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REGIONAL INNOVATION SYSTEMS: ORIGINS, EVOLUTION, APPLICATIONS

The Jena Regional Innovation System

It is always a great pleasure to listen to Phil Cooke and to share his immense knowledge about regional innovation systems (RIS). In his presentation, Phil Cooke showed rather convincingly why it is important to analyze *regional* innovation systems. The simple reason is that innovation activity has a pronounced spatial dimension and that the innovation systems in different regions may have rather distinct characteristics. Phil Cooke has also made clear that this heterogeneity of RIS requires region-specific policies. A "one-size-fits-all" policy approach would be neither appropriate nor would it be effective (Tödtling/Trippl 2005). I wonder, however, if something like a common denominator in terms of more general policy guidelines towards RIS can be formulated. Are there general conclusions how to stimulate the emergence of a strong and effective RIS?

Phil Cooke provided us with a number of examples for RIS that seem to function quite well. But what characterizes a well-functioning RIS? Is it

- a high-class knowledge base (e. g. excellent universities);
- a high level of knowledge spillovers that benefit from "related variety" of activities (neither over-specialization nor over-diversification);
- a network of relations with a high level of formal and informal interaction, characterized by intensive division of innovative labour and links to global knowledge flows;
- a critical mass;

– or is it a high level of innovative entrepreneurship that has produced the main impulses?

I want to discuss these issues taking another interesting example of a RIS – the case of Jena.

About 170 years ago, Jena was a small town of about 6,000 inhabitants with its economy dominated by agriculture, particularly winemaking. There was, however, a quite reputable university in Jena – today known as the Friedrich Schiller University – which was founded in the year 1558. The decisive impulse for the development of the Jena innovation system was not the foundation of the university in the 16th century but rather it occurred about 300 years later with the collaboration of two persons, Carl Zeiss and Ernst Abbe, starting around the year 1863 (for the details see Hellmuth/Mühlfriedel 1996). Seventeen years earlier, in the latter part of the year 1846, Carl Zeiss had set up a small mechanical workshop for the manufacturing of lenses and microscopes in Jena. Zeiss, a native of nearby Weimar, had passed an apprenticeship in mechanics in Jena. His master, also teaching at the university, encouraged Zeiss to attend lectures there. After several years of travelling on the job *(Wanderschaft)* Zeiss returned to Weimar in 1845 and submitted an application to establish a mechanical workshop there. His application was, however, rejected by the public authorities because there were already two mechanical workshops in Weimar and the demand was not considered large enough to provide a commercial basis for a third supplier in this business. Hence, Zeiss went to Jena, worked there at the university as a mechanic and attended courses. At that time, probably through his contacts to the university, he became interested in the field of optics. Zeiss successfully applied for the permission to set up a mechanical workshop in Jena and started his venture in the fall of the year 1846. His product program included lenses and simple microscopes that he expected to sell to university scientists.

Zeiss hired his first employee after about six months. In the following years, the firm slowly expanded. His workshop was moderately successful at that time but was only one among many producers of similar products. The firm was particularly known for a good mechanical quality of its products. At the time Carl Zeiss met Ernst Abbe, he had about 15 employees.

Ernst Abbe had studied mathematics and physics in Jena in the years 1857–1859. After continuing his education in Goettingen and in Frankfurt, he retuned to Jena in 1863 for his *Habilitation* in physics. At that time, he probably first came in contact with Carl Zeiss when he needed some optical instruments for the courses that he was teaching at the university. Through his contact with Zeiss, he developed a particular interest in optics. In the middle of the 19th century, the production of lenses and microscopes was mainly based on experience of the craftspeople, their implicit knowledge, and not on theory. In order to achieve a functioning optical instrument, lenses had to be adjusted in a trial and error process. Abbe started to develop theories and methods for determining the effects of lenses, which was exactly the analytical knowledge that Carl Zeiss and his competitors were lacking. Thus, there was a chance to substitute trial and error by exact science and, thereby, considerably improving the quality of the optical instruments. Zeiss recognized this opportunity, started to cooperate with Ernst Abbe and finally offered him co-ownership of his workshop. Abbe contributed to many practical improvements of the production processes in Zeiss' workshop, which led to a considerable increase in the efficiency and the quality. However, from their first meeting in 1863, it took about seven years until the first lens could be manufactured according to Abbe's calculations. Zeiss started to market the novelties in 1872. It was a great success followed by many other innovative products.

A severe bottleneck for the capabilities of the optical instruments at that time was the quality of glass used for the lenses. In the 1870s, Abbe became acquainted with a young Jena PhD student, Otto Schott. Schott originated from a family of glass producers located in North Rhine-Westphalia and came to Jena to conduct research on the chemistry of glass. After finishing his dissertation in 1875, Otto Schott left Jena to work in his family's business, but he kept contact with Ernst Abbe. Their correspondence focused on the optical qualities of glass, and Schott was sending samples of new sorts of glass for testing purposes that he had developed according to the specifications of Ernst Abbe. Abbe and Zeiss urged Otto Schott to come to Jena and to set up a laboratory and then a factory for the production of optical glasses. Together they founded the *Schott & Genossen* Company which started production in the year 1884, about 38 years after Carl Zeiss had set up his workshop in Jena. The craftsmanship of Carl Zeiss plus the analytical knowledge of Ernst Abbe and Otto Schott lead to the economic breakthrough, making Jena the world's number one location for manufacturing of glass and optical instruments at least until World War II. However, without the consider-

able entrepreneurial spirit of these key personalities, this combination of craftsmanship and analytical knowledge would have never been fruitful.

An important diversification of Jena's industry structure occurred in 1942 when Hans Knöll, a chemist working in the laboratories of the Schott factory, discovered a method for producing Penicillin on a larger scale. This was the starting point for the *Jenapharm* company, a spin-off of the *Schott & Genossen* company, becoming a leading producer of pharmaceutical products.

After World War II, the Jena region was under control of the Russian military administration and was later part of the socialist *German Democratic Republic* (GDR). In order to avoid the socialist economic and political system, leading managers of the *Zeiss* and the *Schott* company moved to West Germany and established another *Zeiss* and *Schott* firm. In the following decades, the East-West German twin firms became competitors on the world market. During GDR times, Jena was still a main location for high-class research in optics and played, for example, a leading role in the development of the laser technology in East Germany.

Soon after the fall of the Iron Curtain and German unification in the year 1990, the twin companies *Zeiss* and *Schott* re-united both under the lead of their western parts, which were much stronger economically. As a consequence, main management functions and a considerable part of research and development are now carried out at the West German headquarters. The remaining R&D of the two companies, which is still carried out in Jena, is now under external control. In the 1990s, *Jenapharm* was acquired by *Schering* and later *Schering* was bought by *Bayer*; thus external control may also be a problem for this company. Since German unification in the year 1990, a considerable number of start-ups in the optical industry emerged in Jena, many of which may be regarded as spin-offs from the *Zeiss* and from the *Schott* company. The two firms are still key players in the Jena RIS. They have been and still are an important source of new businesses that join the flourishing optical industry cluster in Jena, which consists of slightly more than one hundered mostly small and medium-sized firms today.

Another remarkable development that occurred in the 1990s – largely independently from the optics, glass and pharmaceutical complex – was the rise and the fall of the *Intershop* Company. This firm was founded by two PC-dealers who developed e-commerce software. It was very successful in the second part of the 1990s but fell with the burst of the

Internet bubble in the year 2000. The firm still exists and operates on a much smaller scale. The rise of *Intershop* provided a powerful role-model of entrepreneurship in the region (Fornahl 2007). The company was and probably still is a source for a considerable number of spin-offs that may make important contributions to the development of the Jena RIS in the future (Bünstorf/Fornahl 2009).

Today, Jena has about 103,000 inhabitants including 25,000 students. It has a considerable number of innovative firms focusing on optics, measurement technology, medicinal technology, and software programming. A remarkable number of innovative businesses are set up in Jena each year. The Jena RIS seems to be working quite well, and the region is considered to be a lighthouse in Eastern Germany – a part of the country which is only slowly recovering from about forty years of a socialist economic and political system. In Jena, innovation is characterized by a dense network of R&D cooperation among private firms as well as between the universities and the private sector (Cantner/Graf 2006; Graf/Henning 2009; Fritsch/Henning/Slavtchev/Steigenberger 2007). While there is a danger of becoming an externally controlled workbench for the larger players, the RIS benefits from a considerable level of new business formation in innovative fields that may be an important source of future economic growth.

Summing up the reasons for the success of the Jena RIS, we can state that in the early stages the *university* played primarily a role of a magnet that attracted two of the main personalities – Carl Zeiss and Ernst Abbe – to this particular location. Carl Zeiss obviously received knowledge spillovers and impulses from the university that directed his attention to the field of optics. Additionally, Ernst Abbe started working on an optical theory only after he met Carl Zeiss. Moreover, Otto Schott's stay in Jena for his dissertation was probably conducive for his collaboration with Abbe and Zeiss that emerged when he had already moved back to his home region. At later stages of development, the university became more actively involved and provided important inputs, particularly knowledge and laboratories, for the technical developments of the private sector firms. It responded to the demands of the innovative firms, but it did not take on the leading role. Public policy also played a rather passive role in the emergence of the Jena RIS, and never initiated positive developments. The drivers of the Jena RIS have been entrepreneurial personalities which created innovation and commercial success by combining their diverse kinds of knowledge.

A further lesson that can be drawn from the development of the Jena RIS is that the critical mass of persons that is required for the systems' "take-off" may be very small. The Jena RIS started with just one, Carl Zeiss, and gained momentum when Zeiss began the fruitful collaboration with Ernst Abbe and later with Otto Schott. The crucial issue was the combination of a few people. Even today, the whole system which is said to work rather well is not very large. Jena is still a small town. The example of the Jena RIS also shows that it may take several decades until the system starts to flourish and grow.

Jena is just one more interesting case of a RIS. The example of Jena and those presented by Phil Cooke raise the still largely unanswered question regarding the conclusions: What can we learn from this? What can be generalized? What are the conclusions and recommendations for public policy in order to create a strong RIS?

References

Bünstorf, G./Fornahl, D. (2009): B2C – bubble to cluster: the dot.com boom, spin-off entrepreneurship, and regional industry evolution. In: Journal of Evolutionary Economics 19, 349–378.

Cantner, U./Graf, H. (2006): The network of innovators in Jena: an application of social network analysis. In: Research Policy 35, 463–480.

Fornahl, D. (2007): Changes in regional firm founding activities – a theoretical explanation and empirical evidence. Routledge: London.

Fritsch, M./Henning, T./Slavtchev, V./Steigenberger, N. (2007): Hochschulen, Innovation, Region – Wissenstransfer im räumlichen Kontext. Berlin: edition sigma.

Graf, H./Henning, T. (2009): Public research in regional networks of innovators: a comparative study of four East-German regions. In: Regional Studies 43, 1348–1368.

Hellmuth, E./Mühlfriedel, W. (1996): Carl Zeiss 1846–1905 – Vom Atelier für Mechanik zum führenden Unternehmen des optischen Gerätebaus. Weimar: Böhlau.

Tödtling, F./Trippl, M. (2005): One size fits all? Towards a differentiated regional innovation policy approach. In: Research Policy 34, 1203–1219.

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The Technology and Innovations Park (TIP) within the regional innovation network

The British economist wrote in February 2006: "Jena's most important assets, its network of highly skilled people and its entrepreneurial ecosystem – that is rare elsewhere in Germany."

Let me give you a short impression about the position of the Technology and Innovation Park within the network. A few years ago Prof. Cantner confirmed in a study about the innovation system in Jena that the existence of the Technology and Innovation Park as incubator is not a relevant factor for firms to locate in Jena *per se.* During the process of establishing a firm, the existence of an incubator is ranked as less important for the location decision only followed by venture capital. Rather, factors related to interaction seem especially important. The existence of a qualified labour force is named most relevant, followed by the presence of other actors, like competing firms, universities and research institutes as well as an existing personal social network. These are the critical factors for start-ups and spin-offs to locate in Jena.

Therefore I try to see the role of our technology park not only in providing production facilities but especially in fostering interaction by providing contacts to the existing system of innovation.

The cooperation landscape around the incubator is ideal shaped by research centres, two universities and many firms. Together they look for close cooperation in competence networks in order to generate always new innovative potential. The Technology and Innovation Park is supporting the management of these networks.

The other main task is to incubate start-up and spin-off, which are a result of the work within the cooperation landscape. By providing affor-

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