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DISCOVERY SKILLS OF MICROENTREPRENEURS – DIAGNOSIS IN THE CONTEXT OF INNOVATION

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Purpose: The paper aims to assess the impact of discovery skills resulting from the concept of Innovator's DNA on the innovativeness of micro-entrepreneurs.
Design/methodology/approach: Based on the Innovator's DNA concept developed by Dyer et al. (Dyer et al., 2011) which indicates the five discovery skills of innovators, i.e. associating, questioning, observing, networking and experimenting, as well as on a broad understanding of innovation resulting from the 4th edition of the OSLO Manual (OECD and Eurostat, 2018), research was conducted into the impact of the discovery skills of micro-entrepreneurs on their innovativeness. The basis of the empirical analysis was a 2022 study of a randomly selected representative sample of 1,848 micro-entrepreneurs in Poland. Since innovation is a multidimensional phenomenon with many interrelations, a multidimensional probit model (MVP) was used for estimation.
Findings: The main conclusion is that in the case of microentrepreneurs, three out of five discovery skills positively affect all categories of implemented innovations. These discovery skills are associating, observing and networking.
Research limitations/implications: The research has some limitations. Firstly, the presented research only analyses the discovery skills indicated in the Innovator's DNA concept, ignoring delivery skills. Therefore, future research should also include these aspects. Secondly, the study is limited to Polish micro-entrepreneurs, which may affect the results, e.g., through cultural conditioning. Therefore, it would be worth geographically expanding future research.
Practical implications: Being aware that the indicated discovery skills can be further developed, it is worth using the indicated methods and techniques for their ongoing development. The results suggest that such activities should increase the probability of innovativeness among microentrepreneurs.
Originality/value: The originality of the paper's contribution is manifested in the following aspects: it explains the impact of microentrepreneurs' discovery skills on specific categories of introduced innovations, and covers a broad spectrum of microentrepreneurs' innovativeness - from product to business process innovations.

Keywords: microentrepreneurs, discovery skills, innovator's DNA, innovation.

Category of the paper: Research paper.

1. Introduction

The question of how to build innovation in contemporary economies, regions and enterprises is still highly topical. In each of these cases, it is always a question of human innovation as it is people who create the economy, region or enterprise. In other words, it is a question about what stimulates a person to be creative, i.e. to solve problems through an innovative juxtaposition of ideas or behaviours (Jirasek, Sudzina, 2020; Runco et al., 2001). This is where we find the very topical notion of so-called innovative capability. Most often, we refer to the innovative capability of an enterprise or economy, and understand it as the organisational capabilities for managing and creating innovation in the long-term (Smith et al., 2008), i.e. the ability to create new ideas or behaviours (Mendoza-Silva, 2020; Zastempowski, 2022). While the innovative capability of economies (Furman et al., 2002) and enterprises (Martínez-Román et al., 2011) is already well-researched, the innovative capability of individuals, based on management sciences, is still an interesting and relatively little-researched area. This is due to the interdisciplinarity of this issue. Its theoretical foundations can be found in many disciplines, including (a) psychology - Cattel's theory of personality (Cattell, 1950), McCrae and Costa's five-factor model (McCrae, Costa, 1987), and Guilford's theory of thinking (Guilford, 1967), (b) economics - Schumpeter's theory of creative destruction (Schumpeter, 1912, 1939), and Nelson and Winter's evolutionary theory (Nelson, Winter, 1982), (c) sociology – Weber's social action theory (Weber, 2009), and (d) management sciences – resource-based theory (Barney, 2001; Penrose, 1959; Teece et al., 1997) or the Innovator's DNA model (Dyer et al., 2008, 2011).

Therefore, it is worth asking whether it is possible to indicate certain characteristics and features that build the individual innovative capability of a human being. Looking at this question from the perspective of Schumpeter's theory, which places the individual figure of an entrepreneur at the centre of the economic development process (Schumpeter, 1912, 1939), it is worth specifying this further by enquiring about the features that create the innovative capability of a micro-entrepreneur. Innovative capability, , as Mendoza-Silva suggests, can be measured through various types of innovations (Mendoza-Silva, 2020) implemented by the micro-entrepreneur.

Based on two bibliometric databases - Scopus and Web of Science - a narrative systematic literature review indicates, among others, the role of the human personality (Ahmed, 1998; Ali, 2019; Rammstedt, John, 2007; Saatci, Ovaci, 2020; Soto, John, 2009), creativity (Altinay et al., 2022; Ferreira et al., 2018; Janssen, 2000; Jirasek, Sudzina, 2020) and divergent thinking (Basadur et al., 1999; Hausdorf et al., 2021; Runco et al., 2001) in developing innovative capabilities (or, more broadly, innovativeness). The concept that seems to connect all these threads is Dyer et al.'s idea of Innovator's DNA, emphasising the role of five discovery skills, i.e. associating, questioning, observing, networking and experimenting (Dyer et al., 2011).

Considering the above, the main purpose of this article is to assess the impact of discovery skills resulting from the concept of Innovator's DNA, on the innovativeness of micro-entrepreneurs. The basis of the empirical part is a 2022 study of a randomly selected representative sample of 1,848 micro-entrepreneurs in Poland.

The article has the following structure: part 2 presents the theoretical background, focusing on the innovation issues of micro-entrepreneurs in Poland and the Innovator's discovery skills. This section also indicates the proposed conceptual model. Part 3 discusses the empirical research, indicating the method of obtaining data and the characteristics of the research sample, the variables taken into account and the estimation model used. Part 4 presents the model estimation results, and Part 5 discusses these results. The article ends with the conclusions.

2. Theoretical framework

2.1. Innovativeness of Micro-enterprises in Poland

Although in 2021 micro-enterprises in Poland accounted for 97.2% of enterprises, created 29.5% of GDP and employed 4.34 million people (GUS, 2023), their innovativeness is omitted in most studies (e.g. in the study of innovative activity of Polish enterprises by the Central Statistical Office, or the Community Innovation Survey conducted by Eurostat). This situation is not characteristic only for Poland, because around the world, the innovativeness of micro-enterprises is treated as marginal in innovation research. This is particularly interesting in the context of the role that Schumpeter attributed to micro-entrepreneurs in economic development (Schumpeter, 1912, 1939). It is not without reason that Roper and Hewitt-Dundas pointed out that micro-enterprises are *a neglected part of Schumpeter's creative army* (Roper, Hewitt-Dundas, 2017, p. 559).

Research on the innovativeness of Polish enterprises (excluding micro-enterprises) shows that in 2019-2021, 22% of industrial enterprises and 19.7% of service enterprises introduced innovations (Statistical Office in Szczecin, 2022). These studies also show that with an increase in the size of the enterprise, its innovativeness increases.

So far, studies on the innovativeness of micro-enterprises in Poland are scarce. Żołnierski described the innovativeness of micro-enterprises in 2004, indicating that 33% of the companies studied declared that they had introduced innovations in the last two years (mainly organisational - 21%, product - 18.3% and process - 9%) (Żołnierski, 2005). Steinerowska-Streb, examining micro-enterprises in 2009, indicated that organisational innovations were introduced by 39.4% of respondents, product innovations by 57.5% and process innovations by 33.6% (Steinerowska-Streb, 2014). Rozkrut, describing the innovativeness of micro-enterprises in 2011-2013, indicated that based on a representative sample, product innovations were

introduced by 18.5% of micro-enterprises, process innovations – by 19.9%, organisational innovations – by 20.8% and marketing innovations – by 10.4% (Rozkrut, 2013). Research conducted in 2019 by the Polish Agency for Enterprise Development (PAED) showed that 29.2% of micro-enterprises undertook innovative activities (PARP, 2020). In turn, research conducted by Zastempowski on a representative sample of Kuyavian-Pomeranian micro-enterprises showed that in 2016-2018, product innovations were introduced by 17% of respondents and process innovations by 15.7% (Zastempowski, 2022; Zastempowski et al., 2020).

As can be seen, previous research shows different percentages of innovative micro-enterprises. This may be due to several issues, including the different periods of the research, the representativeness of the researched samples, the territorial scope of the research and the methodology of defining innovations (e.g., according to the 3rd or 4th edition of the Oslo Manual) (OECD & Eurostat, 2018, 2005). It also suggests the need for further research on the innovativeness of micro-enterprises.

2.2. Discovery skills

Discovery skills are a key element of the Innovator's DNA concept. Its creators, Dyer et al., indicate that discovery skills can be developed (Dyer et al., 2011, p. 21). This assumption is based on previous research on pairs of identical and fraternal twins, showing that these skills are not genetic traits endowed at birth (McCartney et al., 1990; Reznikoff et al., 1973). Therefore, if innovators can be made and not just born, Dyer et al. asked what determines the fact that some people have great new ideas. In a study conducted on a group of five hundred innovators compared to nearly five thousand managers, Dyer et al. identified five key discovery skills of disruptive innovators i.e., associating, questioning, observing, networking and experimenting (Dyer et al., 2011, pp. 22-25).

Disruptive innovators rely primarily on a cognitive skill that Dyer et al. called associational thinking (association). This is a process that occurs when the brain tries to synthesise and make sense of new information. It involves combining seemingly unrelated questions, problems or ideas, usually at the crossroads of different disciplines, which helps innovators discover completely new directions of action (Dyer et al., 2011, pp. 22-23; 41-65). From the perspective of the innovativeness of micro-entrepreneurs, this leads to the first hypothesis:

H_1: *Associating, as a discovery skill, positively affects micro-entrepreneurs' innovativeness.*

As indicated by Dyer et al., the other four discovery skills imply associational thinking because they help innovators expand the range of ideas from which innovative ideas are born. The first is questioning. Innovators are people who passionately look for solutions, asking both "what if" questions and questioning the status quo. Such questions lead innovators to new insights, connections, opportunities and directions. Interestingly, research by Dyer et al. showed that such questions are at least as highly valued as good answers (Dyer et al., 2011, pp. 23, 67-90). Therefore, the following hypothesis was proposed:

H_2: *Questioning, as a discovery skill, positively affects micro-entrepreneurs' innovativeness.*

Innovators are also keen observers. They look carefully at the world around them, especially customers, products, services, technologies and companies. Such observation allows them to gain an accurate view of the situation, and stimulates the emergence of new methods of operation. It is a kind of catalyst for new thoughts and connections (Dyer et al., 2011, pp. 23-24, 91-114). Consequently, the next hypothesis was formulated:

H_3: *Observing, as a discovery skill, positively affects micro-entrepreneurs' innovativeness.*

As the research by Dyer et al. suggests, innovators spend a lot of time and energy searching for and testing ideas among a wide range of people from different backgrounds and often with different views of the world. Instead of simply doing social networking or networking for resources, innovators actively seek out new ideas by talking to people who may hold radically different points of view (Dyer et al., 2011, pp. 24, 115-135). The above stimulated another hypothesis:

H_4: *Networking, as a discovery skill, positively affects micro-entrepreneurs' innovativeness.*

It is also worth pointing out that innovators constantly try new experiences and try testing new ideas. They tirelessly, mentally and empirically explore the surrounding world, verifying various hypotheses. They visit new places, try new things, search for new information and experiment in order to learn something new (Dyer et al., 2011, pp. 24, 136-160). Therefore, the last hypothesis was proposed:

H_5: *Experimenting, as a discovery skill, positively affects micro-entrepreneurs' innovativeness.*

Consequently, the following conceptual model was formulated (Figure 1).

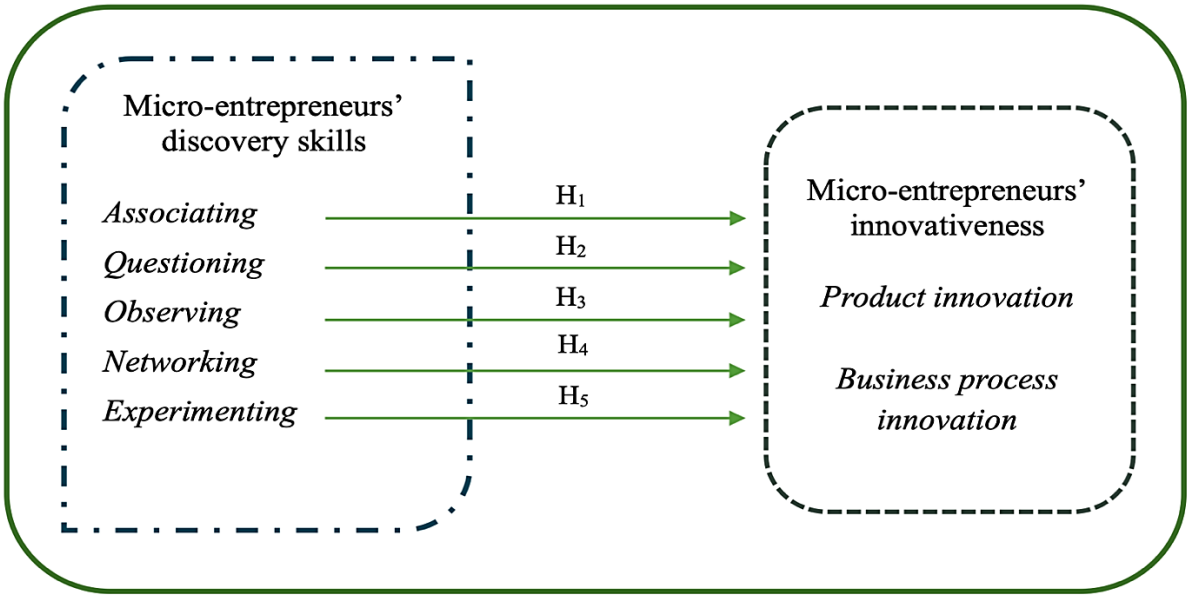

Figure 1. Conceptual model.

Source: own elaboration.

3. Materials and Method

3.1. Data collection

A representative research sample of micro-enterprises (of up to 9 employees) was drawn by the Mathematical Statistics Center of the Statistical Office in Łódź (Poland). The sampling frame was based on active micro-enterprises registered in NOREE[1]. According to data from 2022, this included 4,497,099 micro-enterprises. The sample selection was stratified according to the following criteria: PKD section[2], voivodship and legal form. The original sample consisted of 1850 records. In addition, a reserve sample was drawn (of the same cross-section), corresponding to 19 times the size of the original sample. The data was obtained between August and October 2022, and the final data set covered 1,848 micro-enterprises. This allows conclusions to be drawn at a 99% confidence level with a +/- 3% maximum error. The structure of the sample in terms of the type of activity is presented in Table 1.

Table 1.
Structure of the survey sample of micro-enterprises

Activities	**Share (%)**
A - agriculture, forestry, hunting and fishing	1.73
B - mining and quarrying	1.84
C - manufacturing	7.03
D - electricity, gas, steam, hot water and air conditioning	1.57
E - water supply; sewage and waste management and remediation activities	2.11
F - building construction	13.64
G - wholesale and retail trade; repair of motor vehicles, excluding motorcycles	19.32
H - transport and storage	5.95
I - activities related to accommodation and catering services	3.08
J - information and communication	5.84
K - finance and insurance	2.87
L - activities related to real estate	2.71
M - professional, scientific and technical activity	11.47
N - administration and support activities	3.46
P - education	3.35
Q - health care and social welfare	7.31
R - activities related to culture, entertainment and recreation	1.95
S - Other service activities	4.76

Note. Activities – A section of the Code List of Classification of Business Activities in Poland.
Source: own elaboration.

[1] NOREE - National Official Register of Economic Entities.
[2] PKD - Code List of Classification of Business Activities in Poland.

3.2. Variables

3.2.1. Dependent variable

The dependent variable was the innovativeness of micro-entrepreneurs. Its measurement was based on the guidelines resulting from the fourth edition of the OSLO Manual that divides innovations into two types - product innovation and business process innovation (OECD & Eurostat, 2018).

The micro-entrepreneurs were asked whether, in the last three years (2019-2021), they had introduced a product innovation and/or business process innovation. Taking into account the possible categories of innovations within each type, the following dummy variables were created referring to the introduction of new or improved products or processes (OECD & Eurostat, 2018, pp. 70-74):

- within product innovations:
  - y_1 – goods,
  - y_2 – services,
- within business process innovations:
  - y_3 – methods for producing goods or providing services (including methods for developing goods or services),
  - y_4 – logistics, delivery or distribution methods,
  - y_5 – methods for information processing or communication,
  - y_6 – methods for accounting or other administrative operations,
  - y_7 – business practices for organising procedures or external relations,
  - y_8 – methods of organising work responsibility, decision making or human resource management,
  - y_9 – marketing methods for promotion, packaging, pricing, product placement or after-sales services.

3.2.2. Independent variables

The independent variables describing the discovery skills of micro-entrepreneurs were constructed using the Innovator's DNA concept, based on the odd-numbered statements in the 20-item "Delivery and Discovery Skills Quiz" presented by Dyer et al. (in the quiz, the even-numbered statements referred to performance skills, which were not tested) (Dyer et al., 2011). The micro-entrepreneurs answered on a 5-point Likert scale from 1 - "I strongly disagree" to 5 - "I strongly agree". A list of these is presented in the Appendix.

Consequently, the different types of discovery skills were coded as follows:

- x_1 – associating (statements 7 and 15),
- x_2 – questioning (statements 17 and 3),
- x_3 – observing (statements 5 and 19),
- x_4 – networking (statements 9 and 1),
- x_5 – experimenting (statements 11 and 13).

Additionally, as recommended in the literature (Guan et al., 2006; Martinez-Roman, Romero, 2017), the following two control variables were used:

- x_6 – enterprise age – micro-enterprise age measured by the number of years since the business was founded – this variable was numerical, and a logarithm was applied to the calculations,
- x_7 – enterprise size – micro-enterprise size measured by the number of employees (numerical).

The descriptive statistics of all the variables are displayed in Table 2.

Table 2.
Descriptive statistics of variables

Variable	% - yes	Mean	S.E.	M	D	S.D.	SD^2	Min.	Max.
y_1	4.654	0.047	0.005	0.000	0.000	0.211	0.044	0.000	1.000
y_2	8.496	0.085	0.006	0.000	0.000	0.279	0.078	0.000	1.000
y_3	10.335	0.103	0.007	0.000	0.000	0.305	0.093	0.000	1.000
y_4	5.303	0.053	0.005	0.000	0.000	0.224	0.050	0.000	1.000
y_5	10.335	0.103	0.007	0.000	0.000	0.305	0.093	0.000	1.000
y_6	8.820	0.088	0.007	0.000	0.000	0.284	0.080	0.000	1.000
y_7	9.416	0.094	0.007	0.000	0.000	0.292	0.085	0.000	1.000
y_8	9.037	0.090	0.007	0.000	0.000	0.287	0.082	0.000	1.000
y_9	8.063	0.081	0.006	0.000	0.000	0.272	0.074	0.000	1.000
x_1	-	3.404	0.018	3.500	3.000	0.7774	0,604	1.000	5.000
x_2	-	3.369	0.024	3.000	4.000	1.0682	1.141	1.000	5.000
x_3	-	3.490	0.021	3.500	4.000	0.9240	0.854	1.000	5.000
x_4	-	3.160	0.018	3.000	3.000	0.7896	0.623	1.000	5.000
x_5	-	3.631	0.024	4.000	4.000	1.0349	1.071	1.000	5.000
x_6	-	0.969	0.008	1.000	0.602	0.354	0.125	0.000	2.021
x_7	-	2.692	0.068	2.000	0.000	2.937	8.628	0.000	9.000

Source: own elaboration.

3.3. Method

Innovation is a multi-dimensional phenomenon in which many mutual relations take place. Previous research has shown that introducing one type of innovation leads to other types. In other words, they are not independent of each other (Zastempowski, 2023). Consequently, a multivariate probit model (MVP) was used considering the correlation of error terms (Maietta, 2015; Wainaina et al., 2016). Its specificity lies in the fact that it examines the influence of independent variables on dependent variables (each type of introduced innovation) while allowing for the correlation of unobserved and immeasurable factors (error terms).

The MVP model used consists of nine binary choice equations concerning the introduction of various categories of product innovations (y_1 and y_2) and business process innovations (y_3 - y_9). The MVP model can be written as (Wainaina et al., 2016):

$$y_{ijm}^{*} = X_{ijm}'\beta_m + \varepsilon_{ijm}\ m = 1, 2 \ldots 9 \tag{1}$$

$$y_{ijm} = \begin{pmatrix} 1\ if\ y_{ijm}^{*}>0 \\ 0\ otherwise \end{pmatrix}, \tag{2}$$

where:

y_{ijm}^{*} is a latent variable that captures the degree to which a micro-entrepreneur treats innovation m as worth introducing,

X_{ijm}^{*} is a latent variable that is a linear combination of discovery skills,

ε_{ijm} is the unobserved characteristics captured by the stochastic error term,

β_m – is the estimated vector of the parameters. Considering the latent nature of y_{ijm}^{*}, the estimation is based on the observable binary y_{ijm}, indicating whether a micro-entrepreneur introduced a particular innovation in the previous three years (2019-2021).

Estimating all models was based on the simulated maximum likelihood method (Cappellari, Jenkins, 2003) using STATA.16.1 software.

4. Results

In the first step, the Cronbach's alpha, Kaiser-Meyer-Olkin and Bartlett tests were conducted. The results presented in Table 3 confirm the reliability of the measurement scale. The test values obtained are acceptable for this type of analysis (Hair et al., 2010).

Table 3.
Properties of the measurement scale

Variable	Cronbach's alpha	Kaiser-Meyer-Olkin	Bartlett
Discovery skills	0.727	0.573	2098.719*

Note. * p-Value ≤ 0.01.

Source: own elaboration.

The correlation analysis, the results of which are presented in Table 4, constituted the second stage. Its analysis allows for the formulation of a few conclusions. Firstly, statistically significant correlations between the analysed categories of innovation were observed. They are all positive, and their values range from 0.239 to 0.751. This gives a strong argument for using the chosen MVP estimation method. Secondly, there is a correlation between the independent and dependent variables, but their values (below 0.227) indicate a very poor relationship. Thirdly, there are several significant correlations between the independent variables. However, their value is always below 0.435, and the variance inflation factors (VIF) are below 10 (the highest observed VIF is 2.11), indicating that collinearity is not an issue.

In the next step, the MVP models were estimated (Table 5). It is worth noting that the results of the correlation between error terms showed in several cases that it is strong (greater than 0.7). In three cases, namely rho32, i.e. between innovations in the field of methods for producing goods or providing services and innovations in services, rho93 - innovation in marketing methods for promotion, packaging, pricing, product placement or after-sales services

and in methods for producing goods or providing services, and rho87 - innovation in methods of organising work responsibility, decision making or human resource management and in business practices for organising procedures or external relations, the correlation coefficients even exceeded 0.8. Other strong correlations were also observed for rho92, rho43, rho53, rho83, rho94, rho65, rho75, rho85, rho95, rho76, rho86 and rho98. These results clearly confirm the legitimacy of using the MVP method.

Table 4.
Correlation matrix

	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9
y_1	1.000								
y_2	0.532**	1.000							
y_3	0.431**	0.751**	1.000						
y_4	0.429**	0.448**	0.523**	1.000					
y_5	0.313**	0.438**	0.550**	0.491**	1.000				
y_6	0.239**	0.295**	0.415**	0.412**	0.647**	1.000			
y_7	0.316**	0.354**	0.493**	0.420**	0.548**	0.514**	1.000		
y_8	0.271**	0.344**	0.470**	0.439**	0.556**	0.528**	0.687**	1.000	
y_9	0.454**	0.580**	0.631**	0.506**	0.526**	0.405**	0.463**	0.406**	1.000
x_1	0.137**	0.178**	0.197**	0.129**	0.227**	0.191**	0.231**	0.257**	0.144**
x_2	0.039	-0,012	-0,020	0,031	-0,034	-0.045*	-0,014	-0.064**	0,027
x_3	0.106**	0.171**	0.166**	0.131**	0.204**	0.170**	0.203**	0.224**	0.145**
x_4	0.112**	0.166**	0.176**	0.134**	0.196**	0.174**	0.206**	0.207**	0.160**
x_5	0.041*	0.084**	0.106**	0.060**	0.141**	0.106**	0.154**	0.179**	0.043*
x_6	0.032	0.030	0.020	0.021	-0.007	-0.003	0.003	-0.005	0.028
x_7	0.075**	-0.022	-0.024	0.097**	-0.008	0.018	0.015	0.015	0.044*

	x_1	x_2	x_3	x_4	x_5	x_6	x_7
x_1	1.000						
x_2	0.096**	1.000					
x_3	0.378**	-0,015	1.000				
x_4	0.367**	-0.049**	0.394**	1.000			
x_5	0.435**	0.318**	0.110**	0,033	1.000		
x_6	-0.019	-0.029	-0.039*	-0.015	-0.029	1.000	
x_7	0.070**	0.065**	0.051**	0.044*	-0.059**	-0.031	1.000

Note. * p-Value ≤ 0.05, ** p-Value ≤ 0.01.

Source: own elaboration.

Only three out of the five discovery skills are significant determinants explaining all categories of micro-entrepreneurs' innovations (y_1-y_9). These discovery skills are associating (x_1), observing (x_3) and networking (x_4). The other skills affect only some categories of the innovations, with questioning (x_2) for 6 (negative) and experimenting (x_5) for 3.

An interesting result was also observed in terms of the control variables. In many earlier studies, their impact on innovation was confirmed (Guan et al., 2006; Martinez-Roman, Romero, 2017). Our results for micro-entrepreneurs showed that both the enterprise age and size have a small impact. The age of micro-enterprises (x_6) has a positive effect only on innovations in marketing methods for promotion, packaging, pricing, product placement or after-sales services (y_9), while the size of micro-enterprises (x_7) has an effect on innovations in goods (y_1) and in logistics, delivery or distribution methods (y_4).

5. Discussion

When assessing the level of innovativeness of Polish micro-entrepreneurs, it should be emphasised that it is not as high as suggested by previous research, e.g. by PAED – 29.2% (PARP, 2020). The results presented in Table 2 and Figure 2 show that, on average, 8.3% of micro-enterprises introduced innovations in 2019-2021. The smallest share was for goods innovations (4.7%), and the largest, 10.3% each, for methods for producing goods or providing services (including methods for developing goods or services) and methods for information processing or communication.

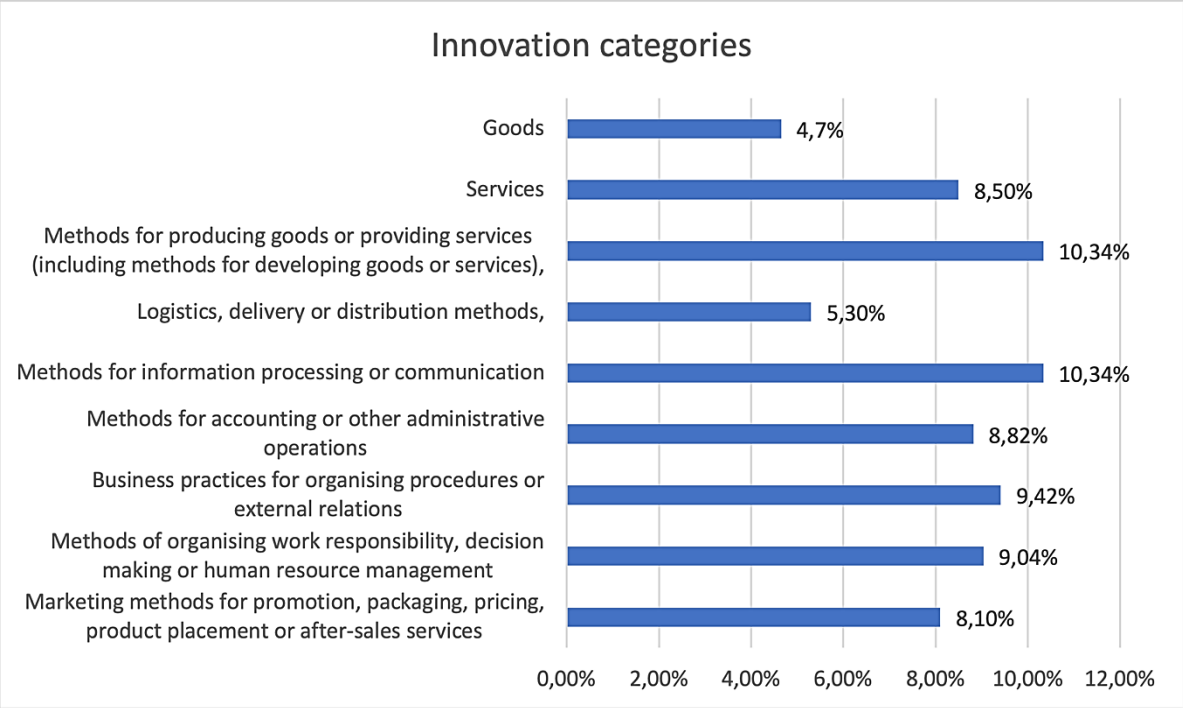

Figure 2. Micro-entrepreneurs' innovativeness.

Source: own elaboration.

Referring to the assessment of the impact of discovery skills resulting from the Innovator's DNA concept on the innovativeness of micro-entrepreneurs, it can be stated that three of them, namely associating, observing and networking, have a positive impact on all categories of innovation. This means that only in the case of hypotheses H_1, H_3 and H_4 are there no reasons to reject them ($p \leq 0.05$). In the case of questioning and experimenting, there are reasons to reject hypotheses H_2 and H_5.

Table 5.
Multivariate probit model results

	Model 1 (y_1)		Model 2 (y_2)		Model 3 (y_3)		Model 4 (y_4)		Model 5 (y_5)		Model 6 (y_6)		Model 7 (y_7)		Model 8 (y_8)		Model 9 (y_9)	
	β	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**	***β***	**dF/dx**
x_1	0.399**	0.024**	0.297**	0.031**	0.288**	0.036**	0.169*	0.011*	0.293**	0.035**	0.255**	0.033**	0.291**	0.033**	0.319**	0.029**	0.252**	0.028**
x_2	0.040	0.005	-0.110*	-0.008*	-0.139**	-0.014**	-0.064	0.000	-0.188**	-0.019**	-0.179**	-0.018**	-0.172**	-0.013**	-0.310**	-0.020**	-0.009	0.005
x_3	0.094*	0.005*	0.189**	0.022**	0.140**	0.020**	0.206**	0.011**	0.222**	0.027**	0.190**	0.020**	0.199**	0.020**	0.258**	0.020**	0.190**	0.016**
x_4	0.155*	0.011*	0.228**	0.025**	0.233**	0.033**	0.295**	0.019**	0.274**	0.030**	0.262**	0.027**	0.317**	0.031**	0.328**	0.024**	0.275**	0.029**
x_5	-0.129	-0.006	0.015	0.005	0.091	0.015	0.040	0.003	0.175**	0.022**	0.098	0.012	0.186**	0.020**	0.281**	0.023**	-0.082	-0.007
x_6	0.216	0.020	0.228	0.029	0.099	0.021	0.178	0.018	-0.005	0.000	0.055	-0.001	0.045	0.003	0.017	-0.003	0.263*	0.030*
x_7	0.039*	0.004*	-0.006	0.001	-0.006	0.002	0.035*	0.005*	0.001	0.002	-0.001	0.002	0.004	0.003	0.017	0.003	0.009	0.004
_cons	-4.009**		-3.813**		-3.555**		-4.206**		-4.130**		-3.665**		-4.382**		-4.754**		-3.857**	
Log likelihood			-2774.289															
Wald chi^2 (63)			474.44															
Prob > chi^2			0.0000															

rho	**rho21**	**rho31**	**rho41**	**rho51**	**rho61**	**rho71**	**rho81**	**rho91**	**rho32**	**rho42**	**rho52**	**rho62**
Coef.	0.573**	0.534**	0.539**	0.434**	0.319**	0.414**	0.390**	0.487**	0.818**	0.633**	0.591**	0.456**
Std. Err.	0.043	0.042	0.046	0.047	0.053	0.045	0.048	0.045	0.022	0.039	0.036	0.043
rho	**rho72**	**rho82**	**rho92**	**rho43**	**rho53**	**rho63**	**rho73**	**rho83**	**rho93**	**rho54**	**rho64**	**rho74**
Coef.	0.504**	0.501**	0.706**	0.763**	0.721**	0.605**	0.699**	0.707**	0.804**	0.697**	0.620**	0.664**
Std. Err.	0.042	0.041	0.031	0.032	0.030	0.039	0.032	0.030	0.025	0.036	0.040	0.038
rho	**rho84**	**rho94**	**rho65**	**rho75**	**rho85**	**rho95**	**rho76**	**rho86**	**rho96**	**rho87**	**rho97**	**rho98**
Coef.	0.691**	0.735**	0.771**	0.740**	0.742**	0.755**	0.713**	0.742**	0.646**	0.845**	0.694**	0.704**
Std. Err.	0.036	0.035	0.025	0.030	0.030	0.030	0.032	0.031	0.039	0.022	0.036	0.034

Notes: * p-Value ≤ 0.05, ** p-Value ≤ 0.01. *N* = 1848; Likelihood ratio test of rho21 = rho31 = rho41 = rho51 = rho61 = rho71 = rho81 = rho91 = rho32 = rho42 = rho52 = rho62 = rho72 = rho82 = rho92 = rho43 = rho53 = rho63 = rho73 = rho83 = rho93 = rho54 = rho64 = rho74 = rho84 = rho94 = rho65 = rho 75 = rho85 = rho95 = rho76 = rho86 = rho96 = rho87 = rho97 = rho98 = 0: chi^2 (36) = 2604.77, Prob chi^2 = 0.0000.

Associating - the first of the discovery skills - involves connecting seemingly unrelated ideas, concepts or experiences to generate innovative insights (Dyer et al., 2011, pp. 22-23). Micro-entrepreneurs who excel in associating can draw from diverse sources of inspiration, and combine them in novel ways. This skill helps them identify unique market opportunities, develop creative solutions, and differentiate their offerings from competitors. Our research clearly confirms this. The higher micro-entrepreneurs assess this feature in themselves, the more likely they are to implement all types of innovations (the probability is greater, between 0.011 and 0.036). Therefore, it is worth encouraging micro-entrepreneurs to develop their associating skills. This can be stimulated by various methods, e.g., by forcing new associations (combining things that do not naturally connect), trying to empathise with the role of another company's employees, creating metaphors and using the SCAMPER method (Michalko, 1991).

Observing - the second of the discovery skills that affect the implementation of all categories of innovations by micro-entrepreneurs - involves keenly observing the world around, paying attention to details, and recognising patterns (Dyer et al., 2011, pp. 22-23). Micro-entrepreneurs who are adept at observing can identify emerging trends, customer behaviours and changing preferences. As our research shows, these insights enable them to create products and services that align with evolving market demands. The greater the observing skill, the higher the probability of implementing all innovations (from 0.005 to 0.027). Among the possible methods of developing the ability to observe, the following can be indicated: regular observation of customers (e.g., how they use the product or service offered by a micro-entrepreneur), observation of the activities of a specific company (e.g. an industry leader), observation of everything that is popular at a given moment, and the use of all the senses for observation.

Networking - the last of the discovery skills that affect the innovativeness of Polish micro-entrepreneurs - involves building a diverse network of people with different backgrounds, expertise and perspectives (Dyer et al., 2011, p. 24) who can expose micro-entrepreneurs to a wide range of ideas and insights. Effective networking helps with access to information from various industries and disciplines, leading to cross-pollination of ideas and innovative solutions. If micro-entrepreneurs assess this skill better, the probability of implementing innovations increases from 0.011 to 0.033. Methods that can serve the development of this skill can also be indicated here. For example, it is worth striving to increase the diversity of the network of contacts, increase the frequency of participation in conferences and fairs, and invite people from outside the company to visit more often.

Although experimenting does not affect all types of innovations introduced by micro-entrepreneurs, it should be emphasised that where this impact has been observed, it is negative. In other words, the higher the assessment of micro-entrepreneurs' ability to experiment, the lower the probability of them implementing innovation. This is probably because experimentation involves trying out new ideas, prototypes and approaches that can lead to both successes and failures, and the results of our research seem to suggest that negative outcomes are in the majority.

6. Conclusions

The article aimed to assess the impact of discovery skills on the innovativeness of micro-entrepreneurs. Based on the Innovator's DNA idea (Dyer et al., 2011) and a broad understanding of innovations (OECD & Eurostat, 2018), the main conclusion is that in the case of micro-entrepreneurs, three of five discovery skills positively affect innovativeness. These skills are associating, observing and networking.

Bearing in mind that these skills can be improved, it is worth using the indicated methods and techniques for their development. The research results suggest that such activities should increase the probability of micro-entrepreneurs being innovative.

It is also worth emphasising that developing the skills of associating, observing and networking should contribute to increasing the generation of ideas, improving adaptability, increasing resilience, building a competitive advantage and making micro-entrepreneurs more customer-oriented.

Finally, it is worth underlining that this research has some limitations. Firstly, the presented research analyses only those discovery skills indicated in the concept of the Innovator's DNA, ignoring delivery skills. Therefore, it would be worth including these aspects in future research. Secondly, the research is limited to Polish micro-entrepreneurs, which may affect the results, for example due to cultural conditioning. Therefore, it would be worth expanding future research geographically.

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