
Development of International RTDI Networks of Small and Medium-sized enterprises

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Abstract: This paper provides a study design to investigate the development of cross-border project-based RTDI networks. The focus is on the development of several exchange relations between the different functional network partners over time. By investigating these relations, the network dynamics can be observed, compared, and assessed. Although project-based RTDI networks develop at different pace, they tend to show a strong level of trust, vivid communication based exchange relations, sufficient science-industry exchanges and a steadily growing internationalisation among the network partners. Despite an overall positive additionality of external project funding, the sustainability of cross-border RTDI networks after the omission of this incentive is limited.

Keywords: innovation management; evaluation; social network analysis; networks of innovation; collaboration for innovation; internationalisation; public funding of innovation

1 Introduction

Usually, public interventions in the field of innovation policy stem from the rationale of minimising market or system's failures occurring within knowledge processes. This essentially defensive argument forms also the background of the "Cooperation in Innovation and Research with Central and Eastern Europe" (CIR-CE) programme. It is a cross-border RTDI programme with a strong innovation focus, initiated and co-funded by the Austrian Federal Ministry of Economy. A further rationale for this public intervention is to facilitate offensively the access of Austrian companies towards markets, firms, intermediaries, and knowledge providers in Central, Eastern, and Southeastern Europe to gain first-mover advantage, especially for Austrian SMEs, in these emerging markets.

The main objective of the programme is to enable through public co-funding in way of non-refundable grants the establishment and deepening of international networks for generating innovation and enhancing technology transfer [1]. More specifically, CIR-CE aims to contribute sustainably to increase the innovation capabilities of enterprises as well as their capacity to absorb and use external knowledge and to improve their cooperation capabilities across national borders [2]. The projects funded under CIR-CE have a strong focus on joint RTDI activities. In addition, some of the projects pursued sub-objectives such as the identification of potential vendors or costumers in foreign countries, to gain access to foreign knowledge providers or to facilitate market entry through joint R&D.

In order to investigate the development of cross-border RTDI network projects funded under CIR-CE, five case studies were conducted and analysed with social network analytical (SNA) approaches. Each case study consisted of one RTDI network with an average of 15 partners. Most of the partners were SMEs. In addition, some intermediary organisations such as technology transfer institutions, and a few knowledge providers ranging from universities to specialised consultants were involved in the investigated networks. 44 % of the network partners under scrutiny were Austrian institutions. The rest originated from Bosnia-Herzegovina, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia.

The network projects covered a broad spectrum of topics such as the reduction of time-to-market and costs for injection moulded plastic parts, the development of mobile tourism applications, the establishment of a cooperation network along the value chain of automotive industry, and feasibility studies to boost solar energy projects.

2 Study design

In accordance with the programmatic rationale of CIR-CE, our main two assumptions for the study design were, firstly, that innovation depends on cooperation and that cooperation can be measured in terms of density, intensity and patterns of communication and other exchange relations between the network partners. Secondly, we were assuming that the ability of a partner to effectively use the results of the project and the network's non-project related economic, social, cultural, and symbolic capital (in the sense of Bourdieu) to build up capacities within her/his own organisation depends to a certain degree on the strength of her/his participation in exchange relations. The degree of participation can be approximated by measuring the accessibility of each network partner vis-à-vis the other network partners within the network's exchange relations.

The exchange relations investigated comprise seven different dimensions of material and non-material exchange among the network partners:

- communication on project management issues
- communication on project content issues
- non-project related communication
- exchange of goods
- exchange of services
- exchange of other useful information

- exchange of valuable contacts and “trust” relations between the network partners as an eighth dimension of a more emotional quality.

Assessments of these exchange relations were recorded for each network partner over roughly three years. Each network partner has been approached by us four times and asked to assess all exchange relations mentioned above between the network partners and her-/himself. These data were recorded and analysed with the SNA. As structural dimensions to analyse the exchange relations we used exchange intensities and exchange densities. Exchange intensities are proxies to assess the subjectively perceived quality of exchange relation (‘high’, ‘average’, ‘low’, ‘none’). The ratings given by each respondent represent the strength of ties (directed edges or directed arcs in graph theory) [3]. Exchange densities provide information about the connection between network partners in two dimensions (‘absent’ or ‘realised’). These two structural dimensions are indicators which describe the complex network systems. By comparing data over time, we can also assess the network dynamics.

The first survey (t_1) was conducted at the end of the project contract negotiation and addressed the exchange relations of the 12 months period before the project start. It poses the baseline for assessing the effects caused by the publicly co-funded network projects. The second survey (t_2) was connected to the mid-term reporting of the funded networks. The time prior to this survey covered the first half of the implementation phase. The third survey (t_3) was conducted close to the end of the network projects. It was connected with the final reporting. This survey covered the second half of the implementation phase. Finally, another survey one year after the formal termination of the network projects (t_4) was executed. Although the participation in this survey was not connected to any project reporting requirement, the response rate was high and enabled us to investigate the sustainability of the funded network projects.

The study design allows drawing evidence-based conclusions on the management of industrial oriented RTDI network projects, the development of science-industry and vendor-customer relations, the development of internationalisation processes, and the sustainability of publicly co-funded innovation networks. In this paper, only the results in terms of development of science-industry relations and development of internationalisation processes are highlighted.

3 Development of science-industry relations within RTDI networks

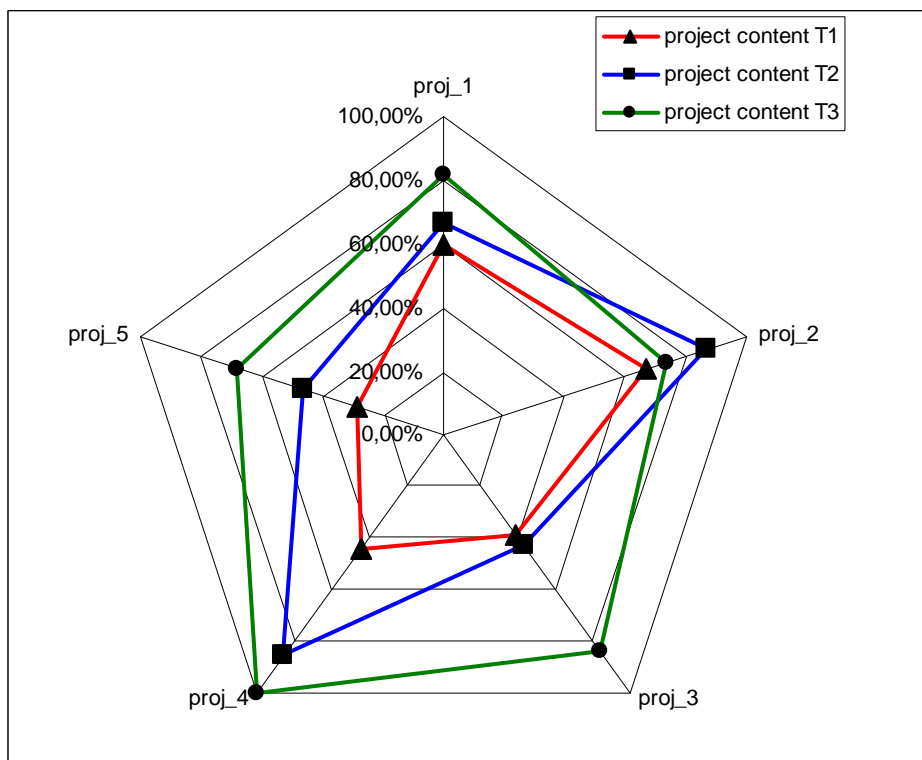
To investigate the dynamics of exchange relations between “science” and “industry” all network partners have been divided in a group of “knowledge providers” and a group of “knowledge users”. This classification was based upon their functional role within the networks. While “knowledge users” were predominantly SMEs, the classification of “knowledge provider” encompasses “academia” as well as consultants. This breakdown is a model simplification because in reality even functional knowledge users might contribute to knowledge generation and knowledge diffusion, while classified knowledge providers are at the same time also users of new knowledge exchanged within the networks.

Since there is hardly any empirical evidence about the development of density of science-industry relations in RTDI networks beyond anecdotic evidence, we assumed the following hypothesis:

Hypothesis 1: Due to programmatic requirement, industrial oriented innovation networks show a strong propensity to engage in science-industry relations in publicly funded RTDI programmes. Thus, the density of science-industry relations will affect a high share of network partners. It is assumed that at least 80 % of all possible relations between network partners from "science" on one hand and from "industry" on the other hand in terms of exchange about the project's intrinsic (technical) content and other valuable information should be realised in order to classify the network as successful.

Figure 1 shows that all RTDI networks under scrutiny developed favourably in terms of developing science-industry relations in the dimension of communication on (technical) project content. However, not all of them have had the highest amplitude towards the end of their projects (t_3). This can be caused by several factors such as the initially planned focus on joint RTD during the first phase of the project with an emphasis on marketing preparations in the second half of the project (clearly evidenced in project 2).

Figure 1: Development of science-industry relations (t_1 - t_3)



In average, the networks started (t_1) with a density of slightly less than half of the possible science-industry relations realised. This high value seems to be caused by the necessity of joining forces to prepare the project proposal. The highest value of realised science-industry relations already at the beginning of the network projects was realised

by project 2 which was clearly emanating from previous project cooperation. The maximum of realised science-industry relations in terms of exchange of the project's (technical) content across all five networks under scrutiny averaged 81 %. This means that the predefined benchmark of 80 % to qualify science-industry relations within the networks as successful has been surpassed.

In our hypothesis, we were also arguing that 80 % of science-industry relations in terms of exchange of other valuable information between "knowledge providers" and "knowledge users" should be realised under the conditions of a publicly funded RTDI programme. In this respect, the average across the five networks amounted to 77 %, which is sufficiently close to the pre-defined benchmark to be considered satisfactory. Again, the initially set benchmark could be reached although the starting value of realised exchange relations at the end of the project negotiation phase was –with an average of 37 % – comparatively low.

We can conclude that a benchmark of 80 % of realised exchange relations between functional knowledge providers and functional knowledge users can be expected within publicly co-funded network projects as a target for success. The entry of the maximum of realised science-industry relations depends on the planned and realised progression of the activities pursued within the networks. While the realised exchange relations regarding the (technical) content of a planned joint project reached already almost 50 % during the project negotiation phase, the exchange of other valuable information between "knowledge providers" and "knowledge users" is significantly lower in this phase. That being said, in successful networks the share of realised exchange relations in this respect makes a big jump forward during the implementation phase.

4 Internationalisation within cross-border RTDI networks

The innovation networks funded under CIR-CE were specifically designed to facilitate the internationalisation of the network partners. The extent of internationalisation can be measured by the percentage of realised relations compared to all possible cross-border relations. Since CIR-CE is a RTDI programme unilaterally designed by Austria, the relative gains of the Austrian network partners in comparison to their foreign counterparts constitute another aspect that deserves attention. Against this background, the following hypothesis was established:

Hypothesis 2: SMEs are in general only marginally engaged in international RTDI endeavours. However, since the USP of CIR-CE is its international orientation, which distinguishes it from RTDI programmes with a local or national outreach, the participating network partners are generally ready to enlarge their technological cooperation base across borders. Nevertheless, the identification of and subsequent cooperation with just one adequate foreign partner might already satisfy the internationalisation need of a SME. It is neither necessary nor always feasible to establish exchange relations with all foreign partners engaged in the network. They could be, for instance, potential competitors or simply from the "wrong" country. Thus, it is assumed that at least 30 % of all possible exchange relations between network partners from Austria on one side and from foreign network partners on the other should be realised in order to classify the network as successful in their international dimension.

In the network projects' negotiation phase, only 14 % of all possible international exchange relations across the Austrian border were realised in average. During the implementation of the network projects, the average maximum reached almost exactly 30 %. Thus, the initially anticipated benchmark of 30 % of realised exchange relations across the Austrian border, which qualifies to label a network "successful" in terms of internationalisation, was achieved. The highest recorded value of realised international relations across all investigated exchange dimensions was 37 % in project 3. Although the level of mutual trust remained very high between the network partners independently of their national origin even one year after the formal termination of the network projects, our sustainability investigation revealed, that three out of five projects under scrutiny failed to sustain their international exchange relations above the starting level. One year after the formal termination of the network projects, the average level of international exchange relations across all investigated exchange dimensions dropped to 13 %, which is one percentage point below the level of the negotiation phase.

In order to identify whether the Austrian network participants gained more advantage from the network projects than the foreign network partners, the realised international exchange relations including the Austrian partners were compared with the realised international exchange relations excluding them. The achieved gains along such terms could not be evaluated for project 2 and project 4, since both projects were comprised of partners from Austrian and one partner country only. The remaining three projects show that the cross-border network density between Austrian and foreign partners was clearly higher than the cross-border network density just in between the foreign partners.

5 Conclusions

With the support of SNA, the dynamics within RTDI networks can be measured and the extent of established exchange relations uncovered. Although quantified data from only five network projects are available, first preliminary benchmarks to assess the success of publicly co-funded international RTDI networks can be concluded. First, with an adequate programme design (and the absorptive readiness of the target group) science-industry relations are not only feasible within international RTDI networks, but can be expected to be realised to a very high extent. In fact, it seems that under the given framework conditions, 80 % of all possible science-industry relations measured in terms of exchange of valuable information and exchange about technical content can be expected to be realised. Secondly, internationalisation processes measured in terms of cross-border exchange relations can be substantially facilitated with the incentive of publicly co-funding. Our results indicate, however, that the sustainability of international exchange relations drops at or even below the initial level after the termination of the public co-funding. It is understood that the evidence base of our investigation is yet too limited to establish signposting benchmarks. Another six projects are currently under investigation to draw *more reliable* conclusions on the development of exchange relations within innovation networks. It should always be kept in mind that the results are contextualised and have to be adapted in any case to different framework conditions.

References and Notes

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