

Quantitative Survey on Innovation in the Czech Republic

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Abstract—One of the most important characteristics of innovation is that it is a continuous process in every organisation. The financial performance of organisations is strongly dependent on successful innovation. Innovation rate resp. the pace of technological change is mainly influenced by investment in research and the ability to use in practice. It is important to emphasise that innovation can also contribute to increasing safety, improving health care, improving the quality of products or services, and introducing environmentally friendly products. The goal of this article is to evaluate whether organisations are dedicated to innovation, to identify the sources of incentives to innovate and to assess the possibilities for further innovation development in organisations operating in the Czech Republic. The results ($n_1=364$; $n_2=278$; $n_3= 389$), show that innovation logically takes the most part in management (67.58%; 62.95%; 60.15%) and specialists (60.16%; 57.19%; 58.87%) in the organisation in the analysed year and a very important source of intentions are employees. The most important innovation areas are quality of work and innovation's activities are focusing on the strategic goal, approving innovation through management and management control (32.69%; 36.69%; 26.22%) and the innovative activity of organisations significantly influences competitiveness.

Keywords—*innovation, invention, innovative process, innovative development, the Czech Republic, survey*

I. INTRODUCTION

The invention is, according to [1], a name for a certain creative activity (new ideas). When inventions are implemented and commercially exploited, innovation can be talked about. The origin of the word innovation comes from the Latin word *innovare*, which can be translated as a word to renew [2]. In the economic sphere, this word was introduced by J. A. Schumpeter. Schumpeter promoted new combinations (so-called creative destruction) that can be seen as absolute innovations.

Reference [3] adds that innovation is "*an inseparable part of a company that develops an entrepreneurial spirit, creativity and imagination, and willingness to take risks.*" Reference [4] understands innovation in a general sense as creating value, contributing something new.

In the Czech Republic, Valenta is considered to be the founder of the innovation theory, which understands innovation as [5]: "*any change in the internal structure of the production organism. Any transition from the original to the new state.*"

The National Innovation Strategy (NIS) from 2008 considers innovation as the renewal and extension of the

range of products and services, the creation of new methods of production, supply and distribution.

There are several types of innovation classifications, the Oslo Manual [6], which has been prepared by experts in measuring and evaluating innovation activities within the OECD member countries, is essential in this context. The Oslo Manual [7] distinguishes the product, process, marketing and organisational innovations. Reference [8] list further possible divisions, namely product, non-technical and social innovation. The fundamental difference between these basic groups is their primary focus.

Reference [9] states that innovation is a key process within each organisation and the level of innovations does not depend on size or sector of the economy. According to this author, the process includes elements of exploration, choice and implementation, including learning. For example, reference [10] emphasises the three basic levels of the process - the level of introduction, implementation and institutionalisation.

According to the [11]–[13] it can be summarised that innovation contributes to achieving a competitive advantage in organisations through technological innovations, continued development of the organisations and human resources, development of the market etc. Competencies are very important for improving innovation potential [14]–[16].

The goal of this article is to evaluate whether organisations are dedicated to innovation, to identify the sources of incentives to innovate and to assess the possibilities for further innovation development in organisations operating in the Czech Republic.

The article's secondary goals are:

- provide a summary of the viewpoints of individual authors who are concerned with the field of innovation, service marketing, and identify the factor which influenced employees' development,
- to present the results of primary research into the area of innovations in organisations operating in the Czech Republic,
- to propose measures in the area of improving the effectiveness of the innovations.

The structure of the paper is as follows: the theoretical background of the work is presented first; this is followed by the paper's methodology which describes the paper's preparation. Furthermore, the results have been evaluated, and we have proposed summary and recommendations outstanding from the research. Finally, the paper also presents

the theoretical and practical benefits and limitations which apply to it.

II. THEORETICAL BACKGROUND

This article takes the study of the innovations further and focuses more sharply on the ways of innovation evaluated by organisations and perceived innovation's development possibilities to define those which are specific and crucial for an individual, microeconomic and macroeconomic development [13], [17], [18].

In today's highly competitive environment, active support for continuous innovation is an integral part of the management approach. Corporate Innovations by [19] are perceived as continuous or discontinuous (breakthrough). An innovative enterprise such as a company that has implemented a technically new or significantly improved product or process over a certain period [7].

Knowing and managing the success factors of product innovation includes the efficiency and effectiveness of innovative projects which is confirmed by reference [17]. After evaluating the success and effectiveness of the innovation project, it is necessary to choose the criteria according to which the project will be evaluated, see Fig. 1. below [1].

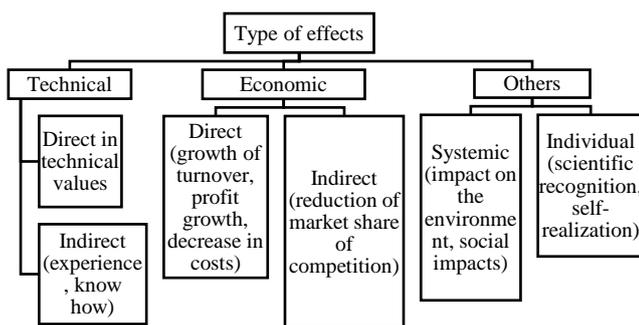


Fig. 1. Scheme of types of evaluation criteria. (source: authors)

The main motivation for the introduction of innovation is the market economy, which is also related to the ever-growing competition. It follows from the above that the most innovative companies are those that are subject to strong competition. Other reasons for introducing innovation are mentioned by [20], such as growing consumer needs and demands, the rivalry between businesses in the area of skilled workers, environmental protection, etc. Reference [21] link innovation and the environment, and state that technological change can have the following environmental impacts by providing important environmental information, improving the efficiency of the use of natural resources etc.

This study, motivated by the recognition that organisational performance and innovations influenced the success of the organisations in the economy, focuses on one of the key factors in organisational efficiency: innovation and customers in the Czech economy. The survey presented in this article is focused on the key areas of innovation from the customers' view and thus reveals the actual current approach taken by organisations to innovation in the economy in the Czech Republic.

III. DATA AND METHODS

The article was elaborated by methods of analysis of secondary and primary sources, knowledge synthesis, induction, deduction and comparison. Secondary sources analysed scientific monographs and scientific articles in the Web of Knowledge and Web of Science databases on innovation, organisational marketing approaches, and business strategies.

Primary data was obtained by performing quantitative research using the data collection questionnaire. The research was carried out between senior and middle management in organisations operating in the Czech Republic. The research was carried out in the last third years, and the individual results are compared with each other.

A. The Sample

In the first year of research, the total number of employees was 364. The structure of the addressed organisations was as follows:

- According to the size of the organisation in which they work: 37.09% of the small, 27.47% of the medium, 35.44% of the large organisations,
- According to the sector in which the organisation operates: 63.46% operate in the private sector and 36.54% in the public and state sector,
- According to the business sector: 5.77% are in the primary sector, 17.58% in the secondary sector and 76.65% in the tertiary sector,
- According to the market on which the organisation operates: 17.31% operate on the local market, 19.23% on the regional market, 30.22% on the national market and 33.24% on the international market,
- According to the membership of a larger group of organisations: 50.27% of organisations are part of a larger group of organisations, 49.73% are not,
- According to the region where the organisation is based: the capital city of Prague is 34.89%, South Bohemian Region 27.75% and Central Bohemian Region 13.46%.

In the second year, the sample of employees consisted of 278 organisations. The structure of the addressed organisations was as follows:

- According to the size of the organisation, they work in 35.61% of the small, 32.73% of the medium, 31.65% of the large organisations,
- According to the sector in which the organisation operates: 71.58% operate in the private sector and 28.42% in the public and state sector,
- According to the business sector: 3.60% is active in the primary sector, 16.91% in the secondary sector and 79.49% in the tertiary sector,
- According to the market on which the organisation operates: 15.83% operate on the local market, 13.67% on the regional market, 21.94% on the national market and 48.56% on the international market,

- According to a larger group of organisations: 50.00% of organisations are part of a larger group of organisations, 50.00% are not,
- According to the region where the organisation is based: the capital city of Prague is 42.45%, Hradec Králové region 16.55% and Central Bohemian Region 13.31%.

The sample of employees made up 389 organisations in the last year. The structure of the addressed organisations was as follows:

- According to the size of the organisation in which they work: 46.78% of the small, 28.53% of the medium, 26.22% of the large organisations,
- According to the sector in which the organisation operates: 66.84% operate in the private sector and 33.16% in the public and state sector,
- According to the business sector: 6.17% are in the primary sector, 18.25% in the secondary sector and 75.58% in the tertiary sector,
- According to the market where the organisation operates: 16.45% of the local market, 21.59% of the regional market, 27.51% of the national market and 34.45% of the international market,
- According to the membership of a larger group of organisations: 43.19% of organisations are part of a larger group of organisations, 56.81% are not,
- According to the region where the organisation is based: the capital city Prague 36.76%, Central Bohemian Region 16.97% and Hradec Králové 11.57%.

Every year, other organisations were involved in the research. For each organisation, one questionnaire survey was filled in by one representative. This was a senior management position at the middle and senior level of management. The approached manager was an expert on the area under investigation. The selection of managers was deliberate. 634 managers (634 organisations) were approached in the first year of research, but only 364 managers were willing to participate in the questionnaire survey. In the second year of the survey, 458 were addressed, 278 attended, and in the third year it would total 597 and participate in 389. Managers were approached by email by personal contacts, addressing organisations participating in the Company of the Year competition or other prestigious events.

B. Data Processing

To evaluate the outcomes of the survey methods of descriptive statistics (absolute and relative frequency, testing of dependency between set qualitative characteristics and power dependency tests) have been applied. Pearson's Chi-square test and Cramer's V have been applied.

The observed (empirical) frequencies and expected frequencies (calculated upon the assumed validity of H_0) were compared for separate combinations of random variables X and Y . The hypothesis H_0 was tested: X, Y are stochastically independent random variables versus the alternative hypothesis H_1 : X, Y are not stochastically independent random variables. The test statistic formula is (1):

$$K = \sum_{j=1}^r \sum_{k=1}^s \frac{(n_{jk} - \frac{n_j \cdot n_k}{n})^2}{\frac{n_j \cdot n_k}{n}} \quad (1)$$

The dependence strength was computed using the Cramér's V measure (2) that is within $0 \leq V \leq 1$, irrespective of the contingency table volume.

$$V = \sqrt{\frac{K}{n \times \min(r-1, s-1)}} \quad (2)$$

If H_0 applies then K is asymptotically governed by the distribution $\chi^2((r-1)(s-1))$. We therefore reject the independence hypothesis of the X, Y variables at the asymptotic significance level α , if $K \geq \chi_{1-\alpha}^2((r-1)(s-1))$. If the p -value calculated by means of the χ^2 test (Pearson Chi-Square) was lower than the selected level of significance $\alpha = 0.05$, hypothesis was rejected. The analysis was carried out using the Microsoft Excel 2013 statistical software IBM SPSS Statistics 22.

IV. RESULTS

The objective of this chapter is to evaluate the results obtained from the primary surveys. The results of the quantitative research have been statistically evaluated, and recommendations have been formulated upon this basis.

A. Innovations in Organisations in the First Year of the Survey

The results in the first year of research have shown that 89.29% of the 364 organisations that participated in the research consider it important for their organisations to be engaged in innovation in today's highly competitive environment. Only 10.71% of the organisations' representatives said that innovation is not important to them, they are rather unique and that they emphasise traditions. Leaders and employees do not like to change, so they try to keep the market according to the already set processes. A total of 75.55% of senior managers said they were doing their job continuously, and 24.45% said they were random activities or did not support innovation at all.

The results show that most often, organisations receive incentives to innovate from employees (46.98%), from experts (specialists) from 45.05% and customers (41.76%). The workplace procedures (53.57%), labour quality (48.63%) and, last but not least, labour productivity (30.22%) are most often innovated. The majority of managers (67.58%), the specialist (60.16%), the administrative (32.69%) and the workers themselves (27.75%) are involved in the innovation process itself. For the largest groups of addressed organisations (32.69%), employees are regularly involved in the innovation process, individuals and teams are working on innovation in a coordinated manner with a focus on the strategic goal, but specific innovation must be approved by management. Additionally, 23.90% of organisations engage their employees occasionally in innovations, when errors occur in new processes or approaches. Again, however, it is necessary for a specific innovation to be approved by management. A total of 7.14% of organisations involve staff regularly, where individuals and teams work on innovation in a coordinated manner with a focus on strategic goals, but without management control, which is the same for 7.14% of

organisations with regular, but non-strategic, strategic coordination. 29.12% of organisations are not involved in the innovation process at all.

Based on the testing of dependencies between qualitative features, it can be said that the dependence has not been proven between the realisation of innovations in individual addressed organisations and:

- organisation size, p -value is 0.896,
- the sector in which the organisation operates, the p -value is 0.832,
- the business sector; the p -value is 0.319,
- the market on which the organisation operates, the p -value is 0.483,
- affiliation to a larger group of organisations, the p -value is 0.550,
- the region where the organisation is based, the test did not fulfil the statistical conditions: no interval with zero frequency, up to 20% confidence intervals at a frequency less than 5.

B. Comparison of Results with Other Years of Survey

Based on the results of the questionnaire survey, it is possible to summarise that 89.29% of the addressed organisations were involved in the first year of research, with only 67.99% of the organisations addressed in the second year and 69.15% in the third year. Tab. 1 shows the results of what group of employees are participating in innovation. Managers could have more answers.

TABLE I. RESULTS OF A COMPARATIVE ANALYSIS

Year	Employee Group	Absolute Frequency	Relative Frequency
First year	Management	246	67.58
	Specialists	219	60.16
	Administration	119	32.69
	Ordinary employees	101	27.75
Second year	Management	175	62.95
	Specialists	159	57.19
	Administration	79	28.42
	Ordinary employees	62	22.30
Third year	Management	234	60.15
	Specialists	229	58.87
	Administration	121	31.11
	Ordinary employees	97	24.94

Source: Authors

It can be summarised that the most participate in innovation management and specialists in every year of the survey. Based on the results, it is possible to make a comparison between the individual years when the research is in progress.

Tab. 2 summarises the sources from which organisations most often receive incentives to innovate. Managers could have more answers.

The results show that the employees who are incumbent of knowledge bring most incentives to innovate, further

customers and experts. This situation was very similar in every year of the survey.

TABLE II. RESULTS OF A COMPARATIVE ANALYSIS

Intentions	First year	Second year	Third year
From employees	46.98	48.56	46.53
From suppliers	17.03	19.06	21.34
From wholesalers	7.69	6.12	4.37
From competition (benchmarking)	26.10	30.58	30.33
From customers	41.76	43.17	43.70
From experts, specialist	45.05	34.53	42.93
From his research department	17.58	17.63	18.77
From co-operation with colleges	7.42	6.47	6.17
Other	2.75	0.72	1.29

Source: Authors

Tab. 3 shows a comparison of the results in the years under review in identifying the area's most frequently addressed by organisations addressed. Managers could have more answers.

TABLE III. RESULTS OF A COMPARATIVE ANALYSIS

Innovation areas	First year	Second year	Third year
Work productivity	30.22	27.70	29.82
Quality of work	48.63	37.05	41.65
Work instructions	53.57	42.81	52.44
The way of delivering the material, respectively services	14.84	12.59	19.28
The way of selling products or services	13.74	10.07	14.40
The length of the manufacturing process	6.87	9.35	8.74
Production costs	18.96	20.86	17.48
Portfolio of products and services	0.00	33.09	27.51
Other	3.02	1.44	1.54

Source: Authors

Innovation is in some sectors even the only option to succeed in ever more demanding markets. The best way not to take innovation as an obligation, but rather as a way and opportunity to develop an organisation and a certain social benefit to go organisation forward, not stagnant, or even did not disappear. Tab. 4 summarises the results of how employees are involved in the innovation process.

TABLE IV. RESULTS OF A COMPARATIVE ANALYSIS

Involvement	First year	Second year	Third year
Regularly, coordinated with a focus on a strategic goal, without management control	7.14	3.60	5.14
Regularly, in a coordinated manner, focusing on the strategic goal, approving innovation through management and management control	32.69	36.69	26.22
Regularly, without shared strategic coordination, innovation is subject to management approval	7.14	6.83	6.17
Occasionally, when errors occur in new processes or processes, innovation is subject to management approval	23.90	20.14	28.02
Employees are not involved in the innovation process	29.19	32.73	34.45

Source: Authors

On the results we can summarize that level of innovation potential is better if the innovation areas are in agreement with the strategic goals and these innovation activities are supported by management. Organisation innovativeness has been the central concern in the upsurge competitive environment and while strategic decisions, such as innovation has been posited to be potentially derived by the top management and specialists with according to the results of [13] or [22].

V. DISCUSSION AND CONCLUSION

Nowadays, prospective are the innovations they have a positive impact on the environment and customers bring some advantage, saving, process acceleration and quality of human resources etc. according to [14], [16]. One of the key findings of the conducted research is that, based on the testing of dependencies between qualitative features, it can be said that the dependence between the realization of innovation and the size of the organisation, sector, business sector, market, membership of a larger group of organisations, the region where the organisation operates is not proven. The results of [23] show that the link between innovation and internationalisation differs according to the type of innovation introduced and the degree of novelty of the innovation. According to the [15], [22] or [23] is very important of importance to managerial practice, the combined effects of different types and degrees of the novelty of innovation are greater than their individual effects, creating a synergy or amplified effect which is confirmed by [17], [18]. As the results show innovation logically takes the most part in management and specialist in the organisation in accordance with [14] and [15]. The sources from which organisations most often receive incentives to innovate are primarily professionals, customers, competitors and employees. Based on the research, the work processes and quality of work are most often upgraded.

Theoretical contribution is to explain the area of innovations and selected approaches of the organisations in innovations. The practical contribution is described the current situation identify in the identification of the sources of incentives to innovate and to assess the possibilities for further innovation development in organisations operating in the Czech Republic. The limit of the article is that the results can be generalised on selected organisations in third-year survey. The future research can be focused on the influence of the knowledge level of the organisation on the innovation potential and apply this survey in Czech and Slovak organisations (the results can be compared).

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