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THE FACTORS INFLUENCING OPEN INNOVATION ADOPTION

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Abstract: Open innovation which has become popular concept over past two decades creates the tool enabling not only speeder development of innovation but also creation of higher quality innovation. On the other hand, the companies suffer from prejudices towards opening up internal company know-how, technology platforms or company competences to external subjects. The factors hindering the adoption of open innovation refer to both business environment factors and internal company context like firm size, company maturity, company readiness for open innovation (OI) adoption or corporate culture. This study aims to examine the factors that influence open innovation penetration in Germany and the Czech Republic. In addition, it examines potential differences or similarities in the approach to innovation in both countries. The research is based on quantitative questionnaire survey conducted in selected countries. The main findings show that open innovation adoption proceeds in a slower way in the Czech Republic as compared to Germany but other important innovation parameters as success of radically new or significantly improved products and services development, new product and service development time or market acceptance of innovative products and services are executed in rather similar way in both countries.

Keywords: Development, market, open innovation, product, service

JEL Classification: O36

INTRODUCTION

The concept of OI was pioneered by Henry Chesbrough in his iconic book in 2003 (Chesbrough, 2006). OI has been defined as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" (Chesbrough & Bogers, 2014, p. 17). The firms became interested in adopting open innovation with the hope of reducing research cost, risks, and time to market (West & Bogers, 2017).

The grounds of innovation diffusion theory were laid down by Rogers (2003). He illustrated the process of continuous penetrating the innovation through the community of adopters. The intensity of this penetration depends on ability of target groups to recognize innovation benefits and become routine users. This paper deals with the interconnection of Rogers´s diffusion theory with the concept of OI coined by Chesbrough (2004).

Previous research pointed out some problems connected with OI adoption – organization might be reluctant to organizational change, success stories cannot be merely copied to other environments, not all lessons learned are applicable to other firms (Lichtenthaler, 2011).

Several large-sample survey of open innovation adoption were elaborated. Chesbrough & Brunswicker, (2014) found that the prevalent part of companies which have already adopted OI persevere in utilization of OI. In addition, customer co-creation, informal networking, and university grants were the three leading inbound practices in 2011; crowdsourcing and open innovation intermediary services were rated lowest in importance. Joint ventures, selling market-ready products, and standardization were the three leading

outbound practices; donations to commons and spinoffs were least frequently used. On top of that they found out that large firms are more likely to receive freely revealed information than they are to provide such information. The same authors continued their research on OI adoption in large companies. They found out that that open innovation continues to be widely practiced in about 80 percent of responding firms. Outside-in (inbound) open innovation is more often practiced than inside-out (outbound). In other words, large firms are net takers of free knowledge flows, in part because they are concerned about IP protection for outbound knowledge. The authors moved the problematics ahead when adding new measures to examine open innovation at the project level. They found out that firms selectively manage knowledge flows into and out of projects and make the processes move from problem definition to innovation execution (Brunswicker & Chesbrough, 2018).

Blume (2020) points out a fact of missing structured taxonomy regarding the type of structures and approaches companies can use in order to deal with business model threatening open innovation processes. He proposes five basic types of corporate open innovation initiatives as a clustering matrix: (1.) Corporate Business Lab, (2.) Corporate Business Incubator, (3.) Corporate Business Accelerator, (4.) Corporate Venture Capital, (5.) Corporate Business Hub. This taxonomy was validated on a sample comprising more than 500 biggest Germany´s companies, banks, and insurances. Rohrbeck et al. (2009) describe Business Lab as a strong driver of open innovation activities which enables effective application of open innovation instruments in Deutsche Telekom company.

Failures that occurred during the OI adoption process triggered exploration of Critical Success Factors (CSF) that are conditional for smooth OI adoption. Subtil deOliveira et al (2018) come to conclusion that at least six thematic categories refer to CSF. They are leadership, internal innovation capability, network and relationships, strategy, technology management, and culture. Furthermore, a total of 22 CSFs for OI implementation were identified within these categories.

Empirical study describing open innovation adoption in Europe was published by Schroll & Mild, 2011). They found out that roughly 30 % companies were highly receptive to open innovation concept while 39 % companies see some benefits of that concept but they are reluctant to pursue open innovation at full speed. Inbound OI Important role in OI adoption plays R&D intensity that provides a counterbalance to OI adoption. By this way the firms can reduce R&D intensity through inbound open innovation. Birke and Gewald (2013) see OI adoption as a phased model when OI is adopted stepwise in dependence of complexity of the innovation. Any individual adoption step comes into effect in the wake of removal of the barriers. This approach was successfully tested on German SMEs. The research aimed at the exploration of OI adoption in SMEs was also conducted by Hungund and Mani (2019). The results confirm that SMEs adopt both open innovation and closed innovation approaches. They revealed that the firm-level factors such as firm age, firm size, education qualification, work experience and culture, and external factors such as customers, competition, technological advances, and ecosystem influence adoption of open innovation approach compared to closed innovation approach. Factors such as culture among firm-level factors and competition among external factors influence the adoption of closed innovation approach. The adoption of OI in SMEs was consequently researched by Cândido and Souza (2015) who identified four practices types, that are, indeed, characteristic of Open Innovation model: customer involvement; Research and Development (R&D) externalization; creation of new enterprises; and externalization market competencies. Other authors highlighted the role of managers, leaders, or founders in the dynamics of OI adoption process in SMEs (Barrett et al., 2021; Barham et al., 2021). The main finding is that management support is positively correlated with the dynamics of OI adoption.

The effects that slow down the adoption of innovations were devoted a great deal of attention as well. N surprise, that product complexity was proven to be meaningful protraction factor that slows down adoption process (Wei, 2012). Morgan and Finnegan (2010) addressed this issue in SW development firms where managers are reported to decide on the adoption of OI based on organizational technological, organizational,

environmental, and individual factors. On the contrary, some studies reported no effects of external idea and knowledge sourcing on SMEs (Van De Vrande et al., 2010).

Finnish authors drew attention to territory aspect of OI adoption in transition economies and revealed some differences in OI adoption process as compared with traditional west European economies (Väätänen et al., 2011). The adoption process in transition economies differentiate from that in Western Europe because of the interference of the states into the ownership. The conclusions derived from the research conducted on transition economics were complemented on by similar research carried out in SMEs in developing countries (Sezen et al., 2016). The authors pointed out of different condition which are typical for developing countries. They defined factors that either encourage or dissuade from the adoption of OI. He recommends the provision to ease the adoption of OI like incentive to leverage SME-university and SME-LE collaboration, creating innovation hubs to improve networking ability of SMEs, free IP consulting, conducting external search on behalf of SMEs.

Naqshbandi et al. (2015) envisaged the impact of organizational culture on OI adoption. They aimed at identifying organizational culture types that enable and retard the two types of open innovation activities: in-bound and out-bound. The findings showed that organisational culture was a significant predictor of OI adoption. They found out that highly integrative culture enables in-bound open innovation but does not significantly affect out-bound open innovation. Besides, hierarchy culture was proven to retard both in-bound and out-bound open innovation. Another important factor that facilitates the adoption of OI is the company readiness for OI adoption. This factor was exemplified on the process of Open-Source Software (OSS) adoption. According to (Filipe et al., 2021) a new set of conditions must be satisfied to reach a successfully OSS adoption. These conditions, considered as a critical success factor (CSF), involve a wide range of resources, capacities, and skills, both in internal and external scopes. Hence, even if adopter organizations should be better prepared to face the challenges related to collaborative innovation, they do not have a systematic approach to value its readiness level to face the adoption challenges. Similarly, Katsamakas and Xin (2019) arrived at the conclusion that open-source adoption depends crucially on organizational IT capabilities, network effects, and the fit of OSS with the organizations' application needs. Moreover, the results suggest that open-source adoption is sometimes socially inefficient.

The research that was conducted in IT sector were consolidated to OI adoption model (Kelly et al., 2006; Katsamakas & Xin (2019). Kelly et al. (2006) proposed adoption model for complex network-based information systems (CNIS) standards which extends current diffusion of innovation theory within a specific technological context. They accentuated the relevance of adoption context. Agile organizations must constantly survey the external environment to determine the potential of emerging technology. Open standards can make organizations less vulnerable to environmental flux due to uncertainties caused by the lack of transparency of proprietary standards. Another model developed by Katsamakas and Xin (2019) predicts that firms may sometimes adopt a heterogeneous IT architecture that consists of open source and proprietary software.

Economic tool with potential to support innovation development are open data, however theirs potential hasn´t been depleted yet (Abela et al., 2022). Open data may contribute to choose of relevant innovation scenario and/or to innovation process optimization. (Saebi & Foss, 2015). They can contribute to sharing of open innovation or some know-how elements as well, which finally support positive economic effects for the organisations (Boček et al. 2012).

Open innovations have indisputable positive influence on organizations' performance (Hungund & Kiran, 2017). But there are not generally accepted indicators which could verify innovation´s performance (Hagedoorn & Cloodt, 2003). The impact of open innovation adoption on company performance was examined for instance through patent analysis. The results show that open innovation adoption - in particular R&D outsourcing - positively affects innovation performance (Cammarano et al., 2017). Some authors (Cunningham & O´Reilly, 2018) criticise attitude based only on hard facts, because there are still further

factors to be taken in account (gained experiences which can be applicated in future, new methods bringing commercial success etc.)
For many companies it is not a matter of choice to be adopters of OI, because they cannot develop everything in-house, this is valid especially for complex product development. In situations like these the companies should have resort to collaborative research that operates on OI principle (Van De Vrande et al., 2010).

1. METHODOLOGY

Methodology comes out of Content analysis of literature resources. WoS, Scopus and ProQuest databases were searched. Following logic combination of search codes as Disruptive innovation* AND ecosystem AND diffusion" was applied. By this way 47 papers were extracted. Subsequently, questionnaire survey examining open innovation diffusion in the Czech Republic was conducted. The data were collected within 2017-2018. The scales were designed by OI-net community network that consolidates the experts, academicians, and experts under one umbrella. an identical questionnaire was sent to companies in selected EU countries. The sample of companies was composed of the set of companies operating in various industrial branches (machinery, chemistry, construction, processing industry and services). Response rate was 36 %. This paper draws attention to the adoption of OI in the Czech Republic and Germany. Since Germany is the most significant trading partner to the Czech Republic and national economy performance in the Czech Republic is closely tied with Germany´s one it was advisable to compare OI adoption process in both countries. To examine potential differences between both states four parameters which characterize company approach to innovation were subjected to quantitative testing. Sample size was 50 and 47 in Germany and the Czech Republic respectively. For each test five level scale was used. Detail description of the scales is set forth in tables 1,3,5,7. The results are presented in tables 2,4,6,8. The exploration of following topics was subjected to testing.

a) Your current open innovation status
b) Success of radically new or significantly improved products and services development
c) New product and service development time
d) Market acceptance of innovative products and services

2. RESULTS

2.1. Your current open innovation status

Tab. 1: The scale for Open adoption status

Adoption status 1	Adoption status 2	Adoption status 3	Adoption status 4	Adoption status 5
We are not adopting and not planning to adopt open innovation	We are not currently adopting open innovation, but plan to implement OI in the near future	We are in the early stages of implementing OI activities	We are in the process of refining OI activities and shaping programmes to help establish best practices in OI	We are experienced adopters of OI (processes, procedures, and best practices are in place)

Source: own research

To examine attitudes towards OI in both Germany and the Czech Republic following statistical frequencies were subjected to chi-square test. The results are following:

Tab. 2: Your current open innovation status

	Adoption status 1	**Adoption status 2**	**Adoption status 3**	**Adoption status 4**	**Adoption status 5**	***Row Totals***
Germany	12 (20.62) [3.60]	8 (6.70) [0.25]	14 (10.31) [1.32]	8 (6.70) [0.25]	8 (5.67) [0.96]	50
Czech Republic	28 (19.38) [3.83]	5 (6.30) [0.27]	6 (9.69) [1.41]	5 (6.30) [0.27]	3 (5.33) [1.02]	47
Column Totals	40	13	20	13	11	97 (Grand Total)

Source: Own elaboration

The chi-square statistic is 13.1772. The p-value is .010442. The result is significant at $p < .05$. A chi-square test of independence showed that there was no significant association between in the adoption of OI in Germany and the Czech Republic. This difference in OI adoption between these two countries is attributable to different structure of Germany business sector which produces products and services for end users. Since the target group for German business sector is end user community that can be incorporated into OI process. On the contrary, the business sector in the Czech Republic is preferably oriented on intermediate production where the interference of end-user with the product development and production is more or less restricted.

2.2. Success of radically new or significantly improved products and services development

Tab. 1: The scale for success level of new and significantly improved products and services development

Success level 1	**Success level 2**	**Success level 3**	**Success level 4**	**Success level 5**
decreased significantly	slightly decreased	remained the same	slightly increased	increased significantly

Source: own research

To examine differences or similarities in success of new or significantly improved products and services in Germany and the Czech Republic following statistical frequencies were subjected to chi-square test. The results are following:

Tab. 4: Success of new or significantly improved products and services

	Improvement level 1	**Improvement level 2**	**Improvement level 3**	**Improvement level 4**	**Improvement level 5**	***Row Totals***
Germany	5 (3.61) [0.54]	3 (2.58) [0.07]	15 (11.86) [0.83]	17 (19.59) [0.34]	10 (12.37) [0.45]	50
Czech Republic	2 (3.39) [0.57]	2 (2.42) [0.07]	8 (11.14) [0.89]	21 (18.41) [0.36]	14 (11.63) [0.48]	47
Column Totals	7	5	23	38	24	97 (Grand Total)

Source: own research

The chi-square statistic is 4.6155. The p-value is .329071. The result is not significant at $p < .05$. There is not statistically significant difference in success of new or significantly improved product and service development in Germany and The Czech Republic. This finding can be attributed to fact that the companies in both countries operate their R & D and technical development in similar competitive environment and adopt similar goal-oriented pro-innovation corporate culture. Many companies in the Czech Republic operate as German company subsidiary and pay respect to the same performance management principles.

2.3. New product and service development time

Tab. 5: The scale for new product and service development time

Development time 1	Development time 2	Development time 3	Development time 4	Development time 5
decreased significantly	slightly decreased	remained the same	slightly increased	increased significantly

Source: own research

To examine differences or similarities in new product and service development time in Germany and the Czech Republic following statistical frequencies were subjected to chi-square test. The results are following:

Tab. 2: New product and service development time

	Development time 1	**Development time 2**	**Development time 3**	**Development time 4**	**Development time 5**	***Row Totals***
Germany	3 (3.09) [0.00]	10 (7.73) [0.67]	22 (22.16) [0.00]	12 (13.92) [0.26]	3 (3.09) [0.00]	50
Czech Republic	3 (2.91) [0.00]	5 (7.27) [0.71]	21 (20.84) [0.00]	15 (13.08) [0.28]	3 (2.91) [0.00]	47
Columns Totals	6	15	43	27	6	**97 (Grand Total**

Source: own research

The chi-square statistic is 1.9323. The p-value is .748205. The result is not significant at $p < .05$. The analysis shows that there is not statistically significant difference in the product and service development time between Germany and the Czech Republic. This conclusion is in consonance with aforementioned finding concerning the success of new or improved product development. Keeping on innovation project schedule is definitely considered one of the key success factors of innovation. Companies in both countries operate innovation management within the same innovation ecosystem using similar structure of resources using almost the same innovation management practices (Stage Gate Control Process, collaborative research, innovation outsourcing, open innovation, strategic and agile approaches etc).

2.4. Market acceptance of innovative products and services

Tab. 7: Market acceptance level scale

Acceptance level 1	**Acceptance level 1**	**Acceptance level 1**	**Acceptance level 1**	**Acceptance level 1**
decreased significantly	slightly decreased	remained the same	slightly increased	increased significantly

Source: own research

To examine differences or similarities in market acceptance of innovative products and services in Germany and the Czech Republic following statistical frequencies were subjected to chi-square test. The results are following:

Tab. 8: Market acceptance of innovative products and services

	Acceptance level 1	**Acceptance level 2**	**Acceptance level 3**	**Acceptance level 4**	**Acceptance level 5**	***Row Totals***
Germany	3 (2.58) [0.07]	5 (4.64) [0.03]	22 (20.62) [0.09]	16 (17.01) [0.06]	4 (5.15) [0.26]	50
Czech Republic	2 (2.42) [0.07]	4 (4.36) [0.03]	18 (19.38) [0.10]	17 (15.99) [0.06]	6 (4.85) [0.28]	47
Column Totals	5	9	40	33	10	**97 (Grand Total)**

Source: own research

The chi-square statistic is 1.0496. The p-value is .902179. The result is not significant at $p < .05$. There is not significant statistical difference in the acceptance of innovative product or services in the market.
The results show that once the development of an innovative product is accomplished and the product or service is put on the market there is no difference in acceptance of the product or service in question in both Germany and the Czech Republic.

3. RESEARCH LIMITATION

The research was limited by a relative sample of respondents. Some reservation to OI concept still perseveres in both countries. Even if the Open innovation topic was coined 20 years ago (2003) many companies haven´t familiarize themselves with the nature of OI. Neither are they receptive to this concept nor willing to make it a part of their business.

CONCLUSION

This paper provides results of comparative research aimed at the execution of innovation practices in two neighbouring countries Germany and the Czech Republic. Concerning business collaboration these countries are mutually dependent and the comparison of selected innovation parameters can highlight potential areas for improvement. The study draws attention to four innovation topics as a) Your current open innovation status, b) Success of radically new or significantly improved products and services development, c) New product and service development time and d) Market acceptance of innovative products and services. In terms of OI adoption, the Czech Republic lags behind Germany. Possible explanation might be the different structure of German industry that is more focused on end user and therefore it is more receptive to include end users or other external subjects to innovation process. The Czech industry is prevalently oriented on semi-finished products to be further processed by finalizers. As pointed out in the research, Czech managers are still suspicious to the adoption of OI because of some distrust to open up company internal technology base, know-how or innovation competences to external subjects. Rather minor part of the Czech industrial sector is determined to current or potential adoption of OI.
The outputs of done research confirmed the general statement the firms working intensively with end markets are better equipped to adopt and implement innovations supporting major business and technological changes (Christensen & Rayner, 2003). Knowledge of end-market behaviour and customer needs

determinates the ability to predict their development and thus mitigates the risk to accept innovations for business opportunities employment (Tidd et al., 2013). As German firms are closer to the end markets, to be compared with those in the Czech Republic, can adopt and use open innovations more effectively.

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