIC marGUNE

Organizational structure of CIC marGUNE is based on a CIC core and a Virtual component, seeking maximum flexibility. Virtual team comprises researchers working on each project, which are provided by technological members (universities and technology

centres) of marGUNE according to needs for each action. Number of researchers working in marGUNE activities can therefore vary from one year to the next without affecting desired goal of the system. New research teams in new areas not covered by the technological members are possible to form to integrate them into CIC core marGUNE.

The function of CIC core is to handle a small part of the actual research work, to coordinate activities and to take responsibility for ensuring usefulness of results in industrial manufacturing processes. The use of information and communication technology, which is handled by an extranet (www.marGUNE.org), is fundamentally important for the coordination of these actions. The coordinated, synergetic oriented basic and applied research work of technological members is turned into usable knowledge that is transferred through collaboration projects from those technological members to companies (Fig. 2), which transform knowledge into new products and, in short, into greater wealth for the country. Therefore, paradigms of common work are collaboration, cooperativeness, common technological lines, but transfer to companies through specific projects, even to companies with competitive products in market. However, alliances between firms make possible a better use of results, in the same way as reported by Moterhan⁸. Common formation of technicians⁹ is also performed in multidisciplinary subject and in a inter-organizational way.

Most important committee of marGUNE is the so-called Projects Directory, in which all partners carry out their new project proposals, and make regularly the tracking and evaluation (partial and final) of the just developed research projects. Decisions from this group are evaluated by the General Board and the Industrial Partners Board. Scientific Advisory Committee meets every year to recommend new research lines; currently it is formed by the CIRP members (International Academy for Production Engineering, www.cirp.net), in charge of main groups of this international association.

Developed Research Projects

CIC projects can be distinguished in two phases: i) 2003-2005 phase; and ii) 2005-2007 phase.

2003-2005 Phase

During this phase, following projects entailed 3 million € of investment: i) *ARKUNE*: Machining process monitoring¹⁰ system tries to improve Basque machines; ii) *BEROTEK*: New machining process, known as Rapid Tooling, Rapid Prototyping, or Rapid Manufacturing, assisted by heating addition systems is increasing in demand; iii) *EXACMED*: Advanced measurement systems has been applied to experimental studies of machining processes¹¹ with models for milling, drilling and turning using Finite Elements Technology and mechanical approaches; and iv) *ULTRASON*: New ultrasonic based machining processes, for drilling, turning and stress relaxation.

2005-2007 Phase

Following projects entail 2.9 million € of investment, being now developed with multidisciplinary groups: i) *GEHITU*: This project based on study of supplied material processes based on mixed technologies includes some applications for moulds and dies manufacturing that has been successfully performed; ii) *SURFMAN*: Measurement of tensile stress and structural changes due to the machining process applied; iii) *CALGESUP*: Assessment of integrity and accuracy during machining processes; iv) *DIAPASON*: It provides advanced machining process from the point of view of process modelling, virtual simulation and monitoring¹²; v) *KONAUTO*: New forming process to generate low rigidity new generation car parts; and vi) *ULTRAMEC*: Analysis of drilling, turning and dressing grinding wheel processes assisted by ultrasonic systems. Some projects are already at the development stage, and industrial

applications are being sought; for example, plasma deposition technology where process and machines are simultaneously developed.

Collaboration within Spanish Manufacturing Scheme

MarGUNE, working together with the University of Basque Country, is now trying to increase collaboration between centres, universities and companies of Spain, in the area of manufacturing technologies. This effort resulted in the development of technological network on advanced manufacturing technologies, so-called R²-TAF (www.ehu.es/r2taf), composed by 25 universities and technological centres, which started off in 2005. Topics suitable for collaboration are advanced removal processes, electro discharge machining, deformation, information technologies, etc.

R²-TAF, led by five partners (marGUNE, University of Basque Country, University of Cadiz, University for Distance Studies UNED, and Spanish Society of Manufacturing Engineers), collaborates in R & D, education and professional skills, normalisation, and cooperation with industrial firms. MarGUNE provides collaboration, cooperation, and industrial focus to this network. Margune partners are also involved in cooperation activities funded by the European or local institutions, such as IPROMS (VI FP), Aerosfin (Interreg), Mantys (V FP), etc.

Results

CIC marGUNE during 2005-2007 had following scientific results: i) 40 scientific papers; ii) 28 contributions to international conferences and symposiums; and iii) 5 philosophical dissertations submitted, 6 are in advance development stage. Industrial outputs include 2 new patents and 14 industrial development projects about new concepts of machine tools and processes. A dynamic evaluation scheme of results is being used based on these indicators. A new strategic plan for 2009-2012 is being proposed, open to international collaborations.

Conclusions

A new concept, CIC marGUNE, in research based on collaboration between entrepreneurial players of different kinds (universities, technology centres, and corporations) has been presented. It seeks to develop new processes on the basis of in-depth knowledge of manufacturing processes, which are taken up by machine

tool and manufacturing sectors, thus effectively upgrading market technology. The experience and the concept can be exported to other communities, regions and countries. MarGUNE can be a link with national indicatives focused on cooperation in research, as in Spanish Network R²-TAF. CIC marGUNE brings together the efforts of competitors in order to improve their unique capabilities, make their efforts in oriented basic and applied research more effective in the framework of manufacturing technologies.

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References

- 1 Hatzichronoglou T, *Revision of the High-technology Sector and Product Classification, Working Paper 1997/2* (OECD, STI, Paris), 1997.
- 2 Santero, M D & Gopalakrishnan, S, The institutionalization of knowledge transfer activities within industry–university collaborative ventures, *J Engg & Technol Mgmt*, **17** (2000) 299-319.
- 3 *Science and Training. CRC: Success Through Innovation, Issue 6* (Australian Government, Department of Education,) October 2005.
- 4 Chiesa V & Toletti G, Network of collaborations for innovation: The case of biotechnology, *Technol Anal & Strategic Mgmt*, **16** (2004) 73-96.
- 5 <http://www.sciencedirect.com>
- 6 Stephen van Dulken, Free patent databases on the Internet: a critical view, *World Pat Inform*, **21** (1999) 253-257.
- 7 *Frascati Manual: Proposed Standard Practice for Surveys Research and Experimental Development* (OECD,) 2002.
- 8 Morteihan O, The role of firms collaborative agreements in the information technology industry transformation, *Technol Anal & Strategic Mgmt*, **16** (2004) 53-71.
- 9 Steensma H Kevin, Acquiring technological competencies through inter-organizational collaboration: An organizational learning perspective, *J Engg & Technol Mgmt*, **12** (1996) 267-286
- 10 Peña A, Rivero A, Aramendi, G & López de Lacalle L N, Monitoring of drilling for burr detection based on internal signals, *Int J Machine Tool & Manuf*, **45** (2005) 1614-1621.
- 11 Arrazola P J, Villar A, Ugarte D, Meslin F, Le Maître F & Marya S, Serrated chip prediction in numerical cutting models, in *8th CIRP Int Workshop on Modelling of Machining Operations* (Chemnitz, Germany) 2005, 115-122.
- 12 Gonzalo, O, López de Lacalle L N, Cerro I & Lamikiz A, Prediction of milling forces from oblique cutting FEM model, in *8th CIRP Int Workshop on Modelling of Machining Operations* (Chemnitz, Germany) 2005, 235-243.