Summary of the Study

Nanotechnology Cluster in the Region Dresden/Saxony

February 2006
Within the scientific and economic scenery in Dresden nanotechnology plays an increasingly growing part. This is the reason why the Capital of Saxony Dresden (Department of Economic Development) together with the Saxon ministries for Economic Affairs and Employment, for Scientific and Social Affairs and further partners has decided to order an extensive study, which informs about the actual status-quo and the future development of the nanotechnology location Dresden / Saxony. The present brochure gives a summary of the results of this study. The aim of the study is, on the one hand, to analyze the status-quo of nanotechnology in the area Dresden / Saxony and, on the other hand, to demonstrate further steps to enhance the developing nanotechnology cluster Dresden. For this study such means as expert interviews, questionnaire surveys and workshops were employed. Below a short summary of the main results can be found to get a first – objective – impression of this location and its development potentials.

**Nanotechnology**

Nanotechnology is one of the key technologies of the 21st century. Already today, products only realized with the help of nanotechnology, generate considerable sales. These sales will increase enormously with the economical breakthrough of nanotechnology.

biotechnology and new materials. Nanotechnology comprises the manufacturing investigation and application of structures, molecular materials, inner interfaces and surfaces with at least one critical dimension or with machining tolerances beneath 100 nanometers. The crucial fact here is that only due to the nano size of the system components, new functions and properties emerge, with which products can be improved and new products can be developed. These new effects and improvements are mainly justified in the ratio of surface to volume atoms and in the quantum mechanical behavior of the material. Already today, nanotechnology influences numerous products in the field of electronics, data storage, functional films and precision optics. For the year 2015 a market volume of about US$ 1,000 billion is expected.

**Future: Nanotechnology**

Nanotechnology is regarded as one of the most promising future technologies. It is no basic technology but rather an interdisciplinary approach across industrial branches for further progress in the field of electronics, optics, development.

The area Dresden / Saxony belongs to the few economically prospering areas of eastern Germany. Here, early successes inspired high-tech enterprises and initiated numerous start-ups, especially in the field of nanotechnology. This region was able to use its excellent research infrastructure, well-trained employees and a long tradition in the field of high technology. Presently, approximately 80 enterprises (out of 500 nationwide) and 40 scientific organizations work in the field of nanotechnology.

Nanoparc GmbH, together with Research Centre Rossendorf, developed the world’s first UV-light source in silicon technology.
Cluster-based economic policy for high-tech sectors

High-tech enterprises – e.g. enterprises dealing with nanotechnology – are not evenly spread out, but concentrated in spatial clusters. The Harvard economist Michael Porter defines clusters as a regional concentration of linked enterprises, specialized suppliers and service providers, other related enterprises as well as institutional organizations (universities, trade organizations etc.). These clusters are often self-reinforcing since, on the one hand, they attract external enterprises and, on the other hand, the enterprises within a cluster have a higher innovative power. This fact, in turn, results in more spin-offs and start-ups. Thus, a cluster-based policy is increasingly employed as means for regional economic development agencies. Nevertheless, it is important to emphasize that it is not possible to create clusters just by policy but cluster formation can thus be supported. Furthermore, cluster-based economic policy cannot substitute other economic steps, but it can sensibly complement them.

Initial situation in the Region

The initial economic situation of the Free State of Saxony and its capital Dresden is better than average compared to other regions in the eastern parts of Germany. For instance, the share of R&D employees in Saxony per 1,000 is 4.8 and thus definitely above average in East Germany (3.3). The economic structure is dominated by five sectors: electronics / electrical engineering / precision engineering (e.g. Infineon, AMD), mechanical engineering and automotive engineering (e.g. VW, BMW and Porsche and numerous suppliers), metal processing as well as a traditionally strong food industry. Especially Dresden is regarded as the most important scientific and economic location in East Germany. This position is verified by a German city test in the magazine “WirtschaftsWoche” (2005). Within the overall evaluation, Dresden is rated 30th. With respect to location quality and economic structure, Dresden was even rated 13th and 11th. Especially in the field of research and development, Dresden has really ideal basic conditions, as one can see in the high number of research organizations (among others: three Max-Planck Institutes, five Institutes of the Wissensgemeinschaft Gottfried Wilhelm Leibniz as well as 11 Fraunhofer Institutes). The high number of highly trained employees reflects this tendency as well: Together with Munich, the share in total employment of highly trained employees (19.7 %) is one of the highest in Germany.
Nanotechnology location Dresden / Saxony – Results of the survey

200 enterprises (response rate: 29%) and 22 research institutions (response rate: 56%) took part in the survey. 54 out of 200 enterprises have already actively dealt with nanotechnology (this really means a response rate of 68% for 80 estimated core nanotechnology enterprises).

65 enterprises are interested in nanotechnology products in the future.

The industrial main focus of these enterprises can be seen in the field of mechanical engineering / process engineering (27%), microelectronics / IT (20%), chemistry / materials (17%) as well as biotechnology / medical engineering (11%). SME’s are dominating. Business start-ups take place continuously, whereas there are differences between the single sectors.

The number of employees of R&D organizations is relatively high compared to that of enterprises. 40% have 50 up to 250 employees, 14% employ even more than 250 staff members. The research focus is here: nanomaterials (27%), nanobiotechnology (23%) and nanoelectronics (18%). The main application fields of nanotechnology research¹ are found in microelectronics/IT (80%), chemistry / materials 55%, biotechnology / medical engineering and mechanical engineering / process engineering (18%).

Three of the most important location factors received a very favorable evaluation: the close proximity to R&D organizations, transport connections as well as the renowned reputation as a technology city. A critical point is that more than half of the enterprises had to solve considerable financial and administrative difficulties during start-up. In most cases, however, they received competent assistance by the Department of Economic Development of Dresden.

The high dependence on public funds was clearly shown in the study: 80% of the participating enterprises use public funds for their corporate financing. Venture capital is of less importance (only less than 10% of the enterprises receive VC). This fact is reflected in the regional comparison of Private Equity-Investments. Nevertheless, many enterprises are basically ready to accept VC money.

¹ Here, several selections were possible, but only few made use of it (as further analyses have shown).
Although nanotechnology is a very young technology, we find here a very high number of employees whose central field of work is nanotechnology (1,200 in the region Dresden / Saxony). This number does neither comprise the indirect employment effects (e.g. further employees in these enterprises) nor the employees of the big chip manufacturers (9,000 at Infineon, AMD and ZMD). For the near future, 50% of enterprises and 60% of R&D organizations intend to increase their staff, working in the nanotechnology sector.

According to the local entrepreneurs, contacts and co-operations are of utmost importance. A close distance would be preferable, but it is not absolutely necessary. However, local entrepreneurs prefer a close cooperation. One reason might be the very profound basic research of the local R&D organization. In the field of application-oriented research and technology transfer, however, there is need for action.

Among the enterprises, which actively cope with nanotechnology, there are 20 companies, which have been founded later than 1998. With respect to their demands and the evaluation they do not really differ from those enterprises founded earlier.

Very close location retention is remarkable for the spin-offs of the R&D organizations. 80% of the spin-offs (out of 14) established themselves near their mother company. This fact reveals that the promotion of spin-offs is an excellent means to strengthen the economy of the region.

The majority of interviewed enterprises produces nanotechnology components (46%). A further 37% produce some equipment for the production or analysis of nanotechnology components. The application, respectively, the use of such components in final products is of less importance (33% respectively 29%).

The high purchasing volume within the region shows a strong connection of the sector with its environment; however, high sales throughout Europe and the world show the strong global competitiveness of this sector in the region Dresden / Saxony.

Infineon Technologies and the Fraunhofer CNT – Center for Nanoelectronic Technologies are located nearby.

Infineon and AMD are the biggest employers within the microelectronics sector in the region. Here: Fab 30 and Fab 36, AMD, in the northern part of Dresden.
Therefore, compared to other national regions, Dresden / Saxony is viewed as being in a above-average position. The main competitors, Bavaria and Baden-Württemberg, are classified higher, but only by R&D representatives. The enterprises, however, consider their own location as the more important nanotechnology site.

The majority of organizations is planning additional investments or at least a strengthening of their R&D work. Only 15% of the enterprises do not plan further investments. Within the R&D organizations, only 23% do not intend to increase their activities. The remaining 77% will definitely increase their efforts.

**Nanotechnology cluster Dresden / Saxony: Further potential for development**

In general, it is correct to name the region a nanotechnology cluster. In some sectors, however, there is a need for action. Clear industrial focal points are microelectronics / IT, mechanical engineering / process engineering, chemistry / materials as well as biotechnology / medical engineering. The enterprises do not only cooperate, but they are also closely related as suppliers or customers. A special excellence can be found in the high quality of the Saxon R&D organizations, which in some areas enjoy an international reputation. The scientific and economic capacities are closely related in this region. Only the field of technology transfer needs to be improved. However, the Nanotechnology Competence Centre „Ultrathin Functional Films“ represents a competent coordination site for the region, in order to demonstrate and utilize interdisciplinary applications for nanotechnology for enterprises.

The location conditions are being assessed positively. However, there is a need for action, primarily in the financial sector, (location costs or better financing possibilities), information and communication as well as in the field of further education.
Currently the microelectronics / IT are dominating in the nanotechnology cluster Dresden / Saxony. In this sector, there are not only very excellent R&D organizations, but also numerous SME’s and the two major corporations AMD and Infineon. The members of the cluster are economically and scientifically closely related (Network Silicon Saxony and the new Fraunhofer Institute CNT – a prime example for public-private partnership to improve the development of a location within the sector of high technology).

In comparison to the nanotechnology cluster in microelectronics / IT, the field of biotechnology / medical engineering is still a developing sector. The scientific infrastructure is excellent and enjoys an international reputation, but the economic application must be developed further. This is, however, true for nano-bio clusters in other regions, as well.

In contrast to the above mentioned branches, the initial situation in the area of mechanical engineering / process engineering must be seen in a differentiated view. In spite of strong entrepreneurial activities and strong interest, the innovation potential and application possibilities in this area are still not widely known, so that there is a lack of a definite direction for the cluster in this industry sector.

For two other sectors – traditionally located in the region of Dresden – automotive industry and aerospace industry, nanotechnology is already playing an important role. Unfortunately, the return of the questionnaire within these sectors was too small to give detailed information.

Building upon the favorable initial situation, the region Dresden / Saxony must increase its efforts to enhance its development as a nanotechnology cluster. Especially in new technological fields, in the course of globalization, even few years can decide whether or not a site is attractive to enterprises and as a consequence, the region is able to profit from the economic prosperity.

The recommended actions suggested within the project support the efforts of those responsible for the region to achieve a competitive position and thus gain a world-wide reputation for the nanotechnology cluster Dresden / Saxony.

Dresden offers an excellent ambience: view across the Elbe river to the Church of our Lady and the Brühlsche Terrasse in the evening.
This brochure was prepared for the Economic Development Office, Dresden, by the Department Future Technologies Consulting of the VDI Technologiezentrum GmbH, in cooperation with the NMTC – Nano & Micro Technology Consulting, as well as the Institute for Geography of the University Halle.

The brochure is based on a study, which was in part financed by the European Union and the Free State of Saxony.

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Photos: minnemedia, Forschungszentrum Rossendorf, Infineon, Landeshauptstadt Dresden, AMD, BioInnovationsZentrum Dresden, Fraunhofer IPMS, Baumgärtel