

# How Objective Are Subjective Measures of Organizational Innovativeness, Really?

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Primary submission: 24.10.13 | Final acceptance: 20.12.13

## Abstract

**Purpose:** This paper aims to match subjective and objective measures of organizational innovativeness and test correlative relationship between the two.

**Methodology:** The research adopts a quantitative approach, and applies correlation analysis to identify interdependencies. The study has been done in the aviation industry, as organizational innovativeness has so far been described especially in high-tech industries – however it has not been investigated within aviation industry yet.

**Findings:** The results show that the discussions over reliability of research based on subjective measurements techniques are not unfounded. The evidence suggests that subjective measures are not correlated with objective measures, and the outcomes of third-party investigations differ considerably. Therefore decisions about measurements techniques should be deliberate, thought out, theoretically grounded and justified. In general, methodological recommendations provided by this paper could be boiled down to the ascertainment that accurate and reliable assessment of organizational innovativeness should use a set of objective measures addressing all stages of the innovation process.

**Originality:** It should be noted that this study was restricted to only one industry and prone to some common bias. The aviation industry sample was relatively small and purposefully selected, disallowing conclusive statements made outside of this empirical setting. However despite the limitations this paper provides some significant contribution to evaluation and research on innovativeness. It compares two approaches to measurement and empirically proves which approach is more suitable in case of such a highly innovation-intensive sector like aviation. Moreover, it introduces a new in Polish research tool for subjective assessment of organizational innovativeness namely the questionnaire developed by Wang and Ahmed (2004).

**Keywords:** measures of innovativeness, subjective measures, objective measures, organizational innovativeness, aviation

JEL: B49, O39

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## | Introduction

Over the years, researchers have explored a plethora of different types of innovation, in various stages of implementation process and by using a range of analyses (Crossan and Apaydin, 2010). From the strategic management standpoint, organizational innovativeness should be perceived as a variable explaining phenomena and processes such as organizational entrepreneurship (Covin and Slevin, 1991; Lumpkin and Dess, 1996; Morris and Kuratko, 2002), organizational performance (Damanpour and Evan 1984; Han, et al. 1998), organizational development (Alegrea et al., 2009), and competitive advantage of organization (Zhou and Wu, 2010; Weerawardena and Mavondo, 2011). Conversely, innovation can be perceived and researched as a variable explained by different phenomena and processes including interorganizational relationships (Dyer and Singh, 1998) and networks (Capaldo, 2007; Czakon, 2012), interorganizational collaboration (Kale and Singh, 2002) and cooperation (Cassiman et al., 2009; Czakon, 2012), knowledge transfer (Friedriksen and Semita, 2012) and spillover effects (Breschi and Lissoni, 2001), or interorganizational trust (Ellonen et al., 2008). Regardless of which approach prevails, the critical for the entire research remains the decision which measurements methodology to use – based on either subjective or objective measures of innovation.

For decades management literature set the stage for discussions of the reliability of research based on subjective measurements. However, some authors favour objective measures over subjective ones. They believe that using subjective measures is less cost effective and time efficient when it comes to data collection. In other words, no information about the problem itself is obtained. However, despite these shortcomings, subjective measures remain popular in management science. Many authors insist that respondents prefer them and that the results they produce are equivalent to results produced by objective measures.

Heated debates over accuracy, precision, reliability and adequacy of objective and subjective measures in management research (e.g. Jennings and Young, 1990; Geringer and Hebert, 1991; McMullan et al., 2001; Wall et al., 2004; Johnson et al., 2007; Forth and McNabb, 2008; Dyduch 2008; Taylor 2011) gave grounds for finding a relationship between objective and subjective measures of innovation. To date, scientific efforts undertaken to explore the extent to which measurement methods could be mutually substitutive provided contradictory findings. Furthermore, no such research has been undertaken in the field of aviation or within Polish enterprises. Therefore, this paper compares findings of research into organizational innovativeness of Polish aviation organizations conducted concurrently using subjective and objective measures, and tests the hypothesis which states that the results are interdependent.

The paper is organized in four sections. The first section presents a twofold approach to innovativeness measurement that incorporates both subjective and objective operationalizations. The second section presents a general research framework consisting of research questions, aims and the applied methodology. The third section gives the empirical results related to subjective and

objective measurements of innovativeness and their correlation. Finally, the last part discusses the empirical results, provides some theoretical and practical contributions and presents future research directions.

## | Theoretical background

In terms of organizational innovativeness, the literature recommends a holistic approach (Damanpour and Evan, 1984) covering more than product innovativeness. Therefore, it is assumed that organizational innovativeness is “an organization’s overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behaviour and process” (Wang and Ahmed, 2004, p. 304). This definition covers diversified, complementary and *co-creating* aspects of innovation processes undertaken within organizations. It especially takes into account both the technical (related to products, services and processes) and the administrative (related to strategy, procedures and social structure) innovativeness of organizations (Evan, 1966; Damanpour and Evan, 1984).

In light of the above, innovativeness is an organizational, immaterial asset (Manoochehri 2010) manifested as a competence and reflected in the ability to adapt to a fast-changing and high-velocity environment (Zhou and Wu, 2010). In that sense it can be perceived as a source of organizational performance (Damanpour and Evan, 1984) and longitudinal competitive advantage (Zhou and Wu, 2010; Weerawardena and Mavondo, 2011) from the perspective of resource-based (Barney, 1991) and dynamic capabilities (Teece et al., 1997) theories.

Our focus on organizational innovativeness includes a wide range of areas in which innovativeness is created. Analysis of scientific accomplishments from the last thirty years – as per a review by Crossan and Apaydin (2010) proves that innovation is a complex, multi-dimensional and intangible concept. However it seems to be a critical factor in development and in competitive advantage. Unfortunately the intangibility of innovativeness results in the diversification of theoretical and research approaches. Moreover its multifaceted and fuzzy nature causes methodological problems (Manoochehri, 2010) and makes selecting measurements difficult. The methodological challenge is to decide upon approach adopted following an evaluation of the level of innovativeness. It is important to upon either a subjective or an objective approach. Each approaches has its pros and cons.

**Subjective approach** involves personal opinions of respondents. Researchers who choose this approach gather data predominantly from primary sources through field research. Research projects that use the subjective approach, to an overwhelming extent use different scales, beyond the Likert scale (e.g. Morris and Kuratko 2002; Wang and Ahmed, 2004; Ellonen et al., 2008). Metering scales, widely used in research using the subjective approach, allow for broader, deeper and cross-sectional research. Respondents can be asked about different aspects of innovation,

thus creating greater opportunities for stating and testing hypotheses (Maravelakis et al., 2006). The subjective approach also allows researchers to assess the process of innovation prior to its fruition (Alegrea et al., 2009), before innovation in the forms of products or services is rolled out to the market. This advantage provides the greatest benefits for organizations running their businesses within industries characterized by long cycles of innovation implementation (Chen and Muller, 2010) such as the pharmaceuticals, aerospace or automobile industries. Moreover, using standard metering scales facilitates international comparison of research findings (Alegrea et al., 2009), hence it is often recommended for innovation research (e.g. by Oslo Manual). One should bear in mind, however, that such a research design is prone to produce erroneous findings, since respondents offer subjective opinions (Maravelakis et al., 2006).

**Objective approach** uses real information and organizational indicators reflecting the level of achieved innovation. Great advantage of objective approach is a wide array of measures (e.g. Romijn and Albu, 2002; Chen and Muller, 2010; Crossan and Apaydin, 2010) which are well suited to assessing the nature of organizational innovativeness. Among the commonly used, universal and overall measures of organizational innovativeness are the level of R&D expenditures, number or value of new products introduced, number of R&D projects realized, or number of patents possessed. However, the value of new products introduced (value of innovations) is the most popular and the most frequently used objective measure of organizational innovativeness. It is often operationalized as a value of sale of new products, the profits from sale of new products (Mankin, 2007), a share of sales of innovative products in total sales (Mairesse and Mohnen, 2002), an economic value of innovations (Kamaruddeen et al., 2009), a market value of new products (Mankin, 2007), the revenues from new products in total sales, a share of profits from new products in total profits, the growth rate of revenue caused by sales of new products (Manooch-ehri, 2010). It should be added, that the evaluation of organizational innovativeness is usually made at the level of innovation introduced successfully with division into radical and incremental innovations (Chen and Muller, 2010) or into technical and administrative innovations (Damanpour and Evan, 1984). Another advantage of the objective approach is the possibility of using a wide range of secondary data, often publicly available. The organizations or researchers do not have to spend time on the design and implementation of empirical research to collect primary data. With the objective approach the data usually come from sources and databases such as statements, reports and rankings of innovativeness, organizational websites devoted to innovation, chambers of commerce, public institutions, or national, regional or global statistical offices. However, these sources are often inadequate and do not fit the research purposes. Quite often, if some objective data is available it cannot be used by researchers due to its level of aggregation, scope or timeframe. The difficulty in accessing required, detailed or raw data becomes the most formidable obstacle. Moreover, within other limitations of the objective approach there are also difficulties in making international comparisons (Maravelakis, 2006) and problems with data accessibility (e.g. some respondents wish to protect their organization against competitors and potential market rivals, therefore they declined to take part in the research and refused to disclose significant information).

All in all, designing a tool suitable for holistic and reliable assessment of innovation could pose a significant challenge. The choice of research approach should be conscious, and aligned with the circumstances (research scope) and resources at the researcher's disposal. According to research obtained by Dess and Robinson (Kale et al., 2002), objective measures are correlated with their subjective counterparts. Those findings have also been confirmed by other research conducted within the field of strategic management, which has proved a strong, positive correlation between subjective measures and their objective equivalents (Jennings and Young, 1990; Geringer and Hebert, 1991; Wall et al., 2004; Taylor, 2011). In light of the above, it would seem that a well-composed set of innovation measures fully reflecting its level is more important than making a dichotomous decision concerning the character of measures used. Even more so, since organizational innovativeness is intangible and complex, using one or several measures could lead to ill-conceived conclusions (Manoochehri, 2010). However, thus far research into equivalence of subjective and objective measures has been inconclusive. Literature provides empirical evidence on the absence of interdependence between objective and subjective measures (Johnson et al., 2007) and even substantial discrepancies between results of research conducted concurrently using both approaches (McMullan et al., 2001; Forth and McNabb, 2008). All of these methodological ambiguities call for further research. To the author's knowledge, another rationale for the problem investigated in this paper is the lack of prior research into equivalence of subjective and objective measures of innovativeness conducted on the aviation/aerospace industry or on Polish organizations. The research gaps and the inconclusive results of foreign research justify the need this research.

## | Research design

This paper compares the subjective and objective measures of organizational innovativeness and verifies the correlation between the two. The reason for this research is the desire to answer the query: *are objective and subjective measures of organizational innovativeness interdependent?* The twofold approach to the measurement of innovativeness allowed us to evaluate considered organizations separately and compare the results.

*Sampling.* The study was conducted in the Polish aviation sector. The sector was hand-picked because of its high-tech (according to OECD) and knowledge-intensive nature (according to Eurostat), above-average R&D outlays and strong pressure to remain innovative, thereby being a perfect environment for measuring organizational innovativeness.

Recent research on innovation within the Polish economy proves that the aviation sector should be deemed the most innovative, knowledge-based and technology-intensive of the country's industry (Baczko et al., 2012a, p. 7) being a crucial supporter of competitiveness and innovativeness of Poland (Baczko et al., 2012b, p. 326). Polish economists argue that the dynamics of

innovative progress reached by aviation organizations *should be a role model* for all Polish enterprises (Baczko et al., 2012b, p. 36).

Pro-innovative specificity of the aviation sector was the basis of the purposeful industry selection. This sector is the most developed, high-tech industry in Poland (Baczko et al., 2012a, p. 197), one that is characterized by extremely fast and deep changes as well as by a intense hyper-competition that forces its actors to engage in continuous learning and to implement innovations. Furthermore, the above-average level of organizational innovativeness that is characteristic of Polish aviation companies results not only from the extremely high expenditure on R&D: 18% in 2009 (Baczko et al., 2012b, p. 224). In the aviation industry, an equally important aspect seems to be a diversification of processes oriented on multidimensional innovativeness implemented within various areas of business activity (Kotowicz-Jawor, 2010). Activities and processes aiming at innovations taken by aviation organizations are implemented not only to leverage the product and process innovativeness, but also to improve the quality of human resources (behavioural innovativeness) and develop knowledge capital through cooperative strategies of mutual learning (strategic innovativeness). Based on the above, it can be concluded that the aviation industry, as a hugely innovative industry, seems to be an appropriate environment for research on innovativeness and innovation processes, especially if organizational innovativeness is considered a multi-dimensional construct (Damanpour and Evan, 1984; Wang and Ahmed, 2004).

The rationale for the purposeful sector selection was the need for research aimed at identifying the interdependencies between subjective and objective measures of organizational innovativeness in Poland, although Polish organizations have been outside the field of exploration in prior research. The narrowed, geographical and industrial scope of the research results from the lack of research on innovation measurements within the aviation sector in general as well as from the lack of research undertaken in Poland. Therefore, the study was focused on the identification of possible relationships rather than on their explanation.

Poland's aviation sector consists of approximately 120 organizations (PAIIZ), 88 of which were invited to take part in the research; however they were not randomly selected. Unfortunately, early in the research it is not possible to compile a complete list of actors co-creating Polish aviation industry.<sup>2</sup> Therefore, the researcher decided to limit the scope of the research to the organizations associated in the most important and the biggest aviation cluster: Aviation Valley. It should be noted that during the research Aviation Valley was the only active aviation cluster in Poland; the other two – Aviation Mazovia and Lubuski Klaster Lotniczy – were registered but were not active. Moreover, due to the cluster's size (88 members) and its importance (90% of the turnover of aviation industry), limiting the research framework to the Aviation Valley has

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<sup>2</sup> The results are a part of a research project financed by National Science Center (DEC-2011/03/N/HS4/00372) assuming conducting field research based on direct interviews. Therefore, the identification of the particular aviation organizations was necessary. Unfortunately, due to the procedural constraints the Central Statistical Office was not willing to disclose the list of organizations taken into account within Polish aviation industry.

not precluded making generalizations for the entire Polish aviation sector (a similar approach was adopted, for instance, by Broekel and Hartog, 2013). Because of the importance of Aviation Valley (taking into account its size, its turnover, and its participants), the Polish aviation sector is frequently narrowed only to that aviation cluster – according to the Polish Ministry of Economy, Polish Agency for Information and Foreign Investment, and even the European Commission.

*Data collection.* The data for purposes of assessing innovativeness was gathered from both primary and secondary sources. Primary sources were collected applying subjective approach to investigate innovativeness of aviation organizations. Secondary sources, collected from the objective approach were taken from the Report on Innovativeness of the Aviation sector in Poland (Baczko, 2012a).

Primary data for purposes of subjective assessment of organizational innovativeness was gathered through direct, on-line and phone surveying. A modified (Ellonen et al., 2008) version of the questionnaire developed by Wang and Ahmed (2004) was used. Organizational innovativeness was assessed using a 7-point Likert scale (1 = *completely agree* to 7 = *completely disagree*). Questions included in the questionnaire concerned four dimensions of organizational innovativeness: (1) product, (2) process, (3) behavioural, and (4) strategic. These four dimensions are depicted in Table 1. The questionnaire consisted of 16 questions, therefore all of the considered dimensions of organizational innovativeness were assessed using multi-item measures.

**Table 1 | Four dimensions of organisational innovativeness**

Dimension	Definition	Driving force	Subject	Orientation
Product innovativeness	“Novelty and meaningfulness of new products introduced to the market at a timely fashion”	Organisation	Assortment – products and services	External
Process innovativeness	“Introduction of new production methods, new management approaches, and new technology”	Organisation	Management processes Production processes	Internal
Behavioural innovativeness	“Formation of an innovative culture, the overall internal receptivity to new ideas and innovation”	Employees – individuals, teams and management	Organisation culture Organisation climate Organisation structure	Internal
Strategic innovativeness	“Ability to identify external opportunities in a timely fashion and match external opportunities with internal capabilities in order to deliver innovative products and explore new markets or market sectors”	Organisation – management and decision-makers	Mission Vision Strategy Strategic, tactical and operational plans Activities	External

Source: Wang and Ahmed (2004).

The data collection started in September 2012 and ended the following November. The final response rate was 60,23% (53 questionnaires returned from 88 sent out) and the effective response rate was 57,95% (2 questionnaires were incomplete). In other words, 51 valid responses could be used for data analysis applying the subjective approach. However, only 32 surveyed businesses were featured in the ranking published by the Report on Innovativeness used in the objective approach. Therefore the research sample was restricted to these 32 aviation organizations whose innovativeness was assessed applying both approaches.

Secondary data pertaining to objective measures of innovation comes from the Report on Innovativeness of the Aviation Sector in Poland (Baczko, 2012a) – the latest objective research on Polish aviation organizations conducted at the industry level. The report ranks the most innovative companies of Poland's aviation sector. In the objective approach, organizational innovativeness was assessed based on market innovation, process innovation and contracts acquired with EU. The group of Economists and aviation experts from the Polish Academy of Sciences decided that these indicators are the most suitable for the evaluation of organizational innovativeness within the aviation and aerospace industries.

Market innovation was determined by sales, exports, employment and qualitative assessment of the most innovative product (service). Process innovation was dictated by ROA in 2009, year-on-year ROA figures and investment outlays per total innovation outlays. EU contracts included the number of signed contracts under the 7<sup>th</sup> FP by the EU and Operational Programme “Innovative economy” 2007–2009.

*Method of analysis.* The analysis of interdependence between subjective and objective measures of organizational innovativeness was made using Spearman's rank correlation coefficient. This method allowed us to identify if there is any linear or nonlinear statistical dependence between subjective and objective measures of innovativeness. Furthermore, the literature recommends correlation analysis using Spearman's rho with the subjective variables (Lieberman, 1964) used during our study.

The identification of the positive relationship assumed that organizational innovativeness consists of:

- a) three components with the objective approach: market innovativeness, process innovativeness and R&D contracts acquired with EU (data taken from the Report about Aviation Sector); objective indicators were based on 3-point scale (1 = *high innovativeness*, 2 = *average innovativeness* and 3 = *low innovativeness*);
- b) four components in case of subjective approach: product innovativeness, process innovativeness, strategic innovativeness and behavioral innovativeness (primary data collected during research); subjective indicators were based on 7-point Likert scale – to be able to run correlation analysis the scale was converted into 3-point scale (1 = *high innovativeness*; 6 and 7 points, 2 = *average innovativeness*: 3, 4 and 5 points; and 3 = *low innovativeness*: 1 and 2 points).



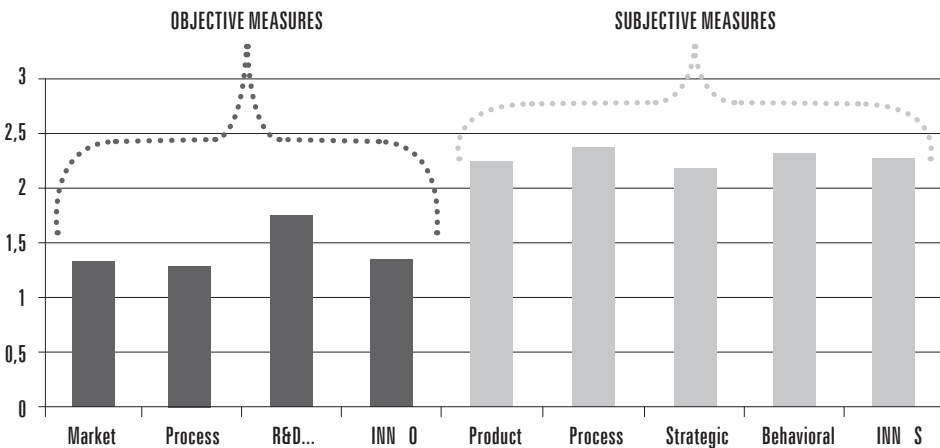
The evaluation of the statistical dependence between considered measurements contained exploration of the following relationships:

- a) objective organizational innovativeness and subjective organizational innovativeness – correlation assessment of organizational innovativeness considered as a multidimensional construct;
- b) objective market innovativeness and subjective product innovativeness<sup>3</sup> – correlation assessment of innovation output (innovation performance) considered only from the external perspective;
- c) objective process innovativeness and subjective process innovativeness – correlation assessment of process innovativeness considered only from the internal perspective.

## Findings

The descriptive analysis yielded two separate evaluations of organizational innovativeness. The results show that an average level of innovativeness reaches 1,43 in the objective approach and 2,38 in the subjective one (3-point scale), as shown in Figure 1. In case of innovativeness considered through innovation output the results are similar. The average level of market innovativeness reached 1,44 in the objective approach while product innovativeness was 2,34 in the subjective one. The results indicate also that considered organizations present slightly worse valuations if the assessment of innovativeness is narrowed only to processes. The average level of process innovativeness reached 1,38 in objective approach while in the subjective one it was 2.

Figure 1 | The level of organizational innovativeness – a multidimensional perspective



<sup>3</sup> It is assumed that subjective product innovativeness reflects innovation performance. It focuses on innovation output and includes market innovativeness (Ellonen et al., 2008).

At bottom the objective rates of organizational innovativeness are approximately 30% lower than the subjective ratings. The differences are also noticeable within the structure of multidimensional innovativeness. Product and process components of innovativeness have different meaning for organizational innovativeness in objective and subjective approaches. On the one hand, the objective process innovativeness is lower and objective market innovativeness is higher than objective organizational innovativeness. On the other hand, the subjective process innovativeness stimulates and the subjective product innovativeness lowers the level of organizational innovativeness.

In order to investigate statistical dependence of objective and subjective measures of innovativeness, correlation tests have been done (Table 2). The research findings show that subjective measures are not correlated with objective measures and that the outcomes of independent investigations differ considerably.

**Table 2 | Correlation coefficients**

	Organizational innovativeness	Innovation output	Process innovation
Objective approach	3-dimensional approach	Market innovativeness	Process innovativeness
Subjective approach	4-dimensional approach	Product innovativeness	Process innovativeness
Spearman's correlation	0,253	0,455*	0,081
Significance (2-tailed)	0,162	0,022	0,751
* Correlation is significant at the level 0,05 (2-tailed)			

In case of organizational innovativeness and its objective and subjective multidimensional measures, there is no significant statistical dependence ( $r_s = 0,253$ ; Sig. = 0,162). Therefore the hypotheses assuming a positive relationship between subjective and objective measurements of organizational innovativeness has to be rejected. The rankings of the most innovative organizations prepared based on subjective and objective measures vary considerably. Only two organizations (6% of the sample) take the same place in both rankings – TUV Nord (6<sup>th</sup>) and UTC Goodrich Aerospace Krosno (7<sup>th</sup>). From the organization's point of view more favorable and affirmative is subjective arrangement in which 17 organizations are located in higher positions. At the same time, 12 organizations found it better to be classified by objective measures of organizational innovativeness.

When we restrict our perception of organizational innovativeness to innovation output (innovation performance) the results will prove a positive, relatively strong relationship ( $r_s = 0,455$ ; Sig. = 0,022). The level of significance (less than 0,05) indicates a low level of uncertainty of the results and a moderate statistical significance when subjective and objective measures of innovativeness are considered an externally perceived innovation performance. The result shows that

these subjective and objective measures which assess the innovation output of the organization do not account for all of the unexploited organizational innovative capabilities; unsuccessfully introduced or not implemented innovative efforts may be used as an alternative. Therefore such a narrow approach to organizational innovativeness, treating it as innovation output is limited because it fails to take into account important indicators of organizational innovativeness. Some manifestations, signs and factors of innovativeness can be missed, especially if they influence innovation output indirectly or with some delay such as with incremental innovations in the area of internal processes.

Last but not least is the perspective focusing on internal processes. In case of process innovativeness and its objective and subjective measures there is no significant statistical dependence ( $r_s = 0,081$ ; Sig. = 0,751). Therefore the hypotheses assuming a positive relationship between subjective and objective measurements of internally perceived innovation performance has to be rejected. In light of above it is not permitted to use interchangeably the objective and subjective measures. Prior research on process innovativeness has proven its strong influence on firm performance (Baer and Frese, 2003). Therefore the decision about objective or subjective approach should be made very consciously. It is important to monitor and develop that component of organizational innovativeness while applying the most appropriate and reliable measures.

## | Conclusion

The aim of our study was to research a relationship between subjective and objective measures of organizational innovativeness. Past studies in management have examined such relationships between subjective and objective measures of particular areas, dimensions or phases of innovativeness for instance product innovativeness (Jennings and Young, 1990) or innovation output (Geringer and Hebert, 1991). Our findings provide insights into the holistic view on organizational innovativeness and its assessment. The results suggest that there is no statistical dependence between objective and subjective measures of organizational innovativeness. The evaluations of its level obtained independently in the two approaches differ significantly from each other.

Firstly, the application of subjective measures provides significantly higher organizational innovativeness than does the application of objective ones. The answers provided by respondents could be highly erroneous due to subjectivism and strong emotional involvement in broadly defined professional life (borderline company loyalty, collectivist behaviours and enthusiasm about the job). The results may suggest also that the discussions of the reliability of research based on subjective measurements techniques are not unfounded. The decision about measurements techniques should be deliberate, thought out, theoretically grounded and justified. Therefore it is appropriate to confirm that in case of estimating and assessing organizational

innovativeness displayed by businesses operating in the aviation industry measuring systems using objective measures should be considered as more adequate and relevant.

Secondly, the results of descriptive analysis proved differences in particular components of organizational innovativeness. In both approaches, organizational innovativeness is based mainly on innovation performance. Simultaneously the internally determined process innovativeness seems to be underdeveloped area of organizational innovativeness. It may indicate that considered organizations are more focused on exploitation than exploration of new ideas, activities, products and services. In other words, the process innovativeness plays a role of bottleneck of organizational innovativeness. Therefore, it is advisable to pay more attention to internal innovativeness rooted in processes, activities and operations.

Thirdly, our study shows that when adopting a holistic view on innovativeness there is no interdependence between objective and subjective measures (McMullan et al., 2001; Johnson et al., 2007; Forth and McNabb, 2008). Compared to multidimensional organizational innovativeness, correlation analysis did not confirm postulates about the equivalence of subjective and objective measures of process innovativeness. In contrast to organizational innovativeness and process innovativeness, we found a significant, positive relationship between objective market innovativeness and subjective product innovativeness. The results prove that in the narrow perspective, restricting organizational innovativeness to innovation performance objective measures is correlated with their subjective counterparts. The significant interdependence of objective and subjective measures was also emphasised by Jennings and Young (1990), and Geringer and Hebert (1991). It can be said that in case of product innovativeness there is a wider range of possible measures. It is easier to make a decision because no matter what evaluation approach is applied, the results will be comparable. However, the relative ease and convenience of choice of measurement may encourage organizations to narrow the assessment of innovativeness to product innovativeness. It should be emphasized that evaluation of organizational innovativeness should not be restricted only to the external perspective and innovation outputs. Such an approach puts emphasis on innovation exploitation whilst ignores innovation exploration. Therefore it does not reflect a reliable level of organizational innovativeness. For instance, an organization with a high level of innovation exploration but is unsuccessful or is not interested in innovation exploitation would be perceived as non-innovative. Moreover, the exclusion of internal innovation efforts and capabilities expressed (covered by process innovativeness) from organizational innovativeness is unfounded. It was shown that process innovativeness is a significant and integral component of the innovativeness at the organizational level (e.g. Baer and Frese, 2003; Wang and Ahmed, 2004; Ellonen et al, 2008).

Previous research also brings methodological recommendations for individuals, organizations or policy makers interested in assessment of innovativeness. The beneficiaries of the findings obtained are individuals (e.g. scientists, PhD students), businesses (e.g. enterprises, industry associations, science institutes, universities, trade organizations and commercial businesses)

and public institutions (e.g. local governments, state governing bodies, EU authorities) taking interest in researching organizational innovativeness of businesses (especially those operating in the aviation industry). The methodological suggestions could be boiled down to the assertion that accurate and reliable assessment of organizational innovativeness should use a set of purposefully chosen measures addressing all stages of the innovation process. The set of measures should include more than one indicator. Furthermore, most of the applied measures included during evaluation should be objective.

In summary, there are some limitations to this study. It was rather exploratory and was vulnerable to common bias. Notably, it is a sample size that was restricted to a single intentionally chosen industry. The aviation industry sample was relatively small, precluding conclusive statements outside of this context. Another limitation is the use of a set of objective measures including only three measures focused on market, process and R&D innovativeness. Therefore in future research the empirical side of this paper should be developed. Further research should include other innovativeness data sources and indicators and should be conducted on a random sample that is not restricted to one industry.

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