13 THE ROLE OF UNIVERSITIES DEVELOPING NEW COLLABORATIVE ENVIRONMENTS: ANALYSING THE VIRTUELLE FABRIK, SWISS MICROTECH AND THE TENET GROUP

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In both developed and developing countries, different initiatives are carried out to motivate organisations, mainly companies, to network in new collaborative environments for innovation. In many cases these different initiatives have been promoted by Universities where academic researchers play a very important role by diffusing these networking concepts to local SMEs and by carrying out applied projects to coach firms in the formation of these new collaborative environments. In some occasions, Universities can also join the network to transfer new knowledge during the new product/service development process. The Virtuelle Fabrik and Swiss Microtech in Switzerland and the TeNeT group in India are three successful collaborative environments located in very different settings where the local University has played and still plays an important role for the collaborative environments' continuous evolution and improvement. Therefore, the objective of this paper is twofold: 1) to assess the University key role for developing new collaborative environments and 2) to propose a methodology to benchmark the different initiatives in Universities to develop new collaborative environments.

1 INTRODUCTION

Growing global competition requires companies to be more competitive, improving their productive and business processes to operate in a leaner way. Enterprises are constantly under pressure not only to offer high quality products with competitive prices, but also to be constantly innovative offering new products and services to the international and borderless markets. One current trend is the development of networks within collaborative environments to increase their innovation capability, where usually companies focus on the development and sharing of core competences. As a result, different networking models have emerged, such as Extended Enterprises, Virtual Enterprises and Breeding Environments.

Nevertheless, most of the times research focuses on networks made up mainly of

companies, and less attention is paid to the different actors in the territory and the local infrastructure provided to these enterprises by Universities (specially to SME's), which in many cases enable or disable them to be more innovative. Universities play a critical role as a source of fundamental knowledge, therefore should contribute in the formation of new collaborative environments increasing their innovation capabilities and continuous improvement. Universities can in fact be considered as a focal element for the development and dissemination of new knowledge and technologies for the design, development and commercialisation of new products and processes. Therefore, research should also be carried out to analyze and promote different agents in the territory, such as Universities as potential partners to create and be integrated in these new collaborative environments for the transfer of knowledge to foster innovation and promote regional sustainable development. This paper will describe and analyse three case studies where Universities have played an important role to create successful collaborative environments (CE).

2 RESEARCH OBJECTIVES AND APPROACH

The research approach selected was to develop case studies where three different Universities in different locations have enabled the creation of successful collaborative environments. A case study is an examination of a specific phenomenon such as a program, an event, a person, a process, an institution or social group. The bounded system, or case, might be selected because it is an instance of some concern, issue or hypothesis. According to Yin (1994) a case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, specially when the boundaries between the phenomenon and context are not clearly defined. The **objectives** of the research were to:

- Study how with the support of Universities new collaborative environments can be started by coaching and motivating local companies and entrepreneurs
- Analyze which processes and tools can be proposed by academic partners to enable the network to collaborate sharing information and improving their operative processes.
- Identify how a University collaborates within the collaborative environment transferring new knowledge for innovation.

3 CASE STUDY 1: THE UNIVERSITY OF APPLIED SCIENCES OF NORTHWEST SWITZERLAND (FHNW) AND THE VIRTUELLE FABRIK (VF)

The Virtuelle Fabrik (VF) is the linking together of real companies with the objective of entering new markets or realizing concrete projects that for the individual companies would not be possible in a profitable manner. As the cooperative association offers a broad spectrum of products and services, it is more attractive than the individual SME. With an order orientation, the core competencies of the Virtuelle Fabrik partners are utilized efficiently and flexibly. At present, there are 20 companies in the network, employing a total of 1500 employees. Their core competencies lie in the areas of engineering and services, mechanical processing, precision mechanics, sheet metal processing, metal working, surface treatments, heat treatments, fitting, welding techniques, plastics injection moulding, plastics working, electrical and electronic engineering. In the entire value-added chain, the

VF offers total solutions and services for assemblies and sophisticated components and replacement parts.

Initially, the VF Project was granted financial support by the Swiss CIM (Computer Integrated Manufacturing) Action Program and organized in a process-oriented manner. The time plan for the project was a period of two years (1997 to the end of l998) and consisted of:

Project Phase I: (1) Analysis and definition, (2) Building of the core network and (3) Prototypical production

Project Phase II: transitioning of the project into independence: it was taken into account that once the project had transitioned into independence, the management processes, main processes, and support processes would continue to function. The basis for management of the project was worked out jointly in a Project Team and voted upon as the project plan. For each process, responsible persons, goals, and resources were defined for the most important activities. Internal project monitoring was conducted each quarter**.** In the starting phase, the project worked closely with the **Institute for Technology Management (ITEM) at the University of St.Gallen**. The transfer of experience and tools from another VF project, "Euregio Bodensee," went smoothly. In order to coordinate activities between the two networks and allow the mutual exchange of experience, a "VF Forum" was held quarterly. At the end of the two-year period, the network had developed its own dynamics to the extent that it was functioning independently and profitably. **Success Factors** as seen by the partner companies are:

- **The Concept:** The VF is an open, simple, densely woven concept, with rules and roles, which works. With the VF, the required professionalism can become visible.
- **The Structure:** The VF has a flexible structure; the customer deals with only one dedicated customer service representative for all problems and gains the services of the entire value-added chain. The interfaces are fluid.
- **The Market:** The time is ripe for the VF as a business model for the future for the processing of complex tasks in the time allotted. Large-scale customers want to purchase complex goods and services that can be produced reasonably only by value-added chains. This is confirmed by the market's perception and acceptance of virtual companies.
- **The offensive Strategy:** In the entire group of network partners, there is a large proportion of companies that follow expansion strategies and that want to develop the VF accordingly.
- **Innovation Willingness:** The companies in the network have to have enthusiasm for the "new," seek new developments, and be prepared to make the occasional investment even if the potential return is not immediately measurable.
- **Multiplication Effect:** Each company has its own established contacts. If these contacts are pooled, new market opportunities can be targeted. Each member company profits from the networks of the others.
- **Partnership:** The "chemistry" among the partners is good, and their interests point towards the same goals, so they can achieve together what they set out to do. The value of partnership becomes particularly apparent when a company has a project and the others refuse to let the company down, even if they themselves are managing heavy loads. If the relationships are good, you help the partner out. Even those partners that are unable to provide that degree of engagement have to

be brought into projects again and again.

- The Culture of Communication: The face-to-face events (conferences for the mutual exchange of experience) have to held frequently enough that thoughts can be exchanged and the "worlds" brought into alignment, so that everyone speaks the same language and follows the same goals. The Executive Committee has the job of making transparent various ways of looking at things, for the network is not looking only to decide by the majority, but rather to examine varying possibilities as well. One of them could turn out to be a potential strength. An Intranet platform was set up to facilitate communication within the VF. Through Intranet communication, all partner companies can post projects and seek possible cooperation partners. One of the ground rules of the VF is that the partner companies must check the Intranet platform at least once a day. This obligation was agreed upon so that projects can be processed as rapidly and efficiently as possible.
- **Know-How:** The VF is a network for knowledge management.
- **1. FHNW key role during the collaborative environment creation phase**
- Project management and administrative tasks (preparation and execution of meetings, animation of work groups, coaching, reporting etc.)
- Know how transfer on networking concepts, prepare, chair and analyse workshops to create new concepts an processes
- Being a neutral “referee” for the project members
- Identification of the ICT-supportable processes and development of the first web-based intranet platform. This intranet was developed with researchers form the university of applied sciences northwest Switzerland, which is - since the beginning, a partner of the network.
- **2. FHNW role for the Virtualle Fabrik continuous improvement**
- R&D partner for national and international projects (discovering interesting projects, preparation of proposals, taking over R&D activities etc.)
- Active partner of the network as part of the steering-team and in tasks as coaching, administration and new partner acquisition
- Pursue, support and enhance the collaborative ICT-platform
- Combined efforts in publishing scientific papers, books and articles in business magazines.

4 CASE STUDY 2: ECOLE POLYTECHNIQUE FÉDÉRAL DE LAUSANNE (EPFL) AND THE SWISS MICROTECH

The Ecole Polytechnique Fédéral de Lausanne (EPFL) is one of the two Swiss Federal Institutes of Technology. In particular, the Laboratory for Production Management and Processes (LGPP) was created in 1995 in order to answer to the challenges faced by the manufacturing industry in the medium and long-term. The development of collaborative networks has been one of the main objectives in the LGPP’s research agenda.

The roots of the Swiss Microtech network can be found in a survey executed in 1998 (Bigoni et. al, 1998) by the EPFL on behalf of the Swiss Commission for Technology and Innovation (CTI) of the Swiss federal government which showed the difficulties faced by the screw machining subcontracting branch:

- These small companies were more and more unable to get in touch with large

customers of the automobile, electronics and medical branches which drastically reduced the number of their suppliers to those able to provide a complete delivery including engineering, machining, thermal treatments and assembly
- These SME were technically up to date, but their commercial services were lacking and their delivery schedules were too long and not very reliable

Following one of the recommendations of the survey, 10 enterprises belonging to the same professional association decided to start an applied research project aiming to develop a competitor based strategic network and asked for the support of the EPFL to define and lead the project which started in 2000. The first step was the definition of the strategy: the expectations of potential customers were gathered by the way of a questionnaire-based survey followed by interviews with selected potential customers. The definition of the product and market segments to be addressed by the network was directly derived from these results. The structure, roles and business processes were defined and have been tested by simulation during 4 months. Finally, the rules of the game were summarized in a chart to be signed by every partner. The legal framework of Swiss Microtech is an association with lucrative goals. After one and a half year, when the time had arrived to formally create the network, half of the initial project members decided to leave the project. Mistrust and fears were stronger then the desire of collaboration. **An important action of EPFL was to motivate the four most committed members to continue until the creation of Swiss Microtech Enterprise Network, which was officially announced at the end of June 2001. EPFL has been an important facilitator** by taking over the following tasks:

1. During the collaborative environment creation phase

- Preparation and redaction of the funding proposal for the Swiss government
- Project management (preparation and execution of meetings, animation of work groups, coaching, reporting etc.)
- Know how transfer on networking concepts and best practices
- Being a neutral "referee" for the project members
- Enabling the Swiss MICROTECH strategy definition together with clear business processes and organisation.
- **2. EPFL key role for Swiss Microtech continuous improvement**
- R&D partner for national and international projects (discovering interesting projects, preparation of proposals, taking over R&D activities, etc)
- Defining and following students' internships in close collaboration with the network to address specific problems
- Technological surveys and dissemination of results
- Developing new projects to form new collaborative environments in other sectors.

5 CASE STUDY 3: THE INDIAN INSTITUTE OF TECHNOLOGY MADRAS (IITM) AND TENET GROUP

The Indian Institute of Technology, Madras (IIT Madras) is a college of engineering located in Chennai, India. Founded in 1959, it is chronologically the third among the Indian Institutes of Technology established by the Government of India to provide high quality education in **the fields of engineering and technology.**

The TeNeT started in 1994 encouraged by the dream of three professors to

develop the rural areas of India: Ashok Jhunjhunwala, Ramamurthi and Gonsalves. The Telecommunications and Computer Networks Group (TeNeT) is a dedicated aR&D network of companies that collaborate closely with IIT professors on the field of telecommunications and computer networking. The mission can be summarized as developing new technologies, fostering research and establishing a man power base in the field of telecommunications and computer networking (Flores, 2006)**.**

The TeNeT group started with a clear vision: To develop new technologies that can be affordable to the rural areas in India by designing and delivering state of the art products that can compete in international markets, which are at the same time specifically suited to developing countries, such as India, in terms of affordability and adaptability. In terms of organisation, TeNeT performs at least one monthly meeting with the partner companies and professors linked to the network to develop new ideas to develop new products. If one idea looks feasible, TeNeT will try to find the adequate partner through the alumni network. After and idea is created (internally or externally), the TeNeT group will evaluate if the competencies are existent within the TeNeT or in IIT. The new technology to be developed should be cost effective and competitive in the global market, focusing on developing countries needs. One key issue about TeNeT is that it has created its own venture capital structure to enable the financing of the new ideas into products. For the TeNeT growth, IIT Madras has provided the infrastructure, such as laboratories and spaces for offices. Up to know, at least six new products have been launched by the TeNeT group.

1. IIT Madras role during the collaborative environment creation phase:

- Identification of market opportunities for new Information and Communication Technologies (ICT) in the rural areas in India
- Discovery and selection of IIT Madras ex-students that could be interested to become entrepreneurs and open start-ups to commercialize the innovations
- Project management and risk analysis for the new product development
- Strong collaboration of IIT Madras researchers and students in the development of the new product. Initially all the start-ups were located inside the campus.
- Searching for seed venture capital for the development of new products

2. IIT Madras role for the TENET group continuous improvement

- Coaching of the TeNeT group to link the members and perform strategic planning to develop new products as a network
- Coordinating monthly meetings to share ideas and make strategic decisions
- IIT Madras professors act as brokers looking for new ICT market needs and transfer knowledge during the development process.
- Strong dissemination of the TeNeT group by publishing scientific papers.

Table 1. Comparison of the three collaborative environments under analysis

COLLABORATIVE ENVIRONMENT	VIRTUELLE FABRIK	SWISS MICROTECH	TeNeT
UNIVERSITY	**FHNW**	**EPFL**	**IIT MADRAS**
LOCATION	Switzerland	Switzerland	India
GEOGRAPHY	All partners located in the same regional area	All partners located in the same regional area	All partners located in the same regional area
LANGUAGE	German, English occasionally	French , English occasionally	Mainly English, then Tamil and Hindi
INITIAL FUNDING TO DEVELOP THE NETWORK	Swiss Commission for Technology and Innovation (CTI) applied project	Swiss Commission for Technology and Innovation (CTI) applied project	Willingness of professors not paid by a funded research project
FUNDING TO IMPROVE THE NETWORK	Swiss Commission for Technology and Innovation (CTI) and European Commission (FP6)	Swiss Commission for Technology and Innovation (CTI) and European Commission (FP6)	USA venture capital Some European multinationals like Nokia have also provided funding for R&D
COLLABORATING ENTITIES	Existing companies and FHNW as coach	Existing companies and EPFL as scientific coach	Start-ups and IIT Madras as key partner for knowledge transfer for new developments
COMPANIES	20	7	14
SECTOR	Metal components and parts manufactured by different machining processes	Screw machining enterprises, other machining processes and thermal treatments	Telecommunications new products
SCOPE	Common marketing strategy Share competences and productive capacity New Product Development and innovative Solutions	Develop new markets shorten delivery schedules, increase their flexibility and reduce production costs Add new services like engineering of parts and logistics	New Product Development coached by IIT Madras Collective Learning Technical knowledge Transfer from Universities to companies
MARKET	Solutions - of the concept over the manufacturing up to the care of products within the range of electromechanical building groups to be sold mainly in Europe	90% export mainly to Europe and USA	Initially for rural India; nowadays global mainly other emerging economies (such as Africa and Latin America with the same need for low cost telecommunication technologies).

Table 1. Comparison of the three collaborative environments under analysis (cont)

COLLABORATIVE ENVIRONMENT	VIRTUELLE FABRIK	SWISS MICROTECH	TeNeT
UNIVERSITY	**FHNW**	**EPFL**	**IIT MADRAS**
COMPETITION AMONG PARTNERS	No direct competition in products on the market but overlap in competences	Yes	No direct competition in products
COLLABORATION MODELS	Breeding Environment enabled by the FHNW and Virtual Enterprise formed by the companies (SMEs)	Breeding Environment enabled by the EPFL and Virtual Enterprise formed by the companies (SMEs)	Breeding Environment enabled by IIT Madras professors and new Virtual Enterprises formed by the companies & IIT Madras according to technological needs
ORGANISATION	Association with responsible units: Steering-Team and Workgroups as much as defined roles: Broker, Order Manager, Coach, In/Outsourcing managers,	Association with lucrative goals. Rules and key roles have been defined: Broker Order Management Coach In/Outsourcing managers	IIT Professors acting as brokers, identifying business opportunities and coaching the network. Strong motivations to file new patents were IIT Madras obtains loyalties.
OPERATIVE PROCESSES	Well defined and shared by all members to manage the complete value chain: Financial Controlling, Marketing and Sales, Development and Member Acquisition, Infrastructure (IT), Training, and Order Processing	Business is done by the members only and each partner is responsible of its own operative processes. Virtual Enterprises are steered by one leading company. The management of the network is supervised by the coach.	Each partner is responsible of its own operative processes.
COLLABORATION ENABLING FACTORS	Common goal to develop new and innovative product(s) Reduction of costs and lead times as a main goal Proximity and Trust Collaborative ICT	Accessing new markets, developing new services and reduction of costs and lead times as main goals Proximity and Trust	Development and sharing of Human Capital New Knowledge Creation Common goal to develop new product(s) Proximity and Trust
INFORMATION & COMMUNICATION TECHNOLOGIES	"Webcorp" developed and provided by FHNW. All partners receive training to use the platform.	Webcorp developed and provided by EPFL in collaboration with FHNW. All partners receive training to use the platform.	Non existent

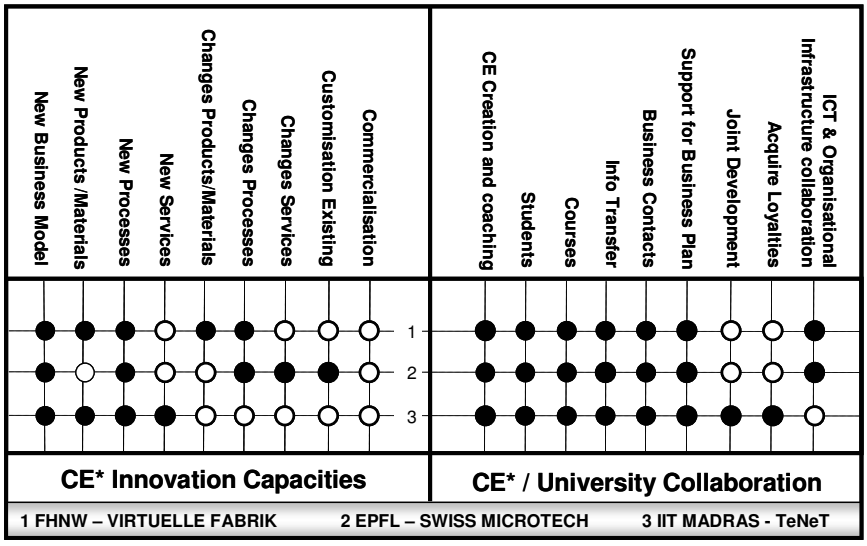
6 PROPOSED METHODOLOGY TO ASSESS THE UNIVERSITY – COLLABORATIVE ENVIRONMENT (CE)

To analyse the three case studies developed, a four step methodology has been proposed as follows:

1) Identify the types of innovations carried out: To identify how can a University may impact the innovation capabilities of the companies within the collaborative environment (CE), it is necessary to identify the types of innovations that the CE is carrying out. For the analysis, the following levels of innovations will be considered: a) Commercialization of existing technologies new to the domestic market, b) Transfer and customisation of existing technologies new to the domestic or emerging market, c) Changes or Improvements of own products and d) New developments

2) Classify the types of Collaborative Environment (CE) – University collaborations: Five main types of collaborations have been identified: a) CE Creation and Coaching, b) Information Transfer (students and courses), c) Start-up development (Business plan and business contacts), 4) Knowledge enhancement for new product development (joint new product development or acquire loyalties), 5) Building Infrastructure (such as ICT platforms, network strategy definition and business roles and rules).

3) Map the Innovation / Network – University Collaboration: Based on the proposed typology of innovations that could be carried out by the network and the proposed classification of possible CE - University interactions, a map can be performed to identify the possible relationship between the innovation activity of the CE and the level of collaboration with the University. Figure 1 shows the map performed for the three case studies under analysis.



CE – Collaborative Environment

Figure 1. Mapping the CE – University Innovation Capacities and Collaboration

4) **Identify the enabling Collaborative Environment – University**

collaboration factors: One of the main goals of the current research is to identify the possible enabling factors that enabled Universities to develop these new collaborative environments. The high and low frequency of successful Collaborative Environments and University interactions could be the result of many different factors which are present at the national and regional spatial contexts, but also in socio-cultural aspects of companies, such as their decision to invest or not in innovation activities and to trust other partners who in some occasions are competitors. At the same time, Universities internal infrastructure and knowledge transfer mechanisms may motivate or not local companies to consider them as potential partners to coach them and be part of new collaborative environments. The identified enabling factors have been aggregated in four main groups:

1) **Spatial elements**, consider all those factors that are embedded in the nation or region which facilitate the transfer of knowledge to increase the innovative capability of new collaborative environments. **Absorptive capacity**, the ability to learn and innovate by including external information in the learning process, is not only required at companies but also in the Universities. At the same time, the **Innovative Culture**, the need and high motivation to invest in innovation, define innovation targeted policies, learn about new methods to develop new products and being updated of the latest technologies should be a task to be carried out by both companies and Universities to be part of the collaborative environment. This interest to do innovations will actually be the seed that could make these collaborations to emerge. **Proximity** should be seen as a competitive advantage, as actors in the same territory should learn about each other capabilities and look to be closer to target innovations.

2) **University Infrastructure**, refers to all the elements that should be present in Universities to facilitate and encourage collaborations. One key enabler to attract firms is the possibility to use the **laboratories** in Universities which are too costly for companies to sustain and which are necessary for the development of new products and technologies. **Human resources** are also important, in the sense that professors should be motivated and interested to do joint projects with the local networks and motivate them to collaborate. The University should also motivate professors by measuring the impact that their innovations and knowledge transfer activities with local networks. As on most occasions academic researchers don't have experience working in the industry, Universities could define programmes where their professors spend sabbatical periods in the local industries understanding their needs and networking with the business staff as part of the CE.

3) **Information and Knowledge Transfer from Universities to companies in the CE** refers to all the different ways Universities could transfer knowledge and collaborate with companies to enable the formation of new networks which will also be dependent on the absorptive capacity of the companies to be interested to learn from external sources of knowledge (in this case coming from the University forming the collaborative environment). It is important that companies take into consideration that all these sources of information and knowledge will be also based on the motivation and internal strategy from each single company.

4) **Entrepreneurship** regards to the entrepreneur culture of the companies participating in the collaborative environment, being motivated to collaborate with others and start new businesses**.**

Table 2 shows the comparison of the enabling factors identified in the three collaborative environments**:**

Table 2. Collaborative Environment (CE) – University collaboration factors

	Virtuelle Fabrik	**Swiss Microtech**	**TeNeT**
1) Spatial Elements			
1.1) Absorptive capacity	+++	+++	+++
1.2) Innovative Culture	+++	++	+++
1.3) Proximity	+++	+++	+++
1.4) Informal and Formal Contacts	+++	+++	+++
1.5) Trust	+++	+++	+++
2) University Infrastructure			
2.1) Laboratories	+	+++	+++
2.2) Professors with Industrial Experience	+	+++	+
2.3) Professors motivated to form collaborative environments	+++	++	+++
3) Information and Knowledge Transfer from Universities to companies in CE			
4.1) Students working in company projects	+	+++	+++
4.2) Specialised courses to local industry needs	+	++	++
4.3) Conferences to Industry	+++	++	+++
4.4) Joint R&D Projects	++	+++	+++
4) Entrepreneurship			
4.1) Entrepreneurship Culture	+	+++	+++
4.2) New Business Development Support	++	++	+++
Intensity: +++ High, ++ Medium, + Low			

7 CONCLUSIONS

Industry-University collaboration is increasingly becoming an important topic to spur collaboration for innovation in local networks, specially for many policy makers that aim that these two actors join forces in Collaborative Environments. Nevertheless, as observed from the three case studies presented, it is also quite evident that companies are actually the ones that can push innovations up to their commercialisation and that collaboration is very much dependent on how much open they are to learn and use Universities' knowledge. Companies that don't see any value from the information or knowledge that Universities can provide will not collaborate. On the other hand, some Universities are also much more active providing infrastructures and targeting the needs of the local companies to form these new collaborative environments and to carry out joint developments. In Switzerland the Swiss Commission for Technology and Innovation (CTI) has been a

key enabler providing funding to start these collaborative environments. On the other hand, the main encountered problems that academic partners had to form the collaborative environments were:

1. At the beginning, mistrust, specially where members are competitors.
2. Some partners were ready to take but not to give (opportunistic behaviour) .
3. Several organisations did not believe in the collaborative network to innovate or were not able to convince other employees in their own company .
4. Some mistrust against the academic world.

This paper aimed to highlight the importance of Universities to promote and enable the formation of Collaborative Environments by managing applied research projects, diffusing these concepts and coaching companies by presenting three successful case studies: the Virtuelle Fabrik, the Swiss Microtech and the TeNeT group. It is true that working cultures and missions are different, nevertheless both could try to find new mechanisms to make collaborations happen as Universities have played and are playing a key role to create new Collaborative Environments. A methodology was also presented to map the impact of these collaborations including the CE – University Innovation Capacities and identifying four main collaboration factors: 1) Spatial Elements, 2) University Infrastructure, 3) Information and Knowledge Transfer from Universities to companies and 4) Entrepreneurship.

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