ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Publisher
http://jssidoi.org/esc/home

CHANGES IN BUSINESS MODELS IMPLIED BY THE USE OF DIGITAL TECHNOLOGY PLATFORMS

Krzysztof Bartczak

Faculty of Management, Warsaw University of Technology, ul. Narbutta 85, 02-524 Warsaw, Poland

E-mail: krzysztof.bartczak@pw.edu.pl

Received 10 February 2022; accepted 20 March 2022; published 30 June 2022

Abstract. The research work concerns digital technology platforms. They are tools that allow for establishing and intensifying various types of relationships between market participants. Due to their constantly growing importance in the economy, it is important to discuss various aspects related to it. The work focuses on examining the impact of such platforms on changes in business models. The main objective is to determine whether these platforms contribute to the implementation of innovative solutions within business models and whether they affect the level of competitiveness of enterprises. Two research methods were used in the implementation of the topic. The first is computer assisted telephone interviews. They were carried out among enterprises that received funding for the implementation and development of digital technology platforms under the Innovative Economy Operational Program. The second method is the regression analysis for CATREG (categorical regression) qualitative variables, where a model for measuring attitudes towards these platforms was developed. As a result of the research, it was found that digital technology platforms significantly influence changes in modern business models, promoting the implementation of innovative solutions within them. As a result, they constitute an important and new factor in the competitiveness of companies in the digital economy. The conducted research creates a wide field for further exploration regarding the impact of digital technology platforms on the functioning of modern enterprises and the business models used by them.

Keywords: model; business model; innovation; digital technology platforms

Reference to this paper should be made as follows: Bartczak, K. 2022. Changes in business models implied by the use of digital technology platforms. *Entrepreneurship and Sustainability Issues*, 9(4), 262-281. http://doi.org/10.9770/jesi.2022.9.4(14)

JEL Classifications: 031, 033

1. Introduction

The article deals with issues related to changes in modern business models. Such changes on a wide scale, which are connected with the necessity for enterprises to respond to the constantly changing needs of consumers, fight against competition on the market or implement their strategies in a dynamically functioning environment. Such changes, which should be emphasised, are largely based on innovative technologies and solutions (Teece, 2010). Thanks to this, it has become possible to obtain a permanent competitive advantage by entities operating on the market (Amit and Zott, 2012).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

These changes are intensified by the use of digital technology platforms (DTP). Currently, they are one of the basic tools for undertaking transactions between market participants, including establishing communication (Broekhuizen et al. 2021). Due to their growing importance in the economy, they are even considered as completely independent business models (Morgan et al., 2016). In addition, the literature often refers to the term 'platform business models' (Täuscher and Laudien, 2018, Venkatesh and Singhal 2019, Stojan and Tohanean 2021), which alludes to the fact that DTP are able to significantly influence many business models and lead to their transformation, including those based on modern technologies such as ICT (i.e., information and communication technologies) (Jetter et al., 2009, Veit et al., 2014, Obukhova et al. 2020).

The main goal of the article is to show the importance of digital technology platforms in the context of implementing changes in contemporary business models. In addition, the article aims to answer the question whether these changes, which DTP is involved in, can be regarded as a new factor in the competitiveness of enterprises. It was decided to put forward the thesis that digital technology platforms significantly influence changes in modern business models by promoting the implementation of innovative solutions within them and thus constitute a new factor of competitiveness of enterprises in the digital economy. The article, aside from literature considerations, is based on its own research results. The research was conducted on a group of 120 Polish enterprises using the CATI method and the CATREG model.

2. Literature review

2.1. Key definitions

The starting point for the considerations undertaken in this article is to define a business model and digital technology platforms. The business model is related to:

a) a conceptual tool by means of which it is possible to present the logic of the functioning of the enterprise, including the way in which it generates profits as a result of the generated value, with the basic feature of this model being that it takes into account all the components of the enterprise and the relationships that occur between them (Osterwalder et al., 2005);

b) revenue streams – including future ones – and the cost structure and margin levels as well as the relationship between these variables (Thompson and Strickland, 2003);

c) the operating logic of an enterprise in which the generation of value for the customer is predominant (Fielt, 2013).

Digital technology platforms have a strong relationship with the virtual environment and innovation. Therefore, it is necessary here to define a digital business model and an innovative business model. The digital business model is identified with all types of solutions or business strategies in which modern technologies play a decisive role by favouring changes in the way business is conducted, resource optimisation or profit growth (Li et al., 2012, Planning, 2017, Bican and Brem 2020). On the other hand, Brousseau and Penard (2007) emphasised the fact that the digital business model is modular, meaning that it is possible to implement new functions or packages into it at any time. These functions and packages form an inseparable whole and only if they occur together, within one model, can we generate concrete value for the company and its stakeholders. An innovative business model, in turn, is one in which a strong emphasis is placed on promoting new ideas that are used to create modern products, services and production systems (Lindgren and Bandsholm, 2016).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

When it comes to the definition of digital technology platforms, it should be noted that this concept has a wide scope – which is largely related to the interchangeable use of different terms by individual authors in relation to it (e.g., digital platforms (Reuver et al., 2015, Bonina et al. 2021), technology (technological) platforms (Corin Stig, 2015, Chursin et al. 2021), IT-platforms (Sun et al., 2015) or digital business technology platforms (LeHong et al., 2016)). In scientific literature, DTP is mainly considered to be a digital tool for establishing and intensifying relations between the various market players, including businesses and consumers, and even administrative bodies (public administrations). This is done by enabling these entities to transact and interact – including business ones – and to communicate with each other using the Internet. The direct effect of this is connecting trade partners and creating business networks (Sun et al. 2015, Constantinides et al., 2018, Rangaswamy et al. 2020). Another definition indicates that digital technology platforms are the base on which the foundations of a given IT or technology system are built. A characteristic feature of DTP is the ability to implement new functionalities and develop complementary products, services and technologies (Gawer, 2014).

to the multiplicity, complexity and variety of definitions related to DTP, an individual approach to them was developed. It has been asserted that these platforms are electronic (digital) tools that can take the form of services or content through which it is possible to create the basis for establishing and intensifying contacts between various entities operating on the market. A very important feature of these platforms is the possibility of constantly expanding them with new modules or functionalities.

2.2. Changes in business models conditioned by the use of DTP

Changes in business models are largely determined by the development of digital technology platforms. In this regard, Zott et al. (2011) pointed out that these changes are mainly due to the convergence of different tools and channels, which has been and is evident (*inter alia*) in the media industry. This results in the creation of large, integrated platforms – including those related to communication and mobile technologies. Importantly, the new platforms form the basis for building and developing new business models.

Brousseau and Penard (2007) noted that modern business models, digital in nature, do not imply changes in the digital sphere alone. The authors pointed out that these changes can be seen as "intermodal" (i.e., those that are visible within the various areas of the organisation). These changes, therefore, concern not only digital content but also physical products and services together with related infrastructure. Moreover, digital business models largely "intersect" with traditional models thus resulting in innovation and new marketing strategies – also in industries that are not directly related to the digital market. This shows the great complexity of the changes that are induced in modern business models, including those based on digital technology platforms.

These changes, compared to traditional models, are manifested in several basic areas. This applies primarily to the entity responsible for the particular model. In the past, it used to be a producer acting either in a direct relationship with the supplier or in a network built by the supplier. Today, the business model works largely thanks to an intermediary that creates the basis for interaction between other entities. Such an intermediary may be a digital technology platform. Differences can also be seen in relation to the owner of the products (formerly a specific company and now more and more users of the platform), sources of value (nowadays interactions between users, while previously features or functions of products and services), the basis for gaining competitiveness (product development versus continuous development of the business model) and sources of profit (previously revenues from the sales of products and services, and now a number of other sources including, for example, commission paid for access to complex functionalities of a given platform) (Zhao et al., 2020). It is worth noting that the vast majority of digital business models are currently created on the basis of DTP. This is because it is these platforms that create the basis for extensive interaction between businesses and customers (B2C relations) or the businesses themselves (B2B relations) (Mourtzis, Angelopulos and Panopoulos 2020), for example.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

This creates business ecosystems that bring together a growing number of actors. Such ecosystems are built on modern platforms using the PFI model for planning and practical implementation of innovative activities. This model may lead to the construction of a platform that integrates the activities of different stakeholders based on a specific ecosystem. In such an ecosystem – which, as it should be emphasised, functions on the basis of networks, replacing hierarchical and vertically integrated structures – all of these stakeholders play an important role, including even customers who become generators of new ideas and creators of innovation (Teece and Linden, 2017, Hein et al. 2019).

As the digitisation and implementation of modern technologies or management methods become more and more advanced, those organisations which have used traditional business models (referred to as *incumbent*) are gradually being replaced by organisations that use innovative business models. In this context, the phenomenon is referred to as *uberisation*, (from the name of the company *Uber*, which introduced a revolutionary way of offering taxi services based on a digital technology platform). This phenomenon leads to the dissemination of modern business models (i.e., those that lead to the displacement of previously proven patterns and methods of functioning of the organisation on the market). They are referred to as hyper-disruptive business models (Zeamari 2020). Among them, there is the Access over Ownership model – one in which access to specific services is possible without purchase (Zipcar platform for car rental for minutes) – or the Freemium model (access to a given service is free but using additional functionalities requires incurring certain costs – for example, the Dropbox platform that allows data storage). It is worth adding that the practical expression of the existence of the first model is the concept of a sharing economy in which various goods are exchanged between people and is mediated by various platforms such as Airbnb thus enabling accommodation sharing (Pieriegud, 2016). Changes in business models in which DTP play a key role are an expression of the existence of the economics of intermediation, whereby the platform acts as an intermediary between users who want to buy and sell or exchange certain goods (Brousseau and Penard, 2007).

It is worth adding that the innovative changes within the modern business model, based on DTP, serve primarily to ensure that the quality and timeliness of service provision is at the highest possible level so that various customer expectations are met and, at the same time, the platforms make satisfactory, increasingly higher profits. Such a model is aimed at the autonomy of customers so that they can influence the final shape of a given product or service thus generating value for the platform or organisations that create it. Another important factor is the personalisation of the what is offered to customers (platforms provide a basis for configuring and selecting products and services, and not only for using ready-made packages – the *curated computing* model), algorithmisation and automation of sales of products and services (based on various algorithms, a number of choices concerning the shape of these products and services are made automatically, which makes it easier for customers to purchase goods) and to enable customers within the framework of particular platforms to access the widest possible content and not only selected works or book files (*video on demand* services) (Filiciak, 2012).

3. Participation of digital technology platforms in the changes of modern business models in the context of increasing the level of competitiveness of enterprises - results of own research

3.1. Research using the CATI method

Our own research was conducted between February the 18th and 28th 2019 using the method of standardised questionnaire interviews (i.e., containing questions of a strictly defined sequence and unchanging wording, usually closed). CATI (i.e., computer-assisted telephone interviews) was used in this respect. Their implementation was based on a survey questionnaire consisting of 23 questions. The CATI method has a high degree of standardisation and is an element of the quantitative paradigm, with its main advantages being that its results can be generalised to the whole population (Gerring, 2001).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

The sample was random and the interviews were conducted with representatives of the management staff who had knowledge of the functioning and use of digital technology platforms by enterprises. Drawing was based on the lists of beneficiaries of the Operational Programme Innovative Economy implemented by the Polish Agency for Enterprise Development. Companies that received funding under this programme for the implementation and development of digital technology platforms were selected for the sample. The final sample consisted of N = 320 records, of which it was assumed that effective interviews would be conducted with the number of entities N = 120. The randomisation algorithm built into the telephone survey software gave each record in the database an equal chance of being included in the sample. Throughout the course of the survey, telephone contact was made with each of the enterprises. 120 interviews were completed, 49 enterprises refused to participate in the survey, two enterprises declared that they did not implement any platforms and it was not possible to complete the interviews with the remaining enterprises within the assumed survey deadlines.
During the CATI survey, respondents were asked a question about the impact of DTP on creating and developing modern business models. This data is included in Table 1.

Table 1. The impact of digital technology platforms on innovative business models

Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?		
	Frequency	Percentage
I strongly agree	63	52.1
I rather agree	45	37.2
I neither agree nor disagree	12	9.9
I rather disagree	1	0.8
Total	121	100.0

89.3% of the respondents (i.e., the vast majority) stated that digital technology platforms have an impact on the creation and development of business models. This is confirmed by the analyses carried out in this respect in the literature on the subject (as mentioned above).

Another question addresses the issues of the benefits that are generated by enterprises using DTP. The analysis of respondents' answers to this question is included in Table 2; however, it should be added that the respondents could indicate answers from 1 – the most significant benefit – to 7, the least significant benefit (Table 2 includes the first three answers).

Table 2. Benefits of using digital technology platforms by enterprises

Benefits	**Answer I**		**Answer II**		**Answer III**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
profit increase	56	46.3	15	12.4	15	12.5
increase in the level of competitiveness	19	15.7	27	22.3	13	10.8
extension of the product range	13	10.7	12	9.9	15	12.5
increasing market share	3	2.5	9	7.4	10	8.3
increase in the level of innovation	6	5.0	2	1.7	9	7.5
increase in the number of customers	2	1.7	9	7.4	4	3.3
improving customer service and increasing the level of consumer satisfaction	3	2.5	5	4.1	5	4.2
increasing the number of markets in which the company operates	2	1.7	6	5.0	4	3.3
expanding the number of business partners, including those operating exclusively in a virtual environment	1	0.8	8	6.6	12	10.0

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

optimisation of the implementation of various business processes, including those in the field of customer service	11	9.1	16	13.2	19	15.8
creating digital supply chains	1	0.8	6	5.0	2	1.7
increase in the overall efficiency of the company's operations	3	2.5	2	1.7	3	2.5
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	0	0.0	4	3.3	4	3.3
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the range or customer base	1	0.8	15	12.4	5	4.2
Total	121	100.0	121	100.0	120	100.0

When analysing the main benefits, attention should be paid to increasing the level of competitiveness of enterprises as one of the most important effects of using digital business platforms. This benefit, as the most significant, was indicated by 19 people (i.e. 15.7% of the respondents). In addition to increasing profits, this is the most important benefit for respondents. Also, in the next indications (answers II-III), the increase in the level of competitiveness was one of the most important of such benefits.

The results of CATI research show that DTP are important generators of changes which take place in contemporary business models. In this respect, the most important thing is that these platforms provide a basis for building and developing these models and are based on innovative solutions. As a result, DTP and the changes in business models resulting from the implementation of these platforms are one of the most important factors contributing to the increase in the level of competitiveness of enterprises.

3.2. CATREG model

In addition to CATI, our own research also used regression analysis for qualitative CATREG (categorical regression) variables, thanks to which a model for measuring attitudes towards DTP was developed. Creating a model of a phenomenon consists of a specific mathematisation of hypotheses (in the form of an equation or a system of equations, respectively) and thus presenting them in a parameterised way in the so-called 'statistical space'. Such a model presents simplified but the most essential and important links between the phenomena under consideration. For this purpose, inductive statistics tools and, most often, regression models are used.

The concept of attitude is deeply rooted in social sciences (particularly sociology) but is also widely used in economics (Soper and Walstad, 1983). Scholars agree that the attitude exhibits a three-component structure: affective (what you feel), cognitive (what you know), and behavioural (what you do) (Garcia-Santillan et al., 2012). The concept of attitude was used in the formulation of Question 13, which is an indicator of an independent variable:

'To what extent do digital technology platforms increase the quality and intensity of the relations established by the company in which you perform your professional duties with all stakeholders, including mainly suppliers, contractors, distributors or customers?'

This question allowed attitudes towards the phenomenon of digital technology platforms to be measured. It includes both evaluation elements referring to knowledge as well as those concerning the evaluation of this phenomenon ("increase in quality and intensity"). Interrelationships relating to the overall assessment of the

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

impact of digital technology platforms on the increase in quality and intensity of business and other assessment elements can be seen, including the cognitive (Questions 5 and 12 for the affective elements and question 9 for the affective-cognitive elements) as well as behavioural (Questions 1, 4, 8, 10, 11 and 14). The influence of socio-demographic variables concerning the company was also examined (Questions 22 and 23), and the probable influence of so-called 'latent variables' concerning the surveyed person (Questions 16, 17, 18, 19 and 20). Individual indicators can also be classified in another important approach – aspects of the company's operation (the list of variables taken into account is presented in Table 3). It was assumed that a company can be transformed by digital technology platforms in the human dimension (assessment of the phenomenon, the scope of its use, expectations etc.) in the cybersecurity dimension (new IT challenges, related to hardware and software), in the economic dimension (related to the account of actual and potential profits and losses) and in the social dimension (changes in the structure of the company and its layout as well as the type and intensity of relations with the environment).

Table 3. Classification of indicators of the attitudes of entrepreneurs towards the phenomenon of digital technology platforms

Survey question	The dimension of the company's operations	Comments
Question 1. Does your company use digital technology platforms (i.e., tools that allow you to connect trading partners and create the basis for intensifying contacts and transactions between them)?	Human factor	Variable measurement level: ordinal
Question 4. Please specify what type of digital technology platforms are or will be used (in the case of implementation plans) in your company. (Please tick all possible answers)	Structural factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 5. What is the attitude of the staff members in your company with regard to the implementation and use of digital technology platforms?	Human factor	Variable measurement level: ordinal
Question 8. Please indicate whether, in connection with the implementation of digital technology platforms in the company where you perform your professional duties, if there were the following negative cybersecurity events and threats, directly resulting from the use of these platforms.	Cybersecurity factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 10. In what areas of operation of your enterprise are digital technology platforms being used or will be used (in the case of implementation plans)? (Please tick all possible answers)	Structural factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 11. Please specify what basic benefits are generated by using digital technology platforms in your company.	Economic factor	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Structural factor	Variable measurement level: ordinal
Question 14. Has the implementation of digital technology platforms in the company (in which you perform your professional duties) forced or will force you to introduce specific changes in its organisational structure?	Structural factor	Variable measurement level: ordinal
Question 22. Please specify in which type of enterprise, taking into account the size of employment, you perform your professional duties.	Structural (sociodemographic) factor	Measurement level of the variable: interval

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Question 23. In what industry does your company operate?	Structural (sociodemographic) factor	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 16. Please state your gender.	The human factor (potential latent variable affecting ratings)	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 17. Please state your age.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 18. Please specify your level of education.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 19. Specify your seniority in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 20. Please specify how long the company in which you perform your professional duties has been operating in the market.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 21. Please specify the type of position you hold in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)	Variable measurement level: nominal (not subject to factor analysis, for example)

In the case of the issues raised in the article, the key factor is the structural factor related to Question 12 and the economic factor related to the benefits of using DTP (Question 11).

The model was built with the use of the above-mentioned variables, indicating which variables and how strongly they affect the independent variable. **Regression for qualitative CATREG variables was used for the analysis. The analytical technique revealed correlates of assessments on the degree of the impact of digital technology platforms on the functioning of the company**.

Optimal scaling belongs to the family of regression methods. It is a method consisting of predicting the value of a selected variable on the basis of values assumed by other variables also indicated by the researcher. It is important that the optimal scaling enables the inclusion (in the analyses) of variables that are at each measurement level: nominal, ordinal, interval and quotient. This is a key advantage of this method and prevents the inclusion of nominal variables in the analyses (thus it is impossible to find out what role they play). This method can be considered a kind of 'first choice' in social sciences as the variables are generally measured here on a qualitative level. The purpose of using this method is to quantify the relationship between multiple independent variables and one dependent variable. It is a "regression for qualitative variables" and its essence is that the combined effect of the variables is investigated (interaction means the "product" of individual variables) (Kooij, 2007). The concept of optimal scaling comes from various sources – correspondence analysis (Greenacre, 1984) and multidimensional scaling (MDS) (Kruskal, 1964, Guttman, 1968), and is considered to be the successor to these methods. It is also statistically more correct and rigorous (Mider, 2017).

Optimal scaling is a technique that provides multi-dimensional data exploration: the number of predictors allowed is two hundred, although only one independent (predicted) variable can be predicted. It is reasonable, however, to limit the number of variables. There should be at least ten – or preferably twenty – units of analysis for each variable; otherwise, you may experience instability in the regression line. This means that in this analysis, where the set is N = 120, a maximum of twelve independent variables can be used and no more than six optimally.
This is important in the context of the number of sixteen variables identified above (Table 3). This means that at least four of them should be eliminated *a priori*. The choice was made for these variables, which, in various variable systems tested many times, showed the lowest level of interaction with other independent and dependent variables.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Interpretations of the regression model for categorical variables are analogous to those of the regular regression model, although there are more indicators that are more sophisticated.

The following numerical results are subject to interpretation:

1) **Multiple R**, also called the multiple correlation coefficient. It is the positive square root of R-squared (Multiple Determination Coefficient). It describes the collective relationship between a dependent variable and independent variables. It takes values between 0 and 1 and is an indicator of the model fit.
2) Factor **R-squared** is a multiple R raised to the second power. It illustrates the total variability of the dependent variable explained by the collective interaction of the independent variables. It takes values from 0 to 1, can be expressed as a percentage and is a comparable value.
3) **Adjusted R-squared** is computed from R-squared taking into account the number of factors in the regression model: the more factors there are, the lower the adjusted R-squared.
4) A pair of variables – **regression and residual** show the variability explained by the regression model and the amount of unexplained variation (residual). These values are subject to visual evaluation. The larger the first value and the smaller the second, the more the selected set of independent variables explains the variability of the dependent variable.
5) **Significance of the regression model** it is interpreted in the same way as in other statistical tests. In social research, the risk of making a Type 1 error of 5% ($p \leq 0.05$) is accepted.
6) **Beta coefficient (β)** is the so-called 'standardised regression coefficient' (independent of the range of the variable, calculated from the slope coefficient (also called regression coefficient) which enables the comparison of individual predictors in the regression model ranging from -1 to +1. Such a scale means that values oscillating around zero mean little or no relation between the predictor and the dependent variable.
7) An important parameter describing individual predictors is significance (interpreted as in p. 5).
8) **The F statistic** is the total goodness of the fit and shows the size of the explained variance. When creating a model, the variables that have the lowest values of this statistic are sequentially eliminated.
9) The correlation matrix – which consists of zero-order correlations, partial and semi-partial correlations – contains less relevant information. **Zero-order correlations** are isolated correlations between the independent and dependent variable. In turn **partial correlations** take into account the correlation of a given predictor as well as the dependent variable with other variables in the model. While **semi-partial correlations** take into account the interaction of a given independent variable with other variables in the model, they do not take into account the correlation of the dependent variable with other predictors. They take values from -1 to +1.
10) **Significance** is the importance of individual variables in the model expressed as part of unity (the maximum value is 1). The higher the importance assigned to a given predictor, the greater the role it plays in the model. The value of this parameter can be expressed as a percentage.
11) **Tolerance** is a measure of the collinearity of variables. This is the inverse of $R.^2$ (tolerance = 1 - R^2). It takes values from 0 to 1. The closer the predictor tolerance is to unity, the less it is collinear with other variables in the model. Co-linearities should be avoided – the closer the coefficient is to zero, the more redundant a given variable is and the more useless information it carries. The variables in the model should be strongly correlated with the dependent variable and weakly correlated with each other. The data validation phase is important for building the model and then the issue of outlier observations must be resolved. The CATREG regression model is very sensitive to outlier data.

A model using CATREG is usually constructed in the following iterative steps:

1) Including a set of variables in the model that, in the opinion of the researcher, affect the dependent variable (this set is already established at the level of preparing the tool for empirical research).
2) Manipulating the order of variables to achieve the highest result (it is iterated repeatedly and is a mechanical activity).
3) Model building and evaluation.
4) Reduction in the number of variables by the weakest predictor.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

5) Creation of a reduced model.
6) Comparisons of the previous and the next (reduced) model.
7) Repeating Points 4 to 6 until the most satisfactory numerical result is obtained.

The procedure as above is a top-down (descending) method which usually gives satisfactory substantive results. The calculation results (the best, final model) for the top-down optimal scaling are presented below in Table 4 and Table 5.

Table 4. Summary of the overall coefficients of the top-down optimal scaling model (descending)

Multiple R	0.668
R-squared	0.446
Adjusted R-squared	0.218

Table 5. ANOVA variance analysis for the optimal scaling model obtained by the top-down (descending) method

	Sum of squares	**Degrees of freedom (df)**	**Average square**	**F**	**Relevance**
Regression	53.971	35	1.542	1.955	$p \leq 0.01$
Residual	67.029	85	0.789		
Total	121.000	120			

The model was created by nine variables included in Table 6 (the order of importance of individual variables constituting the model).

Table 6. Variables used to build a model of attitudes towards digital technology platforms

Question 11. Please specify what basic benefits are generated by using digital technology platforms in your company.	Economic factor
Question 23. In what industry does your company operate?	Structural (sociodemographic) factor
Question 14. Has the implementation of digital technology platforms in the company (in which you perform your professional duties) forced or will force you to introduce specific changes in its organisational structure?	Structural factor
Question 19. Specify your seniority in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)
Question 4. Please specify what type of digital technology platforms are or will be used (in the case of implementation plans) in your company. (Please tick all possible answers)	Structural factor
Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Structural factor
Question 10. In what areas of operation of your enterprise are digital technology platforms being used or will be used (in the case of implementation plans)? (Please tick all possible answers)	Structural factor
Question 21. Please specify the type of position you hold in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)
Question 18. Please specify your level of education.	The human factor (potential latent variable affecting ratings)

In the obtained model, there were five variables belonging to the structural factor, three (although with lower explanatory power) variables belonging to the human factor and one variable being the economic factor (however, the strongest of all variables).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Table 7. Components of the optimal scaling model obtained by the top-down (descending) method

Model component name (predictor)	Beta coefficient	Degrees of freedom (df)	F	Relevance	Zero correlation
Question 11.	0.477	12	19.774	0.001	0.361
Question 23.	0.399	11	12.976	0.001	0.233
Question 14.	-0.295	3	3.881	0.012	-0.162
Question 19.	0.235	2	3.527	0.034	0.150
Question 4.	0.202	1	1.941	0.167	0.130
Question 12.	0.209	2	1.675	0.193	0.116
Question 10.	0.153	1	1.919	0.170	0.135
Question 21.	0.187	2	3.443	0.036	0.100
Question 18.	-0.114	1	0.981	0.325	-0.066
	Partial correlation	**Semi-partial correlation**	**Significance**	**Post-transformation tolerance**	**Tolerance before transformation**
Question 11.	0.522	0.455	0.386	0.911	0.914
Question 23.	0.449	0.373	0.208	0.877	0.965
Question 14.	-0.351	-0.279	0.107	0.890	0.866
Question 19.	0.290	0.225	0.079	0.917	0.828
Question 4.	0.245	0.188	0.059	0.865	0.847
Question 12.	0.265	0.204	0.055	0.955	0.914
Question 10.	0.197	0.150	0.046	0.954	0.918
Question 21.	0.236	0.181	0.042	0.936	0.828
Question 18.	-0.146	-0.110	0.017	0.934	0.931

When analysing the data in Table 7, it should be noted that the most important factor influencing attitudes towards DTP is the economic factor (0.386, which means that it explains 38.6% of the variability of the independent variable) and the socio-demographic factor (0.208). In the case of Question 12, the significance is at a level of 0.055, which means that the attitudes in the surveyed enterprises are only, to a small extent, conditioned by the factor related to the creation and development of innovative business models as a result of using digital technology platforms.

The fit of the optimal scaling model expressed by multiple R was 0.668, which is considered to be a moderate (significant) dependence but almost lies on the border of the so-called 'significant correlation', whose space extends from 0.7. The total variability of the dependent variable, explained by the total interaction of independent variables, was as much as 0.218. This means that the model explains as much as 21.8% volatility of attitudes towards digital technology platforms in enterprises. This is a significant value despite the fact that the model consists of a large number of coefficients. A significant but acceptable number of factors in the model (9) reduces the original (R-squared) value of the coefficient. It is worth noting that the analysis consisting of an attempt to subtract individual coefficients from the model in order to reduce their number increases the forces of explaining the model. Thus, the nine variables interact (at least in a mathematical sense) together, forming an inseparable whole. The model is statistically significant on a more than satisfactory level (i.e., $p \leq 0.01$). Visual assessment of the sum of squares for regression and residuals in ANOVA shows that the regression model explains more than half (53%) of the variability, which thus makes it valid. It is worth noting that the analogous method of creating the model became the basis for the highly rated habilitation thesis by Mider (2017). In that work, the adjustment of the optimal scaling model expressed with multiple R was much less than in this one (it was 0.413). The model should, therefore, be considered valuable as it explains the correlations of positive ratings of digital technology platforms.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Figure 1. Components of the optimal scaling model obtained by the top-down method – graphic interpretation taking into account the proportion of importance of individual factors in the model

<table>
<tr><td rowspan="3">Benefits of Digital Technology Platforms (Q11)</td><td rowspan="3">Industry (Q23)</td><td colspan="2">Changes in organizational structure (P14)</td><td colspan="2">Work experience (Q19)</td></tr>
<tr><td colspan="2">Types of platforms used (Q4)</td><td rowspan="2">Platform operation areas (Q10)</td><td rowspan="2">Type of position held (Q21)</td></tr>
<tr><td rowspan="2">Enabling the creation and development of innovative business models (Q12)</td></tr>
<tr><td colspan="3">Education level (Q18)</td></tr>
</table>

The model covers three groups of factors: economic, structural and human. Positive attitudes towards DTP are mainly explained by **the number of benefits generated in the enterprise by digital technology platforms** (38.6% model fit). The technological factor has long been referred to as the strategic weapon of the enterprise because its importance results from its deliberate application to increase the added value as a result of changes in production and control processes (Porter over Millar, 1985, Wiseman, 1985). Positive attitudes towards DTP are also largely constituted by factors of a structural nature – primarily the industry in which the enterprise operates and the intensity of changes in the internal structure of the enterprise – in total it is as much as 47.5% (i.e., almost half of the model components). It is worth emphasising that the importance of the structural factor has long been widely recognised. Douglas North, a Nobel Prize winner in Economics, argued that development is owed more to organisational progress than to technical progress (Acemoglu, 2009). In turn, the human factor (i.e., *strictly* sociopsychological and demographic factors of the respondent) plays a minor role (in the sense of explanatory power) and is represented by characteristics such as job tenure, position and education (13.8%).

3.3. Alternative model proposal

An alternative model was constructed using the ascending (i.e., the "bottom-up" method) by adding successive variables by trial and error. Attempts were made to base correlation with the ascending method on assumptions of an epistemological nature. The main factor was sought both among the 'hard' elements, relating to measurable econographic features of the enterprise, and 'soft' ones (i.e., those relating to the characteristics of the respondent in his/her professional role – education, experience and other socio-psycho-demographic features). The selected groups of factors showed moderately high values in terms of the F statistic, correlation and importance, but were statistically insignificant (high risk of making a Type 1 error).

The model can be based on synthetic indicators (i.e., indexes or scales). In this case, synthetic values obtained from two or more direct indicators (questionnaire questions) would become independent variables. The direct advantage of this approach is the reduction of the number of independent variables, which makes it possible to reduce the distance between the R-squared coefficient and the adjusted R-squared. As a result, a model explaining the greater part of the variation of the dependent variable can potentially be obtained. The undoubted advantage of such an approach may be obtaining transparency by introducing order and structuring individual factors into groups.

Data was synthesised on the basis of simple, arbitrary summation followed by averaging of sets of indicators. From the point of view of methodology, these are the so-called 'reflective indicators' (i.e., not related to a common cause but, according to the researcher's assumptions, classified into a more general category).

The following five synthetic indexes were distinguished: cybersecurity (represented by one index), economic (one index, related to benefits, Question 11), human (eight sub-indexes), structural (four indexes, including one referring to Question 12) and structural and demographic (two sub-indexes). An attempt to make the model using

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Question 13 as the dependent variable and such indexes as independent variables generated the results presented in Tables 8 and 9.

Table 8. Summary of the overall coefficients of the top-down optimal scaling model (descending)

Multiple R	0.361
R-squared	0.131
Adjusted R-squared	0.052

Table 9. ANOVA variance analysis for the optimal scaling model obtained by the top-down (descending) method

	Sum of squares	**Degrees of freedom (df)**	**Average square**	**F**	**Relevance**
Regression	15.805	10	1.580	1.653	$p \leq 0.1$
Residual	105.195	110	0.956		
Total	121.000	120			

In social sciences, the results of calculations in the field of inductive statistics which show a probability value (p) above 0.05 are considered statistically insignificant. Sometimes, a breakthrough is made in this rule and test results are quoted – which, although they exceed 0.05, are no higher than 0.1. There is a high (10%) risk of making a Type 1 error but, at least, such a result should be noted in the margin.
The model based on synthetic indexes explains the variability in Question 13 **to a much lesser extent than the model developed first.** The most important factor explaining more than a quarter (25.4%) of the variability of the independent variable is the structural (sociodemographic) factor, which covers the size and industry of the enterprise. This is the premise for further exploration in this regard (see Table 10).

Table 10. Components of the optimal scaling model obtained by the top-down (descending) method

Model component name (predictor)	**Beta coefficient**	**Degrees of freedom (df)**	**F**	**Relevance**	**Zero correlation**
Index - Structural (sociodemographic) factor	0.261	0.201	1	10.682	0.197
Index - Structural factor	0.147	0.163	3	0.816	0.488
Index - Human factor	0.141	0.163	2	0.749	0.475
Index - Economic factor	0.070	0.207	3	0.114	0.952
Index - Cybersecurity factor	-0.138	0.159	1	0.756	0.386
	Partial correlation	**Semi-partial correlation**	**Significance**	**Post-transformation tolerance**	**Tolerance before transformation**
Index - Structural (sociodemographic) factor	0.274	0.262	0.254	0.547	0.944
Index - Structural factor	0.140	0.154	0.145	0.157	0.975
Index - Human factor	0.145	0.148	0.139	0.157	0.972
Index - Economic factor	0.105	0.072	0.067	0.056	0.932
Index - Cybersecurity factor	-0.078	-0.141	-0.133	0.083	0.928

The CATREG model described above was supplemented with intergroup comparisons in order to find the specific 'characteristics' of the use of digital platforms from the perspective of various groups of respondents (multidimensional characteristics of the studied population). In this respect, for Questions 11 and 12, they are contrasted with Question 2 (If in Question 1 you indicated 'definitely yes' or 'rather yes', please specify how long have digital technology platforms been used in the enterprise in which you currently perform your professional duties.) and 22 (Please specify in which type of enterprise, given the size of the workforce, you perform your professional duties.). The analyses regarding Questions 2 and 11 are presented in Table 11.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Table 11. Time of application of digital technology platforms vs. benefits of DTP

Question 11. Benefits generated by the use of digital technology platforms in the enterprise:	Question 2. Please specify how long digital technology platforms have been used in the company where you currently perform your professional duties.			
	up to 3 years		over 3 years	
	ranking sum	ranking place	ranking sum	ranking place
profit increase	100.0	1	100.0	1
increase in the level of competitiveness	72.3	2	82.6	2
extension of the product range	61.7	4	56.0	4
increasing market share	29.6	8	48.6	5
increase in the level of innovation	37.4	5	36.2	7
increase in the number of customers	14.0	10	37.9	6
improving customer service and increasing the level of consumer satisfaction	10.0	12	34.8	8
increasing the number of markets in which the company operates	30.8	7	24.8	11
expanding the number of business partners, including those operating exclusively in a virtual environment	34.3	6	30.5	9
optimisation of the implementation of various business processes, including those in the field of customer service	71.7	3	67.0	3
creating digital supply chains	5.3	14	14.2	12
increase in the overall efficiency of the company's operations	16.2	9	28.4	10
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	8.1	13	13.8	13
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the range or customer base	13.7	11	14.2	12

The ranking of benefits offered by the use of digital technology platforms to both groups of respondents is almost identical. The observed differences relate to an increase in market shares, an increase in the number of customers and an increase in the overall efficiency of the company's operation (in their case, the trend is as follows – the longer CPT is used in an enterprise, the greater the benefits of the above-mentioned types are recorded). Therefore, they do not apply to increasing the level of competitiveness (72.3% of responses in the case of enterprises using DTP for up to 3 years and 82.6% in relation to a longer period of using these platforms).

Another aspect concerns the relationship between this time and the impact of DTP on creating and developing innovative business models (see Table 12).

Table 12. Time using digital technology platforms vs. development of innovative business models

Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Question 2. Please specify how long digital technology platforms have been used in the company where you currently perform your professional duties.			
	up to 3 years		over 3 years	
	N	%	N	%
I strongly agree	25	43.1	37	59.7
I agree	29	50.0	16	25.8
I neither agree nor disagree	4	6.9	8	12.9
I disagree	0	0.0	1	1.6
I strongly disagree	0	0.0	0	0.0
Mann-Whitney's Intergroup Comparison Test	no.			
Test of significance of relationships between Pearson chi-square variables and Cramer's V contingency coefficient	no.			

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

There are no statistically significant differences between the studied groups in this respect. Both almost 100% agree that digital technology platforms enable the creation and development of innovative business models. It is worth noting that the force of positive conviction to the statement is higher for enterprises of higher seniority level (over three years).

Another issue raised during the study concerns the benefits of using DTP and takes the different types of enterprises studied into consideration. The data on this issue is presented in Table 13.

Table 13. Enterprise size vs. benefits obtained on the basis of DTP

Question 11. Benefits generated by the use of digital technology platforms in the enterprise:	**Size of the enterprise**			
	micro	**small**	**medium**	**large**
	ranking sum (ranking place)	**ranking sum (ranking place)**	**ranking sum ranking place**	**ranking sum ranking place**
profit increase	75.9 (2)	100.0 (1)	100.0 (1)	100.0 (1)
increase in the level of competitiveness	100.0 (1)	74.8 (2)	70.9 (2)	73.6 (3)
extension of the product range	70.7 (3)	48.9 (4)	51.5 (4)	66.7 (4)
increasing market share	41.4 (6)	45.8 (5)	33.5 (6)	35.8 (6)
increase in the level of innovation	43.1 (5)	30.5 (9)	37.4 (5)	35.8 (6)
increase in the number of customers	70.7 (3)	38.9 (6)	13.7 (11)	14.4 (9)
improving customer service and increasing the level of consumer satisfaction	44.8 (4)	36.6 (7)	17.6 (10)	8.0 (12)
increasing the number of markets in which the company operates	8.6 (9)	31.3 (8)	28.6 (8)	28.9 (7)
expanding the number of business partners, including those operating exclusively in a virtual environment	-	29.8 (10)	33.0 (7)	37.8 (5)
optimisation of the implementation of various business processes, including those in the field of customer service	12.1 (8)	74.0 (3)	63.9 (3)	87,6 (2)
creating digital supply chains	-	16.8 (11)	12.8 (13)	3.0 (13)
increase in the overall efficiency of the company's operations	29.3 (7)	30.5 (9)	13.2 (12)	22.4 (8)
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	8.6 (9)	15.3 (12)	7.5 (14)	11.4 (11)
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the product range or customer base	-	8.4 (13)	20.7 (9)	12.9 (10)

For all businesses, regardless of employment, the most important benefits generated by the use of digital platforms are increased profits and increased competitiveness. The latter benefit was indicated by 100.0% of representatives of micro-enterprises as well as 74.8% in the case of small enterprises, 70.9% of medium-sized enterprises and 73.6% of large enterprises.

Table 14 presents data on the impact of DTP on the creation of innovative business models and takes the size of the enterprises into account.

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Table 14. Company size vs. creating innovative business models

Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Size of the enterprise							
	micro		small		medium		large	
	N	%	N	%	N	%	N	%
I strongly agree	10	83.3	18	64.3	15	36.6	19	48.7
I rather agree	1	8.3	5	17.9	24	58.5	15	38.5
I neither agree nor disagree	1	8.3	5	17.9	1	2.4	5	12.8
I rather disagree	0	0.0	0	0.0	1	2.4	0	0.0
I strongly disagree	0	0.0	0	0.0	0	0.0	0	0.0
H Kruskal-Wallis intergroup comparison test	ni.							
Test of significance of relationships between Pearson chi-square variables and Cramer's V contingency coefficient	ni.							

All enterprises, regardless of the size of their employment, show almost 100% similarity when it is found that digital technology platforms enable the creation and development of innovative business models.

Conclusion

In the summary of the article, it should be pointed out that the results of our own research clearly prove that the use of digital technology platforms creates the basis for building and developing innovative business models. In this respect, the opinions of the respondents are consistent and neither the duration of the DTP application nor the size of the enterprise matter in this respect. It should be emphasised that digital technology platforms determine the increase in the level of competitiveness of enterprises and this benefit is one of the most important, as indicated by the representatives of the surveyed enterprises. In this aspect, no significant differences were noticed depending on the time of using DTP or the size of the enterprise. Any changes in modern business models – based on digital technology platforms – should, therefore, be considered as a factor leading to increasing the competitiveness of enterprises. Consequently, it must be stated that both hypotheses set out in the introduction have been confirmed. Digital technology platforms significantly influence changes in modern business models, promoting the implementation of innovative solutions within them and, at the same time, constitute an important and new factor of competitiveness of enterprises in the digital economy.

The research carried out for the purpose of the article was innovative. They were based on a variety of methods and techniques, integrating such different research paradigms as CATI and CATREG. The results obtained during the research are a significant step forward in relation to the findings that have been made so far in the scientific literature. It has been shown that digital technology platforms are not only one of the most important, but even a key factor enabling the development of innovative business models. It has been proven that such platforms are the basic source of competitive advantage in the modern market. Admittedly, the importance of, for example, human resources for organizational success in business should not be underestimated. The fact is, however, that due to the widespread digitization and technologization, DTP already determines the competitive position of many companies to the greatest extent and allows the promotion of modern business models.

Research Limitations

It should be emphasized that a certain limitation of the conducted research is the purposeful sample of enterprises that applied for and received funding under the In-novative Economy Operational Program for investments in the implementation and development of DTPs, which may cause the management of the surveyed companies to have a positive attitude towards this phenomenon. Therefore, in order to confirm the obtained results, further research should be carried out also covering those companies that did not receive or did not apply for such funding. It

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

should also be said that the results obtained concern the attitudes of managers of Polish companies and due to cultural, social and business conditions they should not be applied indiscriminately in other countries. The study concerned the attitudes of company management towards DTP and their impact on the shaping of production and consumption patterns. The results of the study of the strength of the impact of DTP on consumption patterns among platform users in the context of sustainable development could be interesting, differentiating the results according to the type of digital platform.

It is necessary to also distinguish those limitations related to the CATREG optimal scaling. One of such limitation is related to the permissible number of predic-tors—independent variables, which amounts to 200 (in the case of CATI survey results, this condition is irrelevant, as the number of predictors rarely exceeds 100). At the same time, each variable should have a minimum of ten and, preferably, twenty units of analysis. Optimal scaling is therefore not advisable in the case of small sample sizes. Failure to take this condition into account results in unstable regression lines. Another limitation is the inherent defect of all regression methods, which provide information on the existence or absence of relations between variables but do not provide any knowledge about the cause-and-effect relationship of such relations. An important reservation also concerns the fact that depending on the type and number of variables included in the model, different result values are obtained, and it is difficult to decide which of the constructed models is best. The choice is made by the researcher, taking into account the structure of the obtained results.

References

Acemoglu, D. (2009). Introduction to Modern Economic Growth (Princeton University Press, Princeton, NJ).

Amit, R., Zott, C. (2012). Value Creation in e-Business. Strategic Management Journal, 22(7), 493-520. https://doi.org/10.1002/smj.187

Bican, P.M, Brem, A. (2020). Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable "Digital"? Sustainability, 12, 1-15. https://doi.org/10.3390/su12135239

Bonina, C., Koskinen, K., Eaton, B., Gawer, A. (2021) Digital platforms for development: Foundations and research agenda. Information Systems Journal, 31(6), 1-34. https://doi.org/10.1111/isj.12326

Broekhuizen, T.L.J., Erich, O., Gijsenberg, M.J., Broekhuis, M., Donkers, B., Slot, L.M. (2021) Digital platform openness: Drivers, dimensions and outcomes. Journal of Business Research, 122, 902-914. https://doi.org/10.1016/j.jbusres.2019.07.001

Brousseau, E., Penard, T. (2007). The economics of digital business models: a framework for analyzing the economics of platforms. Review of Network Economics, 6(2), 81-114. https://doi.org/10.2202/1446-9022.1112

Chursin, A.A, Dubina, I.N., Carayannis, E.G., Tyulin, A.E, Yudin, A.V. (2021. Technological Platforms as a Tool for Creating Radical Innovations. Journal of Knowledge Economy. https://doi.org/10.1007/s13132-020-00715-4

Constantinides, P., Henfridsson, O., Parker, G. (2018). Platforms and Infrastructures in the Digital Age. Information Systems Research, 29(2), 381-400. https://doi.org/10.1287/isre.2018.0794

Corin Stig, D. (2015). Technology Platforms. Organizing and Assessing Technological Knowledge to Support its Reuse in New Applications (Department of Product and Production Development Chalmers University of Technology, Gothenburg).

Fielt, E. (2013). Conceptualising Business Models: Definitions, Frameworks and Classifications. Journal of Business Models, 1(1), 85-105.

Filiciak, M. (2012). Treści cyfrowe. Przemiany modeli biznesowych i relacji między producentami i konsumentami (Digital content. Transformation of business models and relations between producers and consumers) (MGG Conferences, Warsaw).

Garcia-Santillan, A., Moreno-Garcia, E., Carlos-Castro, J., Zamudio-Abdala, J.H., Garduno-Trejo, J. (2012) Cognitive, Affective and Behavioral Components That Explain Attitude toward Statistics. Journal of Mathematic Research, 5(4), 8-16. https://doi.org/10.5539/jmr.v4n5p8

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. Research Policy, 43(7), 1239-1249. https://doi.org/10.1016/j.respol.2014.03.006

Gerring, J. (2001). Social Science Methodology: A Criterial Framework (Cambridge University Press, New York, NY). https://doi.org/10.1017/CBO9780511815492

Greenacre, M.J. (1984). Theory and Applications of Correspondence Analysis (Academic Press, London).

Guttman, L. (1968). A general nonmetric technique for finding the smallest coordinate space for a configuration of points. Psychometrika, 33(4), 469-506. https://doi.org/10.1007/BF02290164

Hein, A., Schreieck, M., Riasanow, T., Setzke, D.S. Wiesche, M., Böhm, M., Krcmar, H. (2019) Digital platform ecosystems. Electronic Markets, 1(30),1-12. https://doi.org/10.1007/s12525-019-00377-4

Jetter, M., Satzger, G., Neus, A. (2009). Technological Innovation and Its Impact on Business Model, Organization and Corporate Culture - IBM's Transformation into a Globally Integrated, Service Oriented Enterprise. Business & Information Systems Engineering, 1(1), 37-45.
https://doi.org/10.1007/s12599-008-0002-7

Kooij, A.J. (2007) Prediction accuracy and stability of regression with optimal scaling transformations. Accessed October 12, 2020, https://openaccess.leidenuniv.nl/handle/1887/12096

Kruskal, B. (1964). Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. Psychometrika, 29(1), 1-28. https://doi.org/10.1007/BF02289565

LeHong, H., Howard, C., Gaughan, D., Logan. D. (2016). Building a Digital Business Technology Platform (Gartner, Stamford, CT).

Li, W., Badr, Y., Biennier, F. (2012). Digital ecosystems: Challenges and prospects. Kacprzyk J, Laurent D, Chbeir R, eds. Proceedings of the International Conference on Management of Emergent Digital EcoSystems 2012 (Association for Computing Machinery, New York, NY), 117-122. https://doi.org/10.1145/2457276.2457297

Lindgren, P., Bandsholm, J. (2016). Business Model Innovation from a Business Model Ecosystem Perspective. Journal of Multi Business Model Innovation and Technology, 4(2), 51-70. https://doi.org/10.13052/jmbmit2245-456X.422

Mider, D. (2017). Polacy wobec przemocy politycznej. Politologiczno-socjologiczne studium ocen moralnych (Poles against political violence. Political and sociological study of moral evaluation) (Dom Wydawniczy "Elipsa", Warsaw).

Morgan, L., Hintermann, F., Vazirani, M. (2016) Five Ways to Win with Digital Platforms (Accenture, Dublin).

Mourtzis, D., Angelopulos, J., Panopoulos, N. (2020). A survey of digital B2B platforms and marketplaces for purchasing industrial product service systems: A conceptual framework. Procedia CIRP. 97, 331-336. https://doi.org/10.1016/j.procir.2020.05.246

Obukhova, A., Merzlyakova, E., Ershova, I., Karakulima, K. (2020) Introduction of digital technologies in the enterprise. Ziyadin S, Shaikh A, Dinis de Sousa R, Borodin A, Mottaeva A, eds. The 1st International Conference on Business Technology for a Sustainable Environmental System (EDP Sciences Les Ulis), 1-10. https://doi.org/10.1051/e3sconf/202015904004

Osterwalder, A., Pigneur, Y., Tucci, C.L. (2005) Clarifying Business Models: Origins, Present and Future of the Concept. Communications of the Association for Information Systems, 16(1), 1-25. https://doi.org/10.17705/1CAIS.01601

Pieriegud, J. (2016). Cyfryzacja gospodarki i społeczeństwa - wymiar globalny, europejski i krajowy. (Digitization of the economy and society - global, European and national dimension.)

Gajewski, J., Paprocki, W., Pieriegud, J, eds. Cyfryzacja gospodarki i społeczeństwa. Szanse i wyzwania dla sektorów infrastrukturalnych (Digitisation of the economy and society. Opportunities and challenges for infrastructure sectors) (Instytut Badań nad Gospodarką Rynkową - Gdańska Akademia Bankowa, Gdańsk), 11-38.

Planing, P. (2017). Will digital boost circular? Evaluating the impact of the digital transformation on the shift towards a circular economy. International Journal of Management Cases, 19(1), 22-31.

Porter, M., Millar, V.E. (1985) How Information Technology gives You Competitive Advantage. Harvard Business Review, 64(4), 149-160.

Rangaswamy, A., Moch, N., Felten, C., Van Bruggen, G., Wieringa, J.E., Witz, J. (2020). The Role of Marketing In Digital Business Platforms. Journal of Interactive Marketing, 51, 72-90. https://doi.org/10.1016/j.intmar.2020.04.006

Reuver de, M., Sørensen, C., Basole, R.C. (2015) The digital platforms: a research agenda. Journal of Information Technology, 33(4), 124-135. https://doi.org/10.1057/s41265-016-0033-3

Soper, J.C., Walstad, W.B. (1983) On Measuring Economic Attitudes. The Journal of Economic Education, 14(4), 4-17. https://doi.org/10.1080/00220485.1983.10845031

Stojan, C.A, Tohanean, D. (2021) Platform Business Models - A Case Study of the Technology Industry. Journal of Economics and Management Sciences, 4(1), 18-28. https://doi.org/10.30560/jems.v4n1p18

Sun, R., Keating, B., Gregor, S. (2015) Information Technology Platforms: Definition and Research Directions. Burstein F, Scheepers H, Deegan G, eds. Proceedings of the 26th Australasian Conference on Information Systems ACIS (Australasian Association for Information Systems, Adelaide), 1-17.

Täuscher, K., Laudien, S.M. (2018) Understanding Platform Business Models: A Mixed Methods Study of Marketplaces. European Management Journal, 36(3), 319-329. https://doi.org/10.1016/j.emj.2017.06.005

Teece, D.J. (2010). Business Models, Business Strategy and Innovation. Long Range Planning, 43(2-3), 172-194. https://doi.org/10.1016/j.lrp.2009.07.003

Teece, D.J., Linden, G. (2017). Business models, value capture, and the digital enterprise. Journal of Organization Design, 8(6), 8-10. https://doi.org/10.1186/s41469-017-0018-x

Thompson, A.A, Strickland, A.J. (2003). Strategic Management: Concepts and Cases (McGraw-Hill, New York, NY).

Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Spann, M., Kundisch, D., Leimeister, J.M., Loos, P. (2014). Business Models: An Information Systems Research Agenda. Business and Information Systems Engineering, 6(1), 45-53. https://doi.org/10.1007/s12599-013-0308-y

Venkatesh, R., Singhal, T.K. (2019) Platform Business Models and Digital Services Providers in Global Landscap. 3rd International Business Summit (Amity International Business School, New Delhi), 45-60.

Wiseman, C. (1985) Strategy and Computers: Information Systems as Competitive Weapons (Dow Jones - Irwin, Homewood).

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2022 Volume 9 Number 4 (June)
http://doi.org/10.9770/jesi.2022.9.4(14)

Zeamari I (2020). Uberisation: Business Model Innovation Through the Interplay of Political (Regulatory), Customer and Platform Pressures (the Case of Brussels Vehicle Licenses) https://doi.org/10.2139/ssrn.3634540

Zhao, Y., Von Delft, S., Morgan-Thomas, A., Buck, T. (2020). The evolution of platform business models: Exploring competitive battles in the world of platforms. Long Range Planning, 53(4), 1-24. https://doi.org/10.1016/j.lrp.2019.101892

Zott, C., Amit, R., Massa, L. (2011). The business model: Recent developments and future research. Journal of Management, 37(4), 1019-1042. https://doi.org/10.1177/0149206311406265

Krzysztof BARTCZAK
https://orcid.org/0000-0001-7406-1509