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Summary of the doctoral thesis titled:

Conditions for the application of the concept of open innovations in scientific and research-development institutions

Doctoral thesis titled: „Conditions for the application of the concept of open innovations in scientific and research-development institutions” is a theoretical-empirical work in its character. Its purpose was to identify conditions for the application of the concept of open innovations in scientific and research-development institutions. The plan was also to achieve the following detailed goals of cognitive and empirical character.

Among cognitive goals there were:

- defining the concept of open innovations,
- naming the kinds of open innovations,
- defining the role of open innovations in the development of an organization,
- showing the scope of application of open innovations in Poland and in other countries,
- showing the specific character of the course of the process of managing open innovations,
- defining the specific character of scientific and research-development institutions,
- preparing a conceptual model of conditions for the application of open innovations in scientific and research-development institutions.

At the same time, among empirical goals there were:

- identifying the level of knowledge of the respondents about open innovations in scientific and research-development institutions,
- defining the usefulness of open innovations in the functioning of scientific and research-development institutions perceived by the respondents.
- identifying the areas of utilization of open innovations in the investigated scientific and research-development institutions,
- identifying internal conditions for the application of open innovations in the investigated scientific and research-development institutions,

- identifying external conditions for the application of open innovations in the investigated scientific and research-development institutions,
- preparing a model of conditions for the application of open innovations in the investigated scientific and research-development institutions.

For the preparation of the theoretical part of the thesis the method of critical-cognitive analysis of world literature on the subject was used. The analysis covered secondary sources in Polish and English presenting the approaches of various researchers concerning innovation, managing innovations, the concept of open innovations etc.

The results of the conducted analysis show the existence of a knowledge and research gap with regard to the application of the assumptions of the concept of open innovations in scientific and research-development institutions. Until now these issues have been analyzed mainly with regard to entities representing the sphere of business, including manufacturers and service providers.

On the basis of the results of a cognitive-critical analysis of literature on the subject the following main hypothesis was formulated:

Hg – application of the concept of open innovations has a positive impact on the functioning of scientific and research-development institutions.

Also, the following four detailed hypotheses were formulated:

H1 – the key internal condition for the application of the concept of open innovations in scientific institutions is the management’s knowledge about the concept,

H2 – the key internal condition for the application of the concept of open innovations in research-development institutions is the management’s knowledge about the concept,

H3 – the key external condition for the application of the concept of open innovations in scientific institutions is the clients’ will to share their knowledge,

H4 – the key external condition for the application of the concept of open innovations in research-development institutions is the clients’ will to share their knowledge.

Theoretical part of the work covers three chapters in which a detailed analysis of the current state of knowledge concerning the concept of open innovations is presented. This part ends with a conceptual model prepared by the author. Within the model potential relationships occurring between various entities are shown. According to the author they participate directly, or indirectly in the process of shaping open innovations. Also the conditions in which the process takes place are shown.

The empirical part of the work contains two chapters, which present the results of primary research conducted by the author for the purpose of testing the relationships presented on the

conceptual model. For the purpose of collecting primary data the method of quantitative research in form of a questionnaire survey and the method of qualitative research in form of case study analysis were used. The entity analyzed in detail was Institute of Aviation in Warsaw. At the same time, questionnaire surveys covered scientific and research-development institutions functioning in Poland.

Primary data collected in course of questionnaire surveys were processed by means of statistical analysis. In course of the analysis such statistical methods and tests were used:

- correspondence analysis,
- hierarchical cluster analysis,
- cluster analysis based on the method of two-stage grouping,
- chi-square independence test,
- Mann-Whitney U-test.

As has already been mentioned, the work contains, apart from introduction and conclusion five content-related chapters.

The first chapter constitutes an introduction into the subjects associated with the issues of innovations. In this chapter the essence of innovations, their characteristics, as well as types and sources of innovations and the process of innovation and its stages are presented. In further part of the chapter the influence of innovation on the development of contemporary organizations is discussed. Finally, the essence of managing innovations is presented.

The second chapter is devoted to the issues of open innovations as a concept for the development of organizations. In this chapter the essence and types of open innovations are presented. The author also discussed the influence of open innovations on the development of contemporary organizations and the scope and conditions of application of open innovations in Poland and in the world.

In the third chapter scientific and research-development institutions in Poland, as well as their level of innovativeness are characterized. Factors hampering and stimulating the growth of innovativeness of these institutions are discussed. At the end of the third chapter, which concludes theoretical deliberations contained in three chapters of the work, a conceptual model of conditions for the application of the concept of open innovations in scientific and research-development institutions is presented.

In the fourth chapter, which constitutes the first empirical chapter of the work, the primary research conducted by the author is characterized. Also, the methods and research instruments used to collect primary data and to process the data statistically are characterized. In further

part of the chapter the results of this research are presented and analyzed. Among others, the level of the respondents' knowledge about the concept of open innovations, the way respondents perceive the usefulness of this concept, the level of innovativeness of the investigated institutions are determined.

In the fifth chapter an analysis of internal and external conditions for the application of the concept of open innovations in the investigated scientific and research-development institutions is carried out. In the process particular attention is paid to the knowledge of the management of these institutions concerning the analyzed concept and to utilization of the client's knowledge as a source of innovations. The results of analysis carried out in both empirical chapters were the basis for the preparation of a model view of the conditions for the application of the concept of open innovations in the investigated institutions.

The analysis carried out in the work allowed the author to formulate, among others, the following final conclusions:

1. Respondents, especially those from scientific institutions correctly defined open innovations, even though the way they interpreted other terms associated with innovations suggested the respondents had knowledge gaps in this area.
2. The respondents from institutions in which the concept of open innovations has been applied definitely more often pointed to their positive influence on the current functioning of the institution than the respondents from institutions where the concept hasn't been applied. The results of correspondence analysis confirm the conclusions drawn on the basis of chi-square test results that application of innovations of an open character is associated with their influence on current and future functioning of both types of institutions. The statement contained in the main hypothesis is thus true in case when we take into consideration both groups of institutions.
3. The results of chi-square independence test are to a large extent diversified when we consider both groups of investigated institutions separately. The research on relationships between the utilization of external sources of innovations and their positive influence on the current functioning of scientific institutions, it turned out that they weren't statistically significant, even though 96,00% of respondents from scientific institutions applying the concept of open innovations thought it has a positive impact on the current functioning. Thus, the main hypothesis can be rejected in case of the analyzed scientific institutions.
4. 86,67% of respondents from research-development institutions which have applied the concept of open innovations thought that such a solution has a positive impact on the

current functioning of these institutions. According to the author of this work it is also worth drawing attention to the fact that respondents from institutions, where the concept of open innovations hasn't been applied, expressed the opinion that they have a positive impact on the current functioning of institutions, even though their percentage was smaller by over 31,00%. These relationships turned out to be statistically significant and thus the main hypothesis for research-development institutions is true with regard to their current functioning. At the same time, statistically significant relationships between the application of open innovations by research-development institutions and the positive influence of this solution on the future functioning of an institution haven't been identified.

5. In case of research-development institutions the respondents named the following as the main sources of concepts for innovations: own projects and management personnel, while in case of scientific institutions only one such source was identified – management personnel. The two formulated hypotheses saying that management's knowledge about open innovations is the key internal condition for the application of the concept of open innovations in scientific institutions (H1) and research-development (H2) institutions turned out to be true in case of the investigated entities.
6. Taking into consideration the external aspects, clients' knowledge and the will to share the knowledge didn't belong to the key conditions for the application of the concept of open innovations. As a source of ideas for innovations it was a major, but not the most important element. Thus, it is possible to say that statements contained in research hypotheses H3 and H4 are not true in case of the investigated institutions. It is because the value of average assessment of cooperation with clients was lower than 3,70 for both groups of entities. Taking into consideration the application of the five-degree scale of assessment from 1 to 5, it doesn't make it possible to recognize the above-mentioned variable as one of key conditions either in case of scientific institutions, or in case of research-development institutions.
7. A comparison of the results of qualitative research conducted in the Institute of Aviation in Warsaw and the results of quantitative research conducted in scientific and research-development institutions suggests that there are certain similarities, but also visible differences reflecting the barriers hampering the application of the concept of open innovations in the above-mentioned organization, which includes, for example, the level of management personnel's knowledge.

It is worth pointing out that it was the author's intention to carry out primary research in

all institutions of this kind functioning in Poland. However, during research works she encountered strong opposition of many entities, in which she wanted to conduct her research. The percentage of institutions in which the author managed to conduct the research became a factor limiting the scope of statistical methods and tests that could be applied in case of collected primary data. That's why attention was paid above all to identifying the relationships between the analyzed variables and determining statistically significant diversification of opinions etc., according to the application of the concept of open innovations, or not using this concept. Moreover, the identified elements of the innovative process, its effects etc. have been arranged hierarchically. Attention was paid above all to identifying the hierarchy of internal and external conditions for the application of the concept of open innovations by the investigated institutions.

As research shows, what to a very high degree determines the possibility of efficient application of the analyzed concept is the knowledge of the management personnel about innovation, facilitating, among others, also stimulating the readiness of external entities to cooperate within the process of innovation. Managers' knowledge constitutes a component of the intellectual resources of an organization in case of which the existence of statistically significant diversification has been identified with regard to the application of the concepts of open innovations by all investigated institutions. On this basis we can assume that what determines the utilization of the concept is the above-mentioned category of non-material resources of intraorganizational character. Such diversification has been identified also in case of the ability to adapt to changes in the environment, that is, an element which is also non-material in character, which reflects the level of flexibility of a given organization.

At the same time, among external conditions the occurrence of statistically significant diversification was found in case of economic climate reflecting, among others, economic situation of the country. Thus, these two conditions are decisive for the application of the discussed concept, even though only the first of them can be shaped by a given institution as a controllable element.

Conclusions drawn on the basis of the conducted analysis of primary data constitute an important contribution to management sciences, thanks to, among others:

- identification of many relationships between the application of the concept of open innovations in scientific and research-development institutions and chosen conditions of internal and external character,
- hierarchical arrangement of internal and external conditions for the application of the concept of open innovations in scientific and research-development institutions,

- comparison of the scope and specific character of internal and external conditions facilitating and hampering the application of the concept of open innovations in scientific institutions and research-development institutions,
- development of a model presenting internal and external conditions for the application of the concept of open innovations in scientific and research-development institutions.

The drawn conclusions are also characterized by high application value and the implementation of the model developed by the author may contribute to more efficient management of the analyzed institutions and the processes of innovation taking place in them.

According to the author of this work in the future research concerning the analyzed issues should be repeated regularly. This would allow the identification of the character and scope of potential changes taking place in the approach to the application of the concept of open innovations in scientific and research-development institutions. For the purpose of identification of the influence of other conditions, including cultural conditions, for the application of the discussed concept, it would be justified to expand the scope of research to other European countries. These plans will direct future scientific-research activity of the author at the same time allowing to eliminate certain limitations associated with the conducted research, including the subject scope and geographical coverage.