

Innovation cooperation

Innovation cooperation: experiences from East and West Germany

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This paper deals with innovation cooperation as a means to support the ongoing catch-up process of the East German economy. Against prevalent beliefs, it can be shown that East German enterprises are more often involved in innovation cooperation than West German firms, and differences in cooperation partner priorities only reflect the given structural differences between the two regions. While cooperating enterprises in East and West Germany are clearly more innovative than their non-cooperating counterparts, a productivity advantage of these firms is (so far) only observable in West Germany. Reasons for this surprising finding are discussed.

MORE THAN TEN YEARS after German reunification, East Germany still clearly lags behind West Germany economically. Although manufacturing industry in East Germany has grown fast since the beginning of transition and international markets (exports) are gaining importance (IWH, 2002; Loose and Ludwig, 2003), gross domestic product (GDP) per head and productivity in East Germany are considerably lower than in West Germany. In 2001, labor productivity (gross value added per employee) in East Germany reached only 68% of that in West Germany (IWH, 2002), and nominal GDP per head accounted for €16,514 and €27,004 respectively (BMWA, 2003, page 2).

The low level of economic performance, but even more the deceleration of the catching-up process since the mid-1990s is regarded as problematic. There are several reasons for the relative backwardness of East Germany, such as deficiencies in infrastructure, lower capital intensity, unfavorable composition of branches within manufacturing industry, and lack of big and internationally oriented industrial enterprises (Ragnitz *et al.*, 2001).

Recent literature and policy discussions also emphasize the absence and deficiencies of innovation networks as an obstacle to East Germany's efforts catching-up (for instance, Müller, 2002, page 40ff; Ragnitz and Wölfl, 2001). This has led policy makers to introduce several programs that support the foundation of innovation networks (*Verbundprojekte*), particularly within East German industry. In 2003, there were four major policy programs in place that directly support innovation projects between business enterprises and universities or public research institutes (*InnoRegio*, *Wachstumskerne*, *ProInno*, *InnoNet*), and two that provide managerial

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help (professional innovation consulting) to existing innovation networks (*NEMO*, *InnoMan*).

For an overview of the different programs see BMWI (2002) and Günther (2003). The idea behind them is that catching-up is favored by innovations, and innovations can best be carried out within joint projects, because the development and market introduction of new products requires substantial investment, and because innovations of business enterprises rely increasingly on scientific research results generated outside the firm.

The central characteristic of innovation networks is cooperation among enterprises, but also between enterprises and non-business organizations, such as universities or research institutes. Existing empirical studies on various fields of enterprise cooperation in Germany show that East German firms are usually more often involved in such activities than West German ones (Brussig and Dreher, 2001; Fritsch *et al.*, 1998), but there is no evidence for a positive relationship between cooperation and productivity in East Germany so far (Brussig *et al.*, 2003). While the existing studies deal with various fields of cooperation, for instance, in purchasing, production, marketing or distribution, this paper focuses explicitly on activities aimed at innovation cooperation of business enterprises.

It is the intention of this paper, first to investigate the differences between the general cooperation behavior of East and West German enterprises and then to analyze whether cooperating firms show better performance in terms of product or process innovations and productivity compared to non-cooperating firms. Before turning to the theoretical background of this paper and empirical results, some important terms will be defined.

Important definitions

To specify the subject of analysis of this paper, I will clarify the terms 'cluster', 'network' and 'cooperation'.¹

Cluster

In economic literature, clusters are usually referred to as the geographical concentrations of firms of a certain branch or related branches, usually connected

through the value added chain (Porter, 1990). Because of the geographical proximity of firms, clusters are expected to generate agglomeration advantages, such as easier access to human capital or intermediate products and exchange of information (Marshall, 1952, pages 267ff; Krugman, 1991).

While it is reasonable to assume that there is communication among the firms that form a cluster, direct and frequent cooperation is not, at least not necessarily, a typical feature of clusters. That means that ties are loose in the sense that they are usually confined to pure business contacts. Agglomeration advantages are expected to appear mainly anonymously in the sense of positive external effects. According to Porter (1999, page 51), industry clusters are a typical and "natural" characteristic of advanced economies.

Networks

In contrast, networks are regarded as initiated and coordinated institutions with closer and collaborative ties among the participating enterprises and possibly non-business organizations. They are characterized by active cooperation, not simply business contacts, among the partners. Three independent partners are usually considered the minimum. Networks normally have a medium- or long-term perspective, and they are mostly based on a written contract, which specifies the common goals and details of collaboration (Ragnitz *et al.*, 2001, page 234).

Many networks are characterized by spatial proximity of the participants, especially when regular face-to-face contacts are regarded as important (Fritsch, 1999, page 10ff). In that respect, they can resemble clusters and thus additionally generate the above described agglomeration advantages. Nevertheless, it is also possible to have networks without spatial proximity among the partners as is the case, for instance, with networks on an international level.

Apart from this aspect of spatial proximity, the crucial difference between networks and clusters is that clusters are associated with fairly general advantages while networks are established to pursue very particular goals, often in research and development (R&D) or innovation projects.

Cooperation

Cooperation is the typical and inherent feature of networks, but not every example of cooperation among business enterprises and/or non-business organizations is automatically a network. Cooperation as such can appear as a single event without any long-term perspective, for example, enterprises that once in a while organize their purchasing together. Enterprise cooperation plays a growing role in practice and can refer to many different fields of business activities, such as purchasing, production, distribution, marketing, or education (Corsten, 2001; Kaiser and Kaiser, 2000; Staudt *et al.*, 1995).

These forms of cooperation are primarily aimed at cost reduction, whereas this paper is about innovation cooperation that takes place within innovation networks; in other words, medium- or long-term oriented cooperation among economically independent enterprises or among enterprises and non-business organizations with the declared intention to generate new products, services or production processes. Clusters—the sole agglomeration of enterprises—are not the subject of empirical analysis in this paper.

Theoretical framework

Business enterprises engage in innovation networks with external partners when they expect advantages that they would not experience without cooperation. First, the cooperation partners expect that direct production or rather development costs will be reduced, for example, through the common use of technical equipment, and the exchange of specifically qualified personnel. The closer the location of cooperation partners to each other, the more easily such advantages are realized.

Furthermore, cooperation can be a means to reduce transaction costs. In particular, long lasting and approved innovation cooperations lead, for example, to reduced costs for searching or for the initiation and control of cooperation agreements. Finally, it is the combination of reduced development and transaction costs that allows enterprises to benefit from innovation cooperation.

Yet it is not only, and not primarily, the cost reduction that makes innovation cooperation attractive for enterprises. It also leads to synergy or spillover effects among the partners, especially through the mutual exchange of information and ideas. In this sense, knowledge sharing and learning is a strong advantage of innovation networks. Pyka and Kueppers (2003), Lundvall and Archibugi (2001), Koschatzky *et al* (2001), as well as Bessant and Tsekouras (2001) refer to explicit and tacit knowledge sharing and joint learning as the main motives of enterprises participating in innovation networks. The generation of such learning effects, however, requires a stable and confidential relationship among the network partners, and, in general, it can be stated

Business enterprises expect advantages from innovation networks, for instance, reduction in development and transaction costs: the combination of these reduced costs allows enterprises to benefit from innovation cooperation

that one of the most important conditions for successful innovation networks is trust.

In practice, it is hardly possible to calculate the costs and benefits of innovation cooperation, especially because non-quantifiable aspects also matter. Yet whatever the crucial motive for cooperation is and however the decision to cooperate or not is finally made, it is reasonable to assume that enterprises that engage in innovation cooperation are better able to reduce costs, to take advantage from knowledge sharing, and thus to introduce innovations.

This is expected to translate in the end into a productivity advantage against non-cooperating enterprises. In the empirical part of this paper, East and West German cooperating enterprises will be compared to non-cooperating enterprises with respect to innovations and productivity.

Data source

Empirical data presented in this paper stems from the Mannheim Innovation Panel (MIP), which is an annual innovation survey carried out by the Center for European Economic Research (*Zentrum für Europäische Wirtschaftsforschung*, ZEW) in Mannheim, Germany.² Innovation cooperation in the sense of innovation networks is subject to the enterprise survey every fourth year, so far in 1997 and 2001. Answers refer to the period of the previous three years—1994–1996 and 1998–2000 respectively.

The survey is based on a representative stratified random sample drawn from the *Creditreform* enterprise database.³ Stratifying variables for the sample are firm size (eight classes), branch of industry (2-digit NACE classes), and region (East and West Germany). About 10,000 firms are included in the sample, and the response rate is usually about 25%. As a result of the computation and use of expansion factors for each firm, the descriptive data presented in this paper is representative for the German manufacturing sector.

The terminology used in the questionnaire corresponds to the international guidelines for innovation surveys, the Oslo-Manual (OECD and Eurostat, 1997). For further methodical information on the MIP see Janz *et al* (2001). All statistics presented below are projected (not sample) figures and refer to the branches mining and quarrying, manufacturing, as well as electricity, gas and water supply.

The following empirical presentations introduce the topic by describing the frequency and partners of innovation cooperation, and then turn to a comparison of cooperating and non-cooperating firms with respect to their innovation and productivity performance.

Frequency and partners of cooperation

Different from what we may expect and in accordance with other empirical studies (for instance,

Box 1. Innovation cooperation according to the MIP

According to the questionnaire used in the MIP, innovation cooperation means the active participation of enterprises in joint innovation projects, together either with other business enterprises or non-commercial organizations. It refers to inter-organizational innovation networks whereby the sole awarding of a research and development (R&D) or innovation contract to other companies or research institutes does not count as a cooperation.

Brussig and Dreher, 2001; Brussig *et al.*, 2003), in East Germany, enterprises are clearly more often involved in innovation cooperation than in West Germany. According to the MIP, 15.9% of the East German and 9.2% of the West German enterprises stated that they were actively participating in innovation cooperation during 1998–2000 (see Table 1).

We can assume that the comparatively high frequency of cooperation in East Germany is a result of several innovation policy programs, many of which were introduced exclusively in East Germany in support of the foundation of innovation networks in recent years. Yet cooperation frequency in East Germany had been nearly the same during the previous survey period (1994–1996) when far less policy support was given.

It is remarkable that the frequency of innovation cooperation in West Germany decreased from one survey period to the next, from 17.7% in 1994–1996 to 9.2% in 1998–2000 (Table 1). This is partially explainable through innovation policy changes in West Germany. During the period 1998–2000, about 1000 enterprises fell out of one major innovation policy program ('ProInno') in West Germany as a result of the expiration of the support contracts. Another, but only preliminary explanation is that

Table 1. Cooperation frequency in East and West Germany
(% of firms engaged in innovation cooperation)

	1994–1996 (n=1946)	1998–2000 (n=1732)
East Germany	16.6 (n=587)	15.9 (n=552)
West Germany	17.7 (n=1359)	9.2 (n=1180)

Source: Mannheim Innovation Panel 1997 and 2001 (own calculations)

cooperation frequency is on the decrease in general and only remains as high as 16% in East Germany because of the network policy programs exclusive to East Germany since 1999.

Looking at who the innovation network partners of business enterprises are (see Figure 1), it becomes clear that universities are by far the most important partners to firms in East and West Germany. Of all firms that engaged in innovation cooperation at all in East Germany, 62.4% stated that they cooperated with universities. In West Germany it was 59.9% of the cooperating firms.

The second most important cooperation partner in East Germany is commercial research institutes. Of all cooperating firms in East Germany, 36.4% cooperated with commercial research institutes. In contrast to this, in West Germany commercial research institutes rank much lower. Only 20.8% of the cooperating firms said that they cooperated with commercial research institutes. This is certainly because commercial research institutes are much more common in East Germany. During transition, many researchers that were employed in state-owned companies 'survived' by founding commercial research institutes or R&D companies.

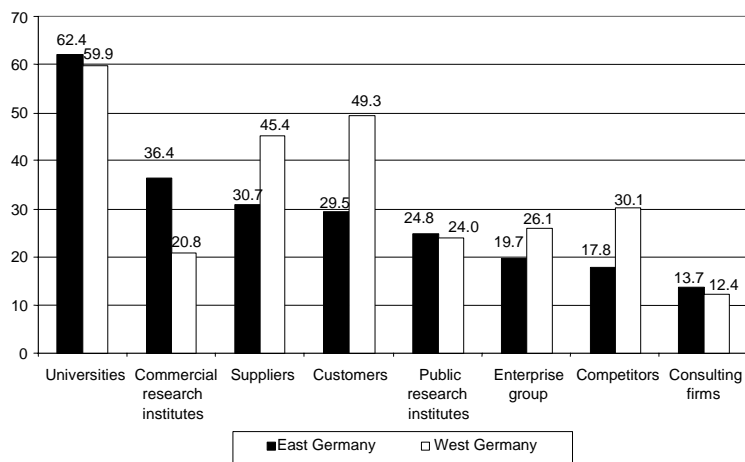


Figure 1. Innovation cooperation according to the type of cooperation partners 1998–2000^a as percentage of all firms engaged in cooperation

Note: ^a Multiple answers were possible, therefore the sum of percentages is not equal to 100

Source: Mannheim Innovation Panel 2001 (own calculations)

At third and fourth place in East Germany come suppliers and customers with 30.7% and 29.5% respectively. However, it stands out that, in West Germany, suppliers and customers have a clearly stronger significance as cooperation partners, with 45.4% and 49.3% of all cooperating firms. This is because of the lack of industry clusters in East Germany. The absence of agglomerations of firms that belong to the same branch or related branches (Ragnitz and Wölfl, 2001) points to the fact that, within East Germany, production networks are much less developed than in West Germany. Accordingly, East Germany offers less favorable preconditions for innovation cooperation with suppliers and customers.

With respect to public research institutes, it was found that 24.8% of the cooperating enterprises in East Germany and 24% in West Germany did actively cooperate with state research institutes or non-profit private research institutes.

Cooperation within the enterprise group is of minor significance. Not very surprisingly, in East Germany fewer companies cooperate within their enterprise group (19.7%) than in West Germany (26.1%). This corresponds to the fact that East Germany is dominated by independent small and medium-sized enterprises, which are simply not part of an enterprise group.

Unlike West Germany, cooperation with competitors is of little importance in East Germany. Only 17.8% of all cooperating firms in East Germany but 30.1% in West Germany worked together with competitors. This is because in West Germany competition is stronger than in East Germany, which also has a lower export rate. That means that international markets where competition is high are less important to East German firms (IWH, 1999, page 145ff). West German firms, especially big and multinational companies, face a stronger need to cooperate with their competitors.

Least important to both East and West German companies are consulting firms, which are probably more strongly associated with management improvements than with technological product or process innovations.

Box 2. Innovation and market novelties according to the MIP

According to the MIP questionnaire and thus OECD/EU nomenclature, an innovation is a new or significantly improved product or service that has been introduced by the relevant company (product/service innovation), or a new or significantly improved production process that has been introduced within the relevant company (process innovation). When talking about "innovation", the product or process at least has to be new to the company, but not necessarily new to the market. Accordingly, "innovation" can also include imitation.

In any case, product or process innovation is based on new technological developments, new combinations of existing technologies or based on the use of externally acquired knowledge. Pure aesthetic modifications of products (e.g. color, style) are not considered an innovation.

Market novelties, by contrast, are products or services that are definitively new to the market. That means, the relevant company is the first one offering the product or service on the market. The definition of "market", however, is up to the company.

Cooperation and innovation performance

Looking at the innovation frequency of cooperating firms, it becomes visible that, in East Germany, nearly all cooperating firms (97.8%) carried out at least one innovation during 1998–2000. In contrast, only 49.6% of the non-cooperating firms carried out an innovation during the same time period. This is not very different in West Germany where 96.6% of the cooperating firms were innovative compared to 55.3% of the non-cooperating firms (see Figure 2).

With respect to market novelties, it shows that 63.1% of the cooperating and 24.1% of the non-cooperating firms in East Germany appear with at least one market novelty in 1998–2000. In West Germany, we can see the same tendency, although on a slightly higher level. That means, 77.4% of the cooperating firms carried out at least one market novelty while 30.9% of the non-cooperating firms were innovative in the narrow sense.

The findings presented in Figure 2 point to the fact that cooperating firms are indeed more innovative, but from the available data it cannot be claimed that the innovations and market novelties are an



Figure 2. Cooperating and non-cooperating firms in East and West Germany with innovations and market novelties respectively 1998–2000 (percentage of number of firms)

Source: Mannheim Innovation Panel 2001 (own calculations)

Table 2. Average proportion of sales with market novelties 2000 (% of total sales)

	Cooperating enterprises	Non-cooperating enterprises
East Germany (n=143)	16.2	4.1
West Germany (n=401)	11.8	6.2

Source: Mannheim Innovation Panel 2001 (own calculations)

immediate result of cooperation. Causality could also be the other way around, which means innovative enterprises could be attracted by cooperation.

These results raise the question of how much the introduction of market novelties finally matters for East and West German firms when it comes to sales. The only figure available within the MIP suitable to answer this question is the “proportion of sales with market novelties” (see Table 2). Not very surprisingly, cooperating firms make a larger proportion of their sales with market novelties than non-cooperating firms and, interestingly, East German cooperating firms make an even larger proportion of sales with market novelties than West German firms (16.2% versus 11.8%).

The fact that cooperating firms in East Germany innovate and make a considerable proportion of sales with market novelties, points in the right direction. Whether this also leads to better performance in terms of productivity (sales per employee) is another question dealt with in the following section.

Cooperation and productivity performance

As presented in Table 3 below, cooperating firms in East Germany are clearly less productive than those in West Germany (137.3 versus 208.8). In other words, cooperating firms in East Germany reach only 66% of the productivity level of West German ones. Non-cooperating firms show nearly the same (low) sales productivity in East and West Germany (151.6 and 168.5 respectively). What is most surprising, however, is that in East Germany cooperating firms are not more productive than non-cooperating firms, but even slightly less so (137.3 versus 151.6).

At first glance, these results imply that innovation cooperation in East Germany has failed, but it has to

Table 3. Productivity (sales per employee) of cooperating and non-cooperating firms in East and West Germany 2000 (in 1,000 Euro)

	Cooperating enterprises	Non-cooperating enterprises
East Germany (n=552)	137.3	151.6
West Germany (n=1180)	208.8	168.5

Source: Mannheim Innovation Panel 2001 (own calculations)

It is reasonable to assume that innovation cooperation is an investment for the future, which today binds resources in the cooperating firm: the expected productivity advantages over non-cooperating firms will appear only in the longer term

be kept in mind that there is no mono-causality between innovation cooperation and productivity. This means that we cannot exclude the possibility that there are factors involved in increasing productivity other than just innovation cooperation. Nevertheless, the rather surprising results about innovation cooperation and productivity call for a discussion of possible explanations, especially in the face of the fact that in West Germany the expected productivity advantages clearly appear.

Conclusions

This empirical study shows that East German enterprises are more often involved in innovation cooperation than West German firms, but they do not show the productivity advantages that their West German counterparts do. Finding a strong productivity gap between East and West German cooperating enterprises as well as between cooperating and non-cooperating enterprises within East Germany is unexpected, but it corresponds to existing empirical studies on other fields of cooperation (for instance, Brussig and Dreher, 2001; Brussig *et al*, 2003).

In the literature, we often find the expression “cooperation from weakness”, which means that in East Germany particularly the economically weak enterprises engage in cooperation in the hope of improving their performance in the future. While this is reasonable for those studies focusing on cooperation and productivity, the theory is not fully supported in this paper, because it could be shown that the vast majority of cooperating firms in East Germany are innovative and thus not necessarily weak.

The findings of this paper rather imply that innovation networks in East Germany have not yet revealed their productivity increasing function. As shown by an in-depth case study presented in Brussig *et al* (2003) for the East German engineering industry, the build-up of a well functioning purchasing cooperation takes nearly ten years. In this respect, West German enterprises have a clear advantage in that they had already had much more time to establish well settled and approved innovation networks.

It still remains questionable why non-cooperating

enterprises in East Germany are more productive than cooperating ones. Here, it is reasonable to assume that innovation cooperation (similar to research and development) is an investment for the future, which today binds resources in the cooperating firm. The expected productivity advantages over non-cooperating firms will then appear only in the long(er) term.

Policy implications

With respect to innovation policy, we first have to acknowledge that there is no general lack of innovation networks in East Germany any more and that the differences in cooperation partner priorities only reflect the given structural differences between the two parts of the country. In the face of these developments, it does not seem to be necessary to increase the number of innovation networks in East Germany by means of further networking policy programs, which would anyway involve the risk of 'artificial' cooperation — business enterprises and universities or public research institutes only building a network in order to apply for public funding and dissolving once public funding ends. However, the issue of windfall gains is a general problem of policy programs and can never really be excluded.

What would be helpful in practice — at least in the case of Germany — is to reduce the large number of network policy programs. In the introduction to this paper, several existing network policy programs were mentioned, and were only those at the federal level. In East and West Germany, the federal states (*Länder*) have further programs to support innovation networks of enterprises within the relevant state. It is not only difficult for enterprises, universities, and public research institutes to overview the large number of programs, but for policy makers too.

The empirical findings clearly show that enterprises in East Germany do not lag behind their West German counterparts with respect to cooperation frequency, but with respect to the final result of cooperation, namely productivity. Thus, it seems to be important now to let the existing innovation networks mature in East Germany so that they can unfold their knowledge-sharing and learning effects. In this sense, we could talk about the second stage of network building in East Germany.

With respect to policy programs, it seems important now to shift to instruments that help to improve the stability of existing networks and the quality of cooperation. This has already been undertaken by the introduction of programs that support network management (see introduction to this paper) and it should be enlarged if necessary. However, the stability and quality of innovation networks depends largely on the composition of partners and interpersonal relationships within the network, and thus, finally, it is up to the participating partners themselves to make networking a success.

Notes

1. The following distinction has been made for economic reasons and with a focus on business enterprises. The terms may be used differently in other contexts or disciplines.
2. The author thanks the ZEW for the provision of data and friendly support.
3. In contrast to most other European countries, in Germany there is no business register. Thus, other databases have to serve as sampling frames for enterprise surveys. The MIP uses the database of Germany's most important credit rating agency, *Creditreform*, from which the sample is drawn.

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