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# Exploring the Factors Hindering Innovation Projects within Romanian R&D Firms - a fsQCA Approach

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Product innovations developed internally or in collaboration with other organizations had a novelty character only for the companies included in our research sample, to a greater extent than for the market or markets on which the investigated companies operate. Causal configurations of factors that favour the focus of resources on incremental innovation at internal level have a greater impact than disruptive innovation. This study aims at exploring the impact of insufficient R&D dedicated funds, lack of qualified R&D staff, inability of firms to attract external R&D funding sources, difficulties in finding innovation cooperation partners, high innovation costs) on hindering innovation projects within Romanian companies, using a configurational approach. A major contribution of this study consists of explaining the strategic solutions conceived to minimize the effects of hindering innovation projects within companies with relevant R&D activities.

Keywords: innovation, research and development, SME**,** funding

JEL Code: I23, H32

## 1. Introduction

The weight of product innovations with relevant activity in the field of R&D is high, most investigated companies considered that they develop product innovations based on collaborative relationships with other companies, which indicates the adoption of open innovation principles. A significant number of companies adapt or modify products or services initially developed by other companies, given that they are not endowed with disruptive innovation capabilities. And from the perspective of service innovations, most companies embrace the idea of open innovation (co-creation of innovations based on strategic partnerships in the field of R&D).

The ways in which process innovations are implemented by Romanian firms included in the research sample reflect the fact that, unlike product innovations, most firms develop process innovations internally and based on collaborative relationships with other firms, while a share their small ones adapt or modify goods initially developed by other companies.

Most of the representatives of the investigated companies have their own permanent R&D staff, in the context of their involvement in activities on NACE code specific to R&D activities. However, a significant number of respondents from companies revealed that they have temporary R&D staff, employed only during the duration of R&D projects, especially

with European or national funding. This approach to the human resources strategy is in line with the degree of project allocation of staff. A major problem is the inability to identify on the market qualified human resources in R&D when accessing funds for research projects.

The management of innovation projects involves contingency plans to minimize risks in case of abandonment of projects, respectively in case of delays in carrying out activities, which often have external causes to the company that implements the projects and cannot be anticipated. Half of the respondents expressed their views on the delay of R&D projects for various reasons, a quarter stated that they abandoned innovative projects during the design period, while a small number of respondents abandoned them after the activities were started. . The significant number of R&D projects abandoned since the design phase must be an alarm signal for companies wishing to develop innovative projects.

This study explores how the causal configurations of specific antecedent conditions (insufficient dedicated R&D funds, lack of qualified R&D staff, inability of firms to attract external R&D funding sources, difficulties in finding innovation cooperation partners, high innovation costs) hinder the R&D projects.

## 2. Theoretical background

Analyzing barriers to innovation is crucial for entrepreneurs, as this process allows for a focused view on the innovation mechanisms at the firm level, especially from a strategic perspective on innovation capabilities. Analyzing barriers to innovation is highly valuable for the identification of any bottlenecks constraining innovative activity within SMEs (Hölzl and Janger, 2014).

As we can observe from the academic literature, there are powerful barriers to innovation, but the way forward is for leaders of SMEs to adopt an experimental approach enabling business model innovation (Chesbrough, 2010). In what concern the role of barriers to innovation in SMEs, empirical evidence largely focuses on the factors affecting perceptions of managers related to the importance of barriers or on the impact of inhibitors on the willingness to innovate and/or the intensity of innovation developed at internal level (D'Este et al., 2012).

Given the shaky strategies of start-ups and importance of innovation, SMEs have lower levels of internal resources and expertise in innovation than larger companies, which makes innovative processes harder to develop. Furthermore, the competitive environment influences and often limits the innovative capacity in SMEs and disadvantages entrepreneurs in terms of their innovation-based competitive strategies (Demirbas et al., 2011).

Fries et al. (2016) identified six relevant factors hindering SMEs' adoption of innovations: perceived unbalance of risks due to the fragile market position, compatibility with daily work routine, lack of market fit, complexity in infrastructure investments, IT know how and significant budgets for setup innovation processes.

The difficulties SMEs face in accessing finance have been widely reported as barriers to innovation and the solution is to develop internal mechanisms to apply for alternative sources of finance, such as non-reimbursable grants, venture capital etc. In the case of technology-based SMEs the time for development of new products from idea conception to market can be affected by the insufficient innovation capabilities (Larsen and Lewis, 2007).
Madrid-Guijarro et al. (2009) classify barriers to innovation in the case of SMEs in two clusters: internal barriers (limited financial resources, poor human resources, weak financial position and high cost and risk) and external barriers (turbulence, lack of external partners opportunities, lack of information regarding capturing innovation opportunities and lack of

government support). External barriers arise when the SMEs have difficulties accessing technological information, or when they confront with the lack of external finance, or skilled personal, or when there are factors related the market conditions. A SME perceives internal barriers when it lacks internal R&D funds and when the entrepreneur feels that the risks and costs of innovation are too high (Segarra-Blasco et al., 2008).

Barriers to innovation could be different, but most of them rely on cost pressures, institutional constraints, lack of highly skilled human resources, organizational culture, flow of information and government policy with low interest in supporting innovation, lack of information about how technology match clients' needs, lack of customer responsiveness (Talegeta, 2014).

Innovation capability health check is valuable for any SME which confronts with barriers to innovation. This methodology proposed by Loewe and Dominiquini (2006) assesses the extent to which levers such as R&D allocation mechanisms, reward systems for innovation outcomes, KPIs related to innovation, leadership behaviors, organizational structure and corporate culture enhance or hinder innovation.

## 3. Methodology

Qualitative Comparative Analysis (QCA) is a research technique that aims to bridge the gaps between qualitative and quantitative analyzes (Rihoux and Ragin, 2009). Unlike quantitative research, QCA creates the opportunity to analyze how multiple causal configurations affect an outcome (Ragin, 2014). The QCA value for this current research is based on the existence of conditions that are sufficient (but not necessary) to determine the outcome. Using coherence (analogous to correlation) and coverage (a value of effect size), QCA explains how causal configurations lead to a certain outcome (Woodside, 2010). Qualitative comparative analysis (QCA) really introduces the concept of "equifinality", based on the idea that several paths to a desired result can coexist in a configurational research design (Fiss, 2007).

The research model (Table 1) reflects the impact on the blocking of RDI projects as a linear function whose arguments are the five antecedent conditions embedded into the research questionnaire.

**Table 1 – Research framework**

| **Antecedent conditions** | | | | | **Outcome** |
|---|---|---|---|---|---|
| Insufficient dedicated R&D funds | Lack of qualified R&D staff | Incapacity of firms to attract external R&D funding sources | Difficulties in finding innovation cooperation partners | High innovation costs | R&D projects blocked |

*Source: authors*

*Calibration process*

The research focuses on the assumption that the relationships between the antecedent conditions used in this study are asymmetric, as perceptions of the causes of blocking R&D

projects vary from respondent to respondent. Therefore, alternative combinations of causal conditions may lead to a certain degree of impact studied.

We have turned the values for the causal conditions (insufficient own funds dedicated to RDI, lack of qualified staff in the field of RDI, inability of companies to attract external RDI funding sources, difficulties in finding cooperation partners for innovation, high innovation costs) and the impact on blocking RDI projects in fuzzy membership scores set from 0 (fully out) to 1 (fully in).

Table 2 reflects the calibration of the causal conditions and the outcome, taking into account their values from the specific evaluation scale.

**Table 2 – Scale's calibration**

| Scale point | Fuzzy membership score | Membership |
|---|---|---|
| Very high (5) | 1 | Fully in |
| High (4) | 0.75 | More in than out |
| Medium (3) | 0.5 | Cross-over (neither in nor out) |
| Low (2) | 0.25 | More out than in |
| Very low (1) | 0 | Fully out |

Adapted from*: Ragin, C. C. (2014). The comparative method: Moving beyond qualitative and quantitative strategies. Berkely and Los Angeles, USA: University of California Press.*

The definition of fuzzy set values for the antecedent conditions is consistent with the same rule for calibrating the outcome, reflecting the logic of the constructs in the configuration design approach.

We defined a new ANTECED variable as a result of computing the values of the fuzzy set of antecedent conditions in the conceptual model using the fsQCA software:
*ANTECED* = fuzzyand (Internal_funds, Staff, External_funds, Partners, Innovation_costs)

**Table 3 – Calibrated fuzzy sets values related to 50 cases**

| Internal_Funds | Staff | External_Funds | Partners | Innovation_Costs | Outcome |
|---|---|---|---|---|---|
| 0.75 | 0.5 | 1 | 0.75 | 0.75 | 0.75 |
| 1 | 1 | 0.5 | 0.75 | 0.5 | 0.5 |
| 0.75 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0.75 |
| 0.75 | 0 | 1 | 0.25 | 0.5 | 0.5 |
| 0 | 1 | 0.5 | 0.75 | 0.75 | 0.75 |
| 1 | 0.5 | 1 | 0 | 1 | 0.5 |
| 0.25 | 0.5 | 0.25 | 0.25 | 0.5 | 0.25 |
| 0 | 0.25 | 0 | 0 | 0.25 | 0.5 |
| 0.75 | 1 | 1 | 1 | 1 | 1 |
| 0.75 | 0 | 1 | 0.75 | 0.75 | 1 |
| 0 | 1 | 0.25 | 0 | 1 | 0.5 |
| 0.25 | 0.25 | 0.25 | 0 | 0.5 | 0.5 |
| 0.5 | 0.25 | 0.25 | 0.75 | 0.5 | 0.75 |
| 0 | 0 | 1 | 0.25 | 0.25 | 0.5 |
| 0.75 | 0.25 | 0.25 | 0.75 | 0.75 | 0.75 |
| 0.75 | 0.75 | 0.5 | 1 | 0.25 | 0.5 |

| Internal_Funds | Staff | External_Funds | Partners | Innovation_Costs | Outcome |
|---|---|---|---|---|---|
| 0.25 | 0.5 | 0.5 | 1 | 0.75 | 0.75 |
| 0.75 | 0.75 | 0.5 | 1 | 0.75 | 0.5 |
| 1 | 1 | 0.75 | 0.5 | 0.75 | 0.75 |
| 0.5 | 0.5 | 0.25 | 0.75 | 0.75 | 0.75 |
| 0.25 | 0.25 | 0.5 | 0.5 | 1 | 0.75 |
| 0.75 | 1 | 0.25 | 0.75 | 0.75 | 0.75 |
| 0.75 | 0.75 | 0.5 | 1 | 1 | 1 |
| 0.5 | 0.75 | 0.75 | 0.5 | 0.75 | 0.25 |
| 0.25 | 1 | 0.5 | 0.75 | 1 | 0.5 |
| 0.5 | 0.75 | 0.75 | 1 | 0.5 | 0.75 |
| 0.75 | 0.75 | 0.5 | 0.75 | 0.5 | 0.5 |
| 0.75 | 0.75 | 0.5 | 1 | 1 | 0.5 |
| 0.25 | 1 | 0.75 | 0.5 | 0.25 | 0.5 |
| 0.75 | 0.75 | 0.5 | 0.75 | 0.5 | 0.75 |
| 0.75 | 0.75 | 0.25 | 0.75 | 0.75 | 0.5 |
| 0.5 | 1 | 1 | 0.75 | 0.75 | 0.75 |
| 0.5 | 1 | 0.75 | 0.5 | 0.75 | 0.5 |
| 0.5 | 1 | 0.25 | 0.75 | 0.75 | 0.75 |
| 0.75 | 1 | 0.5 | 0.75 | 0.5 | 0.5 |
| 0.5 | 0.5 | 0.75 | 0.75 | 1 | 1 |
| 0.75 | 1 | 1 | 1 | 1 | 1 |
| 0.5 | 0.75 | 0.25 | 0.5 | 0.75 | 0.5 |
| 0.5 | 0.5 | 0.5 | 0.75 | 0.75 | 0.5 |
| 0.75 | 1 | 0.5 | 1 | 0.5 | 0.75 |
| 0.75 | 0.75 | 0.5 | 1 | 0.75 | 0.5 |
| 1 | 1 | 1 | 1 | 1 | 0.75 |
| 0.75 | 1 | 1 | 1 | 1 | 1 |
| 0.75 | 0.75 | 0.25 | 0.75 | 0.75 | 0.5 |
| 0.75 | 0.75 | 0.5 | 1 | 0.75 | 0.75 |
| 0.75 | 1 | 1 | 0.75 | 0.75 | 0.5 |
| 0.75 | 0.75 | 0.5 | 1 | 0.75 | 1 |
| 0.75 | 1 | 0.25 | 0.75 | 0.75 | 0.75 |
| 0.75 | 0.5 | 0.5 | 0.75 | 0.5 | 0.5 |

*Source: data processed with fsQCA software*

## 4. Findings

The first stage of the QCA analysis aims at combining the levers that are sufficient to determine the impact of the antecedent conditions on the blocking of RDI projects. It examines whether a causal configuration of the conditions is always present when the outcome is present.

We continued the analysis of the consistency and XY plot scores of the fuzzy sets (Figure 1). The visual representation of the cases on the XY plot demonstrates the expected result: the antecedent conditions are sufficient to affect the outcome: the blocking of RDI projects, due to the positioning of most cases above the diagonal of the graph.

The XY plan shows whether a specific condition is sufficient to achieve the result, emphasizing how consistent a given combination of conditions is. In addition, the XY plan provides graphical information on how reliable the research model is.

The consistency score (the extent to which a causal combination leads to a result) is 1 (maximum), while the coverage score (how many cases with result are represented by a particular causal condition) is 0.537. These scores imply that the distribution of the fuzzy sets is consistent with the statement that all the above conditions have an impact on the blocking of RDI projects.

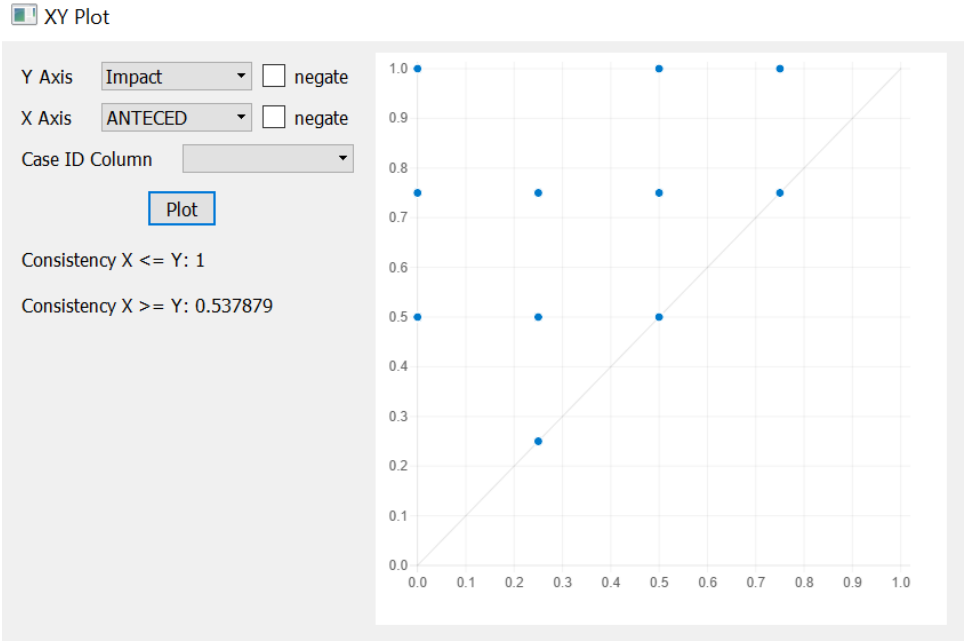


**Figure 1 - Distribution of cases in the XY plan graph**

*Source: fsQCA software*

The truth table reveals different case configurations by listing all logical combinations of causal conditions and performing sufficient conditions analysis. Five configurations were identified in the research sample (Table 4).

**Table 4 - Truth table analysis**

| Internal_ funds | Staff | External_ funds | Partners | Innovation_ costs | Outcome | Raw consistency | Proportional reduction in consistency |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 | 0.9649 | 0.875 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0.9594 | 0.9 |
| 0 | 0 | 0 | 0 | 1 | 1 | 0.9473 | 0.5 |

*Source: fsQCA software output*

Conducting the analyzes to find the complex solution implies compliance with the condition: a consistency limit of 0.8, which means that the membership score of the impact on

the blocking of innovation funds is constantly higher than the membership score of the five causal configurations (dedicated own funds Insufficient RDI, lack of qualified staff in the field of RDI, inability of companies to attract external RDI funding sources, difficulties in finding innovation cooperation partners, high innovation costs).

**Table 5 - Complex solution for the research model**

| Complex solution | Raw coverage | Unique coverage | Consistency |
|---|---|---|---|
| Internal_funds*Partners*Innovation_costs | 0.6893 | 0.5 | 0.9191 |
| ~Internal_funds*~Staff*~Partners*~Innovation_costs | 0.1818 | 0.05 | 0.8571 |
| ~Internal_funds*Staff*~External_funds~Partners*Innovation_costs | 0.2045 | 0.02 | 0.9310 |
| Solution coverage: 0.7803 | | | |
| Solution consistency: 0.8879 | | | |

*Source: fsQCA software output*

The complex solution offered by the Quine-McCluskey algorithm (Table 5) provides relevant information showing that insufficient dedicated R&D own funds, difficulties in finding innovation cooperation partners and high innovation costs are the most influential predictors of the outcome. This combination of antecedent conditions has the greatest impact on blocking innovative projects.

**Conclusions**

This study employed fsQCA to identify sufficient conditions for respondents to perceive the causal recipes that lead to the blocking of innovative projects. Most studies on the background of causes that prevent the development of R&D projects have focused on correlational analysis, not on the effect of combinations of factors. Therefore, this study differs from previous studies by identifying and analyzing the configurations of cause predictors that lead to the blocking of innovative projects.

A first important finding of this study is that a model based on the trajectories of analyzing the impact of obstacles to innovation (insufficient dedicated R&D own funds, lack of qualified R&D staff, inability of firms to attract external R&D funding sources, difficulties in finding cooperation partners for innovation, high innovation costs) is largely appropriate to explain the ways to minimize these effects by managers of companies with relevant R&D activities. Another empirical finding of this study places insufficient dedicated R&D own funds, difficulties in finding cooperation partners for innovation and high innovation costs are the most influential predictors of the outcome as the main predictors of blocking innovative projects.

The research-development-innovation activities carried out in the last two years by the companies in the research sample focused on creating new knowledge or to solve scientific or technical problems (including the own development of computer-software programs which meet these requirements), on investments in support activities for R&D (purchase of high-performance machinery, equipment, software and buildings to be used for new or significantly improved products), respectively subcontracting of R&D activities to other companies. A major problem still facing research institutes / centres in Romania is the inability to efficiently transfer the results of research conducted in the business environment.

This weakness is also enhanced by a rather limited confidence of the Romanian business environment in terms of innovation capabilities of research institutes / centres.

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**References**

1. Chesbrough, H. (2010). Business model innovation: opportunities and barriers. Long range planning, 43(2-3), 354-363.
2. D'Este, P., Iammarino, S., Savona, M., & von Tunzelmann, N. (2012). What hampers innovation? Revealed barriers versus deterring barriers. Research policy, 41(2), 482-488.
3. Demirbas, D., Hussain, J. G., & Matlay, H. (2011). Owner-managers' perceptions of barriers to innovation: empirical evidence from Turkish SMEs. Journal of Small Business and Enterprise Development.
4. Fiss, P. C. (2007). A set-theoretic approach to organizational configurations. Academy of Management Review, 32(4), 1180–1198.
5. Fries, V., Pfluegler, C., Wiesche, M., & Krcmar, H. (2016). The Hateful Six–Factors Hindering Adoption of Innovation at Small and Medium Sized Enterprises.
6. Hölzl, W., & Janger, J. (2014). Distance to the frontier and the perception of innovation barriers across European countries. Research Policy, 43(4), 707-725.
7. Larsen, P., & Lewis, A. (2007). How award-winning SMEs manage the barriers to innovation. Creativity and innovation management, 16(2), 142-151.
8. Loewe, P., & Dominiquini, J. (2006). Overcoming the barriers to effective innovation. Strategy & leadership.
9. Madrid-Guijarro, A., Garcia, D., & Van Auken, H. (2009). Barriers to innovation among Spanish manufacturing SMEs. Journal of small business management, 47(4), 465-488.
10. Ragin, C. C. (2014). The comparative method: Moving beyond qualitative and quantitative strategies. Berkely and Los Angeles, USA: University of California Press.
11. Rihoux, B., & Ragin, C. C. (2009). Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques. Thousand Oaks, CA: Sage.
12. Segarra-Blasco, A., Garcia-Quevedo, J., & Teruel-Carrizosa, M. (2008). Barriers to innovation and public policy in Catalonia. International entrepreneurship and management journal, 4(4), 431-451.
13. Talegeta, S. (2014). Innovation and barriers to innovation: small and medium enterprises in Addis Ababa. Journal of Small Business and Entrepreneurship Development, 2(1), 83-106.
14. Woodside, A. G. (2010). Case study research: Theory, methods and practice: Theory, methods, practice. Bingley, UK: Emerald Group Publishing.