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ASSESSING THE IMPACT OF ARCHITECTURE EFFICIENCY ON THE BUSINESS MODEL COMPETITIVENESS

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Abstract. The purpose of this research is to develop a methodological approach to assessing the impact of the architecture effectiveness of the enterprise business model on the level of its competitiveness. The study methodology suggests the author's approach to assessing the architecture effectiveness and the level of enterprise competitiveness. The scenario approach was used in order to the evaluate the connection between competitiveness, business model potential and enterprise architecture based on the economic-mathematical method of solving the nonlinear optimization problem through the use of hierarchical synthesis. The study was conducted according to the materials from 15 private clinics in Ukraine. The analysis of the obtained indices of architecture efficiency, competitiveness and potential level of the business model of the private clinics under study was carried out. It is determined that the level and growth rates of the enterprise architecture efficiency of private clinics have significant distinctions, which affect the level of their competitiveness. A group of leading companies in terms of the level of business model potential is singled out based on the definition of the correlation between the level of business model potential and the enterprise architecture efficiency. It is established that the level of business model potential of private clinics is substantially dependent on the level of enterprise architecture efficiency. It is proved that the efficiency of enterprise architecture has a significant influence on the potential and competitiveness of the business model. The novelty of the study consists in the methodological approach to assessing the impact of business model architecture on the level of its competitiveness, taking into consideration the identification of functional rather than strictly parametric correlation between variables. This research can be useful for professionals, scientists and researchers involved in developing and implementing effective business models and designing the enterprise architecture in order to achieve the company's strategic intentions and to create and maintain competitive market positions.

Keywords: architecture effectiveness, business model, business process, competitiveness, efficiency, enterprise architecture.

JEL Classification: M10, L21.

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1. Introduction

In the current circumstances, any company requires a flexible business model to be competitive. This creates new challenges for the companies' top management, the solution of which requires the use of an architectural business model. The actualization of the enterprise architecture is conditioned by the implementation of a new approach to the description of the enterprise business model. This approach enables the coverage of the activities of both the

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enterprise as a whole and its individual units. Meanwhile, modelling is carried out in order to analyse and optimize the portfolio of business strategy, processes, organizational structure, tasks and measures, information flows of the company and technological infrastructure (Kotusev, 2017). The availability of tools to support the development, storage and enhancement of enterprise architecture visualization is important in the formation of the company's competitive business model. Complex development of the company's architecture and implementation of a systematic approach based on it, that is, a common perception and consistent modelling of strategy and business processes, allows to justify management and investment decisions, to minimize risks and variability of enterprise operation and performance and particularly to improve its competitiveness (Bakar et al., 2019). This requires the comprehensive integration of individual elements, blocks or structural units of the corporate architecture through the consolidation of management decisions. Given that consumers are increasingly striving to maximize personalized value, improving the company's architecture in terms of business model competitiveness is particularly evident with respect to demand for customized products and the growing influence of stakeholders on business processes and enterprise development in general (Dang & Pekkola, 2017). Therefore, both operational activities and a reasonable choice of competitive strategy requires a clear definition of the current state of the architecture of the enterprise business model and its compliance with current and future demand for output and range of products (services). This creates an objective need for the conformity of each value chain expected to be added to output of products (services) with the business processes of the enterprise necessary for the organization of production and efficient business model performance (Trad, 2021a). The architecture of the enterprise business model includes not only the production and logistics structure, but also the management system and the corresponding organizational structure. The architecture of the enterprise business model reflects the hierarchical structure of production, logistics, management and, respectively, organizational systems that can have a significant impact on the level of company's competitiveness as a whole (Mayer et al., 2019).

Implementation of any strategic company's intention begins with its design, which gives all stakeholders the opportunity to evaluate both the existing business model of the company and its future architecture, functionality and prospects. Therefore, the need for the business model architecture to be simple, be easy to use and contain a complete set of design tools becomes particularly relevant. A priori, the competitiveness of the enterprise, in conformity with the functioning business model, is determined by its appropriateness to the changing conditions of business environment, which conflicts the inertia of enterprise architecture and limited opportunities for its required transformation. Therefore, this study aims to fill this scientific gap by forming a methodological approach to assessing the impact of the architecture effectiveness of the enterprise business model on the level of its competitiveness.

2. Literature review

Nowadays, the concepts of "enterprise architecture" and "corporate architecture" are firmly established in the practices of modern companies' management. A great number of scientific publications is devoted to the study of the application and development of this concept. Modern enterprise is a complex system composed of many distinct elements, which relationship plays a key role in management processes (Dwipriyoko et al., 2019). This relationship became particularly evident as a result of the active development of information technology and the introduction of information systems that maintain and/or automate certain business processes in the enterprise model network. The introduction of information systems always entails dramatic changes in the content and/or sequence of processes, as well as organizational structures. The concept of enterprise architecture originates from the need for quality management of such changes (Dumitriu & Popescu, 2020). The following main directions for determining the enterprise architecture can be distinguished based on the results of modern research. It is regarded as a discipline (field of knowledge) in terms of proactive and holistic management of the company's response to destructive forces by identifying and analysing the necessary modifications towards the desired strategic intent and obtaining concrete results of the business model (Kitsios & Kamariotou, 2019). Enterprise architecture refers to the management practice aimed at maximizing the return on enterprise resources, investment in IT, system development activities in achieving the enterprise development goals (Korhonen & Halén, 2017). The business model architecture is considered as a fundamental organization of the business process system, embodied in its components, their interrelationships, as well as the principles governing its design and development (Bokolo, 2021). Enterprise architecture provides a coherent set of principles, methods and models used in the design and implementation of company's organizational structure, business processes, information systems and technologies (Venkatesan & Sridhar, 2019). The business model architecture forms the logic of the business processes organization and IT infrastructure, which reflects the integration and standardization of the operating model requirements of the business entity. Meanwhile, the operational model refers to the desired level of integration and standardization of business processes for delivery of a product or service to the final consumer (Shanks et al., 2018). The business model architecture is also understood as a practice that analyses the areas of joint activity within enterprises or their interrelations, where information and other resources are exchanged, in order to manage future conditions of companies taking into consideration the integrated requirements of strategy, business and technology (Bhattacharya, 2017). The description and visualization

of the structure of a given system, its elements, their interactions and relationships link vision, strategy and intentions with a focus on long-term effectiveness of use. The business model architecture enables the formation and definition of key principles, basic rules and standards, reflecting the enterprise vision. The architecture of the business model implies the use of tools to optimize fragmented business processes in a cohesive integrated environment capable of responding and adapting to changes, as well as of supporting the implementation of business strategy (Aldea et al., 2018). Based on the above-mentioned modern studies of enterprise architecture, it can be asserted that an important target component of this concept is to promote the implementation of strategies and goals of business development. However, considering the above-mentioned directions the company's architecture definition, insufficient attention is paid to its impact on competitiveness, as one of the determinants affecting the achievement of the established business objectives. Most studies are characterized by a thorough examination of standards and best practices for the introduction of information business model components (Gong & Janssen, 2019). However, among the definitions that are fundamental for this study, it should be clarified that enterprise architecture is a management practice that includes a coherent set of design methods and principles, visualization and subsequent implementation of organizational structures, business processes, information systems and technologies aimed at maximizing the return on enterprise resources, and used to implement the company's strategic intention (Zimmermann et al., 2020). If there are no strategic forecasts, then there is no enterprise architecture. In other words, the architecture of the enterprise business model today is a functioning competitive business system tomorrow. It is important to stress once again that the enterprise architecture involves development of a coherent business model combining elements of business and technology for the benefit of strategic forecasting for the business entity (Rahimi et al., 2017). The main characteristic of enterprise architecture lies in its ability to provide a comprehensive perception of the organization of the company's business model and its components. In this case, study considers the development of the business model architecture "as it is", which characterizes the state of affairs in the company, as well as the design architecture model ("as it should be"), in which all components of the business organization are given in the most optimal and effective relationships. The actual state of enterprise architecture according to competitiveness, business processes organization, information systems and infrastructure is reflected in the model "as it is", while the model "as it should be" is developed in conformity with the target status of enterprise architecture, which is the basis for the transition from the actual state to the target one (Nikpay et al., 2017).

It is generally accepted practice in the development of enterprise architecture models to combine individual components into group, conditionally defined layers or domains of architecture. Both various authors and companies working on improving the criteria and methods of enterprise architecture management provide their own options and views on which domains should be used to indicate architectural models (Trad, 2021b). Therefore, it should be noted that there is no consensus in modern research on the composition and number of layers of enterprise architecture. At the same time, the diagnostics of business model architecture in terms of ensuring its competitiveness remains insufficiently researched. All the above-mentioned factors determined that the purpose of this study is to form a methodological approach to evaluate the impact of the effectiveness of the business model architecture of the enterprise on the level of its competitiveness. The following hypotheses are formed in order to achieve the goal:

- H1: the effectiveness of enterprise architecture has a significant impact on the potential of the company's business model;
- H2: the effectiveness of enterprise architecture has a significant impact on the business model competitiveness.

The logic of this study involves the following tasks:

- firstly, to evaluate the architecture effectiveness of the studied enterprises;
- secondly, to determine the level of interdependence of potential and competitiveness of the business model on the effectiveness of the business model architecture;
- thirdly, to perform scenario modelling of the identified interdependencies between the studied indicators;
- fourthly, to determine the level of influence of the efficiency of the business model architecture on its potential and competitiveness by forming the nonlinear optimization for the group of researched enterprises according to the developed scenarios.

3. Materials and methods

Such key indicators as the enterprise architecture efficiency index, the competitiveness index and the level of potential of the company's business model were used in the process of conducting this study. The Enterprise architecture efficiency index (EA_{ei}) is an integrated indicator, which is calculated as follows:

$$EA_{ei} = \sqrt{EA_q^2 + EA_v^2 + EA_{sp}^2 + EA_{str}^2}\ , \quad (1)$$

where EA_q is the coefficient of business processes quality of the company's architecture; EA_v is business process value ratio; EA_{sp} is the coefficient of speed of business processes of enterprise architecture; EA_{str} is the coefficient of structure of architectural business content.

The level of potential of the company's business model is determined on the basis of an integrated indicator (Business Model Potential – *BMP*) and is calculated by the following Equation:

$$BMP = \sum_{i=1}^{n} x_i \cdot d_i, \quad (2)$$

where x_i is the value of the indicator, which is a constituent part of the BMP indicator, d_i is the weighting coefficient in the structure of the *BMP* indicator (Table 1).

Table 1. Indicators of enterprise potential assessment (source: formed by authors based on the works of Akhmetshin et al. (2018), Sosnovska & Zhytar (2018), and Tkachenko et al. (2019))

Type of potential	Indicators	Weighting coefficient of the group of indicators
Personnel potential	Personnel hiring turnover ratio Personnel attrition rate Personnel turnover ratio Change in average annual output	0.15
Production potential	Fixed assets growth ratio Fixed assets depreciation ratio Fixed assets suitability ratio Fixed assets turnover ratio Fund capacity Return on fixed assets Material intensity The share of material inputs in the cost of production	0.4
Financial potential	Financial independence ratio Current liquidity ratio Quick liquidity ratio Absolute liquidity ratio Return on assets Return on equity	0.25
Technological potential	Equipment progressiveness ratio Equipment modernization ratio	0.1
Information potential	Percentage of well-informed employees The share of employees with access to information The share of jobs provided by modern PCs	0.1
Scientific and technical potential	The share of innovation processes in the overall processes system The share of employees involved in the development and implementation of innovations	0.5

The study of economic dimensions of competitiveness in the context of enterprise architecture and its modelling make it possible to assert that the level of this indicator is influenced by the cost and quality of business processes. In our view, the proposed approach possesses a number of advantages. First of all, it enables considering a wider range of factors that determine the level of business model competitiveness, which makes this method of evaluation based on the company's architecture systematic and comprehensive. Second, there is a functional rather than a parametric correlation between variables. The business model competitiveness indicator is proposed to be defined as a function of four variables of enterprise architecture: the quality of business processes affecting product quality; the value of business processes affecting the price of products; the speed of business processes and the efficiency of business architecture structure:

$$EA_{comp} = f\left(EA_q, EA_v, EA_{sp}, EA_{str}\right). \quad (3)$$

In order to assess the level of business model competitiveness using the above-mentioned indicators, we introduce the change in competitiveness in the form of the following differential:

$$K' = \sum_{i=1}^{n}\left(\frac{\partial K}{\partial EA_q}dEA_q + \frac{\partial K}{\partial EA_v}dEA_v + \frac{\partial K}{\partial EA_{sp}}dEA_{sp} + \frac{\partial K}{\partial EA_{str}}dEA_{str}\right) = \sum_{i=1}^{n}\left(K_q + K_v + K_{sp} + K_{str}\right), \quad (4)$$

where K_q is the competitiveness of the business model dependent on the quality of business processes in the enterprise architecture, K_v is the competitiveness of the business model dependent on the value of business processes; K_{sp} is the competitiveness of the business model dependent on the speed of implementation of business processes in the enterprise architecture; K_{str} is the competitiveness of the business model dependent on the effectiveness of the structural component of the enterprise architecture.

This research is focused on the investigation of the competitiveness dependence on the quality of business processes, considering other factors unchanged. Evidently the speed of change in the competitiveness of the enterprise will be directly proportional to the change in product quality, which explicitly depends on the quality of business processes. Increasing the quality of business processes while increasing the level of competitiveness of the business model is usually due to the fact that more qualitative products are more attractive to consumers under otherwise equal conditions, and, accordingly, such products should have a greater market share. The quality of business processes is evaluated with the help of quantitative measurement of their properties. A comprehensive indicator of the business processes quality is proposed to be calculated in this study on the basis of quantitative measurement of key quality indicators, with respect to their importance.

In order to build an evaluation model, the ratio of the change in competitiveness in quality to change in the business processes quality (K_q) is set in the range from 0 to 1. The relationship between the level of this ratio and the level of business processes quality (EA_q) is determined by the coefficient. The value of this coefficient varies α_{1i}. By entering this coefficient, we obtain

$$\frac{\partial K_q}{\partial EA_q} = \alpha_{1i} EA_q. \quad (5)$$

From here we obtain:

$$K_q = \sum_{i=1}^{n}\alpha_{1i}\int EA_q \partial EA_q = \sum_{i=1}^{n}\alpha_{1i}\int\left(\frac{EA_q^2}{2} + r_{EAq}\right), \quad (6)$$

r_{EAq} assume equal to 0, since it is an arbitrary constant. The coefficients α_{mi}, m = 1 ... 4 are determined by the expert method and define the degree of impact of each parameter on the products competitiveness.

Furthermore, we calculate the rate of the competitiveness change in the business model from the change in the business processes cost. For each business entity, the rate of change in the level of business model competitiveness will be inversely proportional to the cost of business processes, and the competitiveness of the business model will decrease with the increasing cost of business processes. The ratio of the change in the business model competitiveness level, depending on the value of business processes, to the change in the value of business processes varies from 0 to 1 and is approximately equal to the negative value of the inverse value of business processes. The cost of business processes is determined as follows:

$$EA_{vi}^{w} = 1 - \frac{EA_{vi}}{\sum_{i=1}^{n} EA_{vi}}; \quad (7)$$

$$0 < EA_{vi}^{w} < 1,$$

where EA_{vi}^{w} is the relative share of the value of the i-th business process, EA_{vi} is the value of the i-th business process, $\sum_{i=1}^{n} EA_{vi}$ is the sum of the value of homogeneous business processes used for study.

By entering the coefficient, we obtain:

$$\frac{\partial K_v}{\partial EA_v} = \frac{-\alpha_{2i}}{EA_v} \quad (8)$$

from here we obtain:

$$K_v = \sum_{i=1}^{n} \alpha_{2i} \int \frac{-dEA_v}{EA_v} = \sum_{i=1}^{n} \alpha_{2i} \left(-\ln EA_v + r_{EAv}\right), \quad (9)$$

in this case: $0 \le \alpha_{2i} \le 1$, r_{EAv} assume equal to 0, since it is an arbitrary constant.

Assessment of competitiveness of business model with respect to speed of implementation of business processes of enterprise architecture shows that generally the speed of competitiveness improvement in the enterprise improves at the same time as the efficiency of sales management increases, since with efficient implementation of business processes in this direction the enterprise can significantly increase the volume of sales and therefore its market share. Thus, the ratio of change in the level of business model competitiveness, depending on the speed of implementation of business processes in enterprise architecture, to changes in the level of business processes efficiency is approximately equal to the indicator of implementation speed of business processes over time t. The value of this ratio varies from 0 to 1. The effective enterprise architecture in this case can be evaluated as follows:

$$EA_{sp} = \frac{P_{ad}}{C}, \quad (10)$$

where P_{ad} is the additional enterprise profit from increasing the speed of business processes, C is the cost of marketing activities. By entering the coefficient $\beta 3i$, the value of which ranges from 0 to 1, we obtain:

$$\frac{\partial K_{sp}}{\partial EA_{sp}} = \alpha_{3i} EA_{sp}; \quad (11)$$

$$K_{sp} = \sum_{i=1}^{n} \alpha_{3i} \int EA_{sp} \partial EA_{sp} = \sum_{i=1}^{n} \alpha_{3i} \int \left(\frac{EA_{sp}^{2}}{2} + r_{EAsp} \right), \quad (12)$$

similar to the previous cases, we assume r_{EAsp} equal to 0, since it is an arbitrary constant.

There is an inverse correlation between the speed of change in the competitiveness of the business model and the change in the structural component of the enterprise architecture. Thus, the ratio of the change in the competitiveness of the business model, depending on the structural component of the enterprise architecture (EA_{str}), to the change in the structural efficiency of the enterprise architecture is approximately equal to the negative value of the inverse measure of the business structure efficiency. The value of the ratio varies from 0 to 1.

By entering the coefficient α_{4i}, the value of which lies within $0 \le \alpha_{4i} \le 1$, we obtain:

$$\frac{\partial K_{str}}{\partial EA_{str}} = \frac{-\alpha_{4i}}{EA_{str}}; \quad (13)$$

$$K_{str} = \sum_{i=1}^{n} \alpha_{4i} \int \frac{-dEA_{str}}{EA_{str}} = \sum_{i=1}^{n} \alpha_{4i} \left(-\ln EA_{str} + r_{EAstr}\right), \quad (14)$$

r_{EAstr} assume equal to 0, since it is an arbitrary constant.

By defining the components of calculating the competitiveness of the business model, it is possible to construct a model that, taking into consideration the above, looks as follows:

$$KBM = \sum_{i=1}^{n} \alpha_{1i} \int \frac{EA_{qi}^{2}}{2} - \sum_{i=1}^{n} \alpha_{2i} \ln EA_v + \sum_{i=1}^{n} \alpha_{3i} \int \frac{EA_{spi}^{2}}{2} - \sum_{i=1}^{n} \alpha_{4i} \ln EA_{str};$$

$$KBM = \sum_{i=1}^{n} \left(\frac{\alpha_{1i} EA_{qi}^{2}}{2} - \alpha_{2i} \ln EA_v + \frac{\alpha_{3i} EA_{spi}^{2}}{2} - \alpha_{4i} \ln EA_{str} \right). \quad (15)$$

The sum of the coefficients α_{ni} equals to one. The value of the competitiveness indicator of the business model varies from 0 to 1. The resulting model enables determining the competitiveness level of the business model depending on four important components of the enterprise architecture effectiveness: quality, value, speed of business processes and their structural effectiveness.

The study was conducted according to the materials from 15 companies. As a result of the scenario approach to assessing the connection between competitiveness,

business model potential and enterprise architecture, the authors propose to use the economic-mathematical method based on solving the nonlinear optimization problem with the help of the hierarchical procedure of Thomas L. Saati. In the course of this study, this methodological approach was adapted in order to solve the nonlinear optimization problem by selecting a scenario to improve the enterprise architecture efficiency. For this purpose, the regression dependence of potential ($y1$) and competitiveness ($y2$) of the business model on the level of the enterprise architecture efficiency (x) was defined. As a result, paired models of linear regression $y1 = a1 + b1 \times x$, $y2 = a2 + b2 \times x$ were obtained. In these equations, x is replaced by the values corresponding to each of the scenarios. The first scenario assumes an increase in the level of enterprise architecture efficiency by 10% of the average among the companies studied, and the second and third scenarios – by 20% and 30%, respectively. The final stage of the study is a hierarchical synthesis and a comparison of the results and the identification of their key characteristics.

4. Results

The modern market of private medical services in Ukraine is characterized by the emergence of new players. Despite the high level of required investments, the field of private medical services is a promising business, as the services of private health care are still used by a relatively small share of Ukrainians compared to European countries, which in the long run makes it possible to increase this number several times. On the other hand, the emergence of new investors in the Ukrainian market of private medicine will increase even more with the improvement of the investment climate. There is an expansion of network players by opening new clinics or absorbing single players in Kyiv and other regions of Ukraine. In recent years, Kyiv has accounted for the major share of the private medicine market. The Ukrainian market provides the existence of large clinics, whose revenue and level of investment in equipment are many times higher than for medium and small players. Nevertheless, this does not preclude the latter from developing in this market both in Kyiv and other regions of Ukraine. Meanwhile, most of the players are still focused on middle-income people, who are gradually moving from public to private health care services.

Large clinics such as Boris, Oberig, and Dobrobut started to operate with a single unit, but over time, due to increased patient inflows and opening of new branches, it became necessary to increase the amount of medical services (in order to maintain market position and improve competitiveness), which in its turn resulted in the purchase of new equipment. The application of technical novelties and innovations in the treatment makes it possible to attract medical personnel with foreign expertise who have experience in the treatment of complex diseases, and the availability of modern equipment in the clinic will enable precise diagnosis and treatment. Most doctors with foreign experience come from large private clinics in Kyiv. In this case, we can talk about the emergence of completely new players, and the expansion of existing ones. Those private clinics that cannot be classified as premium are vigorously developing in this direction, i.e. general clinics continue to expand the range of services provided in different health care fields.

The index of enterprise architectural efficiency for the last five years is determined based on the proposed methodological approach in the process of calculations of architectural efficiency indices, competitiveness and the level of business model potential in the studied private clinics. The obtained results are shown in Figure 1.

During the research period, the highest rates of growth in the business architecture efficiency of clinics were recorded in Oxford Medical (1.5 times). Most of the

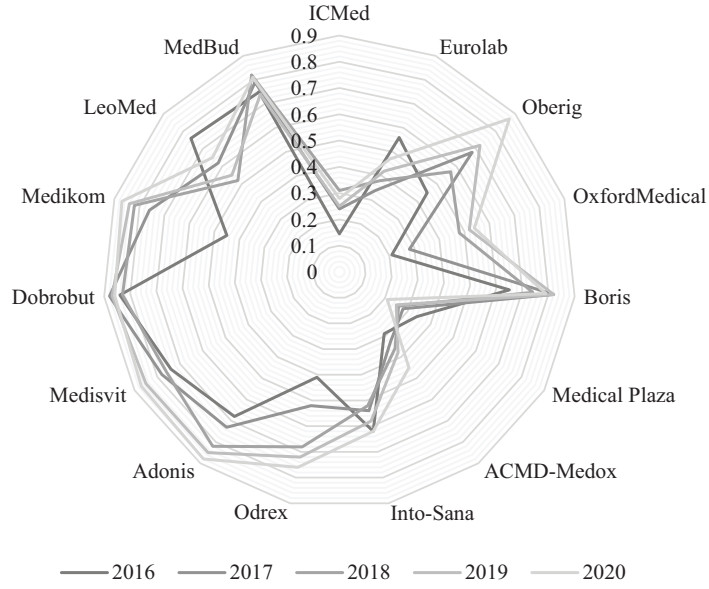

Figure 1. The architecture effectiveness of the studied private clinics in 2016–2020 (source: formed by the authors)

private clinics under study show an increase in the level of business architecture efficiency, but there are companies that have experienced a decrease in this indicator. These include Medical Plaza (–18%), Eurolab (–16%) and LeoMed (–14%). For Medical Plaza and LeoMed, this result is primarily due to the reduction of the speed of business processes in the enterprise architecture, and for Eurolab this result is due to the coefficients of quality of business processes in the company's architecture and the cost of business processes. Medical Plaza has the lowest level of business architecture efficiency among the companies under study. The highest level of architecture efficiency of the surveyed private clinics in 2020 was recorded at Adonis, Oberig, Medikom, Medisvit and Dobrobut. At the same time, ICMed, having one of the lowest efficiency indicators in 2020, had a fairly high growth rate over the last five years (93%) compared to other private lines studied. This shows that the level and speed of growth of the private clinics architecture efficiency differ considerably, and this can have a direct impact on the level of their competitiveness and economic security.

A comparison of the level of potential of the business model and the enterprise architecture effectiveness for the studied clinics is carried out in order to identify the correlation between these indicators. Its results are shown in Figure 2.

Leaders in terms of business model potential are Adonis, Boris, MedBud, Oberig. At the same time, these companies have a high level of efficiency of the enterprise architecture. The lowest rates were recorded at Medical Plaza and ICMed. This interdependence can be explained by the narrow direction of these clinics, compared to other companies studied. In general, the level of business model potential of private clinics is quite highly dependant on the level of enterprise architecture efficiency.

A comparison of the level of business model competitiveness and the enterprise architecture effectiveness for the studied clinics is carried out in order to identify the correlation between these indicators. Its graphical results are shown in Figure 3.

Adonis, MedBud, Medikom, Medisvit, Oberig have the highest level of business model competitiveness among the surveyed companies. Most companies with above-average

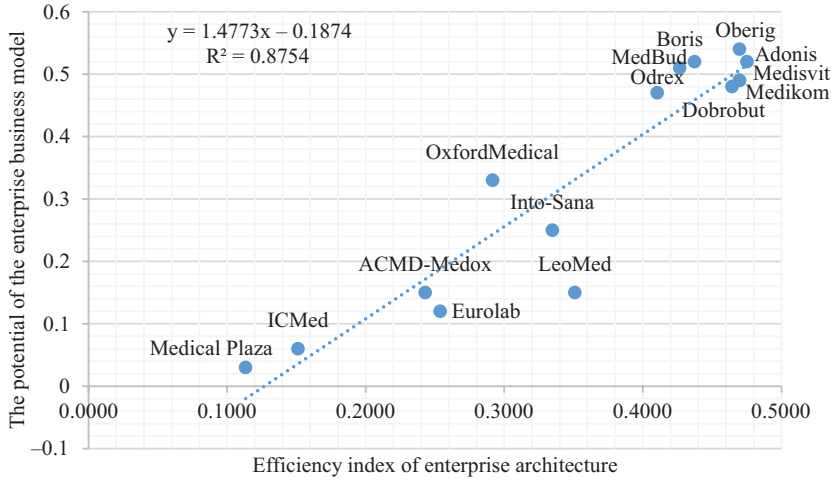

Figure 2. Interdependence of architecture efficiency and potential of business model of private clinics (source: formed by the authors)

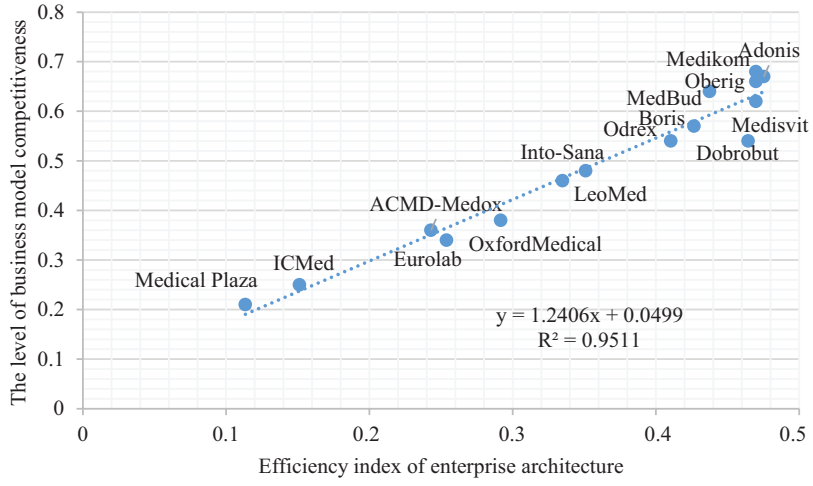

Figure 3. Interdependence of architecture efficiency and competitiveness of business model of private clinics (source: formed by the authors)

competitive business models are characterized by a fairly high level of business model potential. Thus, it is possible to trace the indirect connection between such three indicators, as competitiveness, business model potential and enterprise architecture efficiency. Therefore, in order to determine the degree of influence and interdependence of these indicators, an assessment was carried out on the basis of modelling scenarios to improve enterprise architecture efficiency. For this purpose, it is assumed that the first scenario projects 10%, the second – 20%, and the third – 30% increase in the efficiency of enterprise architecture. The key indicators of the simulation are shown in Table 2.

Table 2. The results of modelling scenarios to improve enterprise architecture efficiency (source: formed by the authors)

Regression models	a	b	–
Business model potential (y_{BMP})	–0.1874	1.4773	–
Business model competitiveness (y_{BMC})	0.0499	1.2406	–
Scenario modelling	x	y_{BMP}	y_{BMC}
Scenario1	0.7282	0.8884	0.9533
Scenario2	0.7944	0.9862	1.0354
Scenario3	0.8606	1.0840	1.1176

Based on the obtained results, it can be asserted that increasing the enterprise architecture efficiency by 1% contributes to the growth of the business model potential of the clinic by 7%, and the competitiveness of the business model of the clinic – by 4%. The results demonstrate the interconnectedness of the triad chain "business architecture – potential – competitiveness". The key driver in this triad is business architecture, the development and improvement of the efficiency of which can enhance the company's capabilities. At the same time, the effectiveness of business architecture facilitates the engineering of business processes and, while enhancing the company's capabilities, ensures the competitiveness of the business in an unstable business environment. This confirms the direct positive impact and advisability of increasing the of enterprise architecture efficiency for private clinics in order to increase business potential, formation and consolidation of competitive positions in the market (Table 3).

Table 3. Formation of nonlinear optimization for a group of private clinics under study according to the developed scenarios (source: formed by the authors)

Criterion	Assessment	Scenario1	Scenario2	Scenario3
Business model potential	Initial (y_{BMP})	0.8884	0.9862	1.0840
	Normalized	0.3003	0.3333	0.3664
	Weighted sum	1.8017	2.0000	2.1983
Business model competitiveness	Initial (y_{BMC})	0.9533	1.0354	1.1176
	Normalized	0.3069	0.3333	0.3598
	Weighted sum	0.0522	0.0567	0.0612
Hierarchical synthesis		0.0940	0.1133	0.1345

Based on the conducted hierarchical synthesis and comparison of the obtained results, it becomes possible to define their key characteristics, in particular, a clear growth in the synthesized indicator with each subsequent scenario. Taking into consideration the assumptions made during the development of scenarios for the gradual increase in the level of efficiency of enterprise architecture, it can be stated that the resulting indicators of potential and competitiveness of the business model in total by 12% with each scenario implemented. Thus, there is a direct regression dependence on the level of enterprise architecture efficiency for the private clinics under research. Based on this factor, the established research hypotheses were confirmed: the effectiveness of enterprise architecture has a significant impact on the potential and competitiveness of the business model.

The results indicate that companies can use business architecture performance diagnostics for strategic planning and risk management in a crisis and unstable business environment. By adjusting the cost and quality of business processes to improve the efficiency of business architecture, companies are able to simulate scenarios to improve its level of competitiveness. In doing so, the modelling is based on functional dependency rather than parametric dependency. Ensuring a company's competitiveness based on the approach proposed in this study takes into account such components of architecture efficiency as quality, cost and speed of business processes. Continuous monitoring and development of these components for the studied companies becomes the lever to ensure their competitiveness. The formation of a business architecture that can adapt and be flexible in a fast-changing environment can ensure not only the survival of companies in crisis, but also increase their competitiveness and potential under different scenarios of anticipated circumstances.

5. Discussion

The study of economic dimensions of competitiveness in terms of enterprise architecture and its modelling suggests that the change in the level of this indicator is influenced by the value and quality of business processes. The proposed methodological is characterised by a number of advantages. First of all, its use on the basis of enterprise architecture it enables considering a wider range of factors that determine the level of business model competitiveness. This confirms the advisability of applying this methodological approach to evaluation on a systematic and integrated basis (Bui, 2017). In addition, a significant advantage of this study is the identification of functional rather than parametric correlation between variables. The business model competitiveness indicator is proposed to be defined as a function of four variables of enterprise architecture: the quality of business processes affecting product quality; the value of business processes affecting the price of products; the speed of business processes and the efficiency of business architecture structure (Ahlemann et al., 2021). This indicates a comprehensive diagnosis of

the impact of the effectiveness of the business model architecture on the level of its competitiveness.

Measuring the competitiveness of the enterprise business model based on the speed of business processes architecture makes it possible to establish that, in general, with increasing efficiency of sales management, there is an improvement of the enterprise competitiveness (Ansyori et al., 2018; Moscoso-Zea et al., 2019). This is facilitated by the fact that with the efficient introduction of business processes in this direction, the company can significantly enhance the sales of products (services) and, accordingly, increase its market share (Olsen, 2017). The connection between the change in the competitiveness of the business model, which depends on the speed of business processes implementation of enterprise architecture and the level of business processes efficiency, almost coincides the speed of business processes implementation (Gampfer et al., 2018; Sosnovska & Zhytar, 2018).

A peculiarity of this study is the use of scenario modelling in combination with hierarchical synthesis, which allows to determine the degree of influence of interdependent indicators, including the potential and competitiveness of the business model and the effectiveness of enterprise architecture (Haghighathoseini et al., 2018). The limitation of this study can be seen as the application of only two parameters of dependence, such as the potential and competitiveness of the business model. Indicators of these variables should be defined according to the same methodology for a group of surveyed companies. However, it is possible to expand the set of key indicators taking into consideration the specific conditions of the studied enterprises operation (Hazen et al., 2017; Masuda et al., 2018).

In the future, the study may be focused on deepening the proposed methodological approach within the context of expanding the range of indicators that make up the model for assessing the impact of business model architecture on the level of its competitiveness. It is possible to apply the proposed methodological approach to enterprises of other industries, taking into consideration the specifics of their activities. This will facilitate a comparison of the results obtained not only between specific groups of enterprises, but also between regions of the country.

6. Conclusions

The conducted analysis based on the calculations of indices of architectural efficiency, competitiveness and potential level of the business model of the studied private clinics, in accordance with the proposed methodological approach, enabled identifying the companies with the highest growth rates. Most of the private clinics studied show an increase in the level of efficiency of business architecture, but there are companies that have experienced a decrease in this figure by 14–18%. They account for 20% of the total number of companies under research. The reason for this is the reduction of the coefficient of speed, quality and value of business processes of the business model enterprise architecture. Despite the fact that one of the surveyed companies has one of the lowest performance indicators of business model architecture during the last year, over the study period (5 years) it showed the highest growth rate, which is almost twice as much as other private clinics under research. It can be argued that the level and growth rate of the efficiency of the architecture of the enterprise of private clinics have significant differences, which are reflected in the level of their competitiveness.

Based on determining the interdependence between the level of business model potential and the enterprise architecture effectiveness by comparing these indicators for the clinics under research, a group of leading companies in terms of the level of business model potential was singled out. At the same time, they have a high level of enterprise architecture efficiency. The lowest rates were recorded in clinics with a narrow specialization, compared to other surveyed companies. The analysis revealed that the level of business model potential of private clinics is significantly dependent on the level of enterprise architecture efficiency.

Based on determining the interdependence between the level of business model competitiveness and the effectiveness of enterprise architecture by comparing these indicators for the clinics under research, it was determined that most companies with a high level of business model competitiveness have a high level of business model potential. As a result, there is a significant correlation between competitiveness, business model potential and enterprise architecture efficiency. Based on this factor, the established research hypotheses were confirmed: the effectiveness of enterprise architecture has a significant impact on the potential and competitiveness of the business model.

According to the results of modelling scenarios to improve the enterprise architecture efficiency, it was determined that that increasing the enterprise architecture efficiency by 1% contributes to the growth of the business model potential of the clinic by 7%, and the competitiveness of the business model of the clinic – by 4%. This confirms the direct positive impact and advisability of increasing the of enterprise architecture efficiency for private clinics in order to increase business potential.

The novelty of the study consists in the methodological approach to assessing the impact of business model architecture on the level of its competitiveness, taking into consideration the identification of functional rather than strictly parametric correlation between variables. The model of assessing the business model competitiveness as a function of four variables of enterprise architecture is proposed. This confirms a comprehensive diagnosis of the impact of the architecture effectiveness of the business model on the level of its competitiveness.

The contribution of the conducted research to the theory of competitiveness management is in demonstration of changes in its level based on the adjustment of business architecture in the direction of cost and quality of business processes. An important scientific contribution

lies in the proposed methodological approach, the advantage of which, in comparison with previous studies, is a comprehensive account of factors based on the architecture of business model enterprise, determining the level of competitiveness of the business model, the identification of functional rather than parametric relationship between business process characteristics affecting product quality and price, business process acceleration and efficiency of the architecture. This allows for a comprehensive diagnostic impact of business model architecture performance on the level of its competitiveness.

The contribution of this study to the practice of business management is to identify the key relationship between the effectiveness of business model architecture and the formation of the company's competitiveness. Determination of enterprise business model competitiveness based on the speed of implementation of business processes of its architecture allows to establish that, in general, with the increase of efficiency of sales process management, there is an acceleration of growth of company's competitiveness. Under conditions of effective implementation of business processes, taking into account this direction, the company can significantly increase sales of products (services) and, accordingly, increase its market share. In this case, the relationship between the change in business model competitiveness which depends on the speed of implementation of business processes and the level of efficiency of business processes almost coincides with the indicator which characterizes the speed of implementation of business processes. Companies can use business architecture efficiency diagnostics for strategic planning and risk management in crisis and unstable business environment. By adjusting the cost and quality of business processes to improve the efficiency of the business architecture, companies are able to simulate scenarios to improve its level of competitiveness.

The limitation of this study is the application of only two dependency parameters, such as business model potential and competitiveness. Indicators of these variables should be determined by the same methodology for the group of companies under study. It is possible to expand the set of key indicators to take into account the specific conditions of the studied companies.

In the future, the study may be directed at deepening the proposed methodological approach in the context of expanding the spectrum of indicators that are components of the model for assessing the impact of the efficiency of the business model architecture on the level of its competitiveness. It is possible to apply the proposed methodological approach to enterprises in other sectors, considering the specifics of their activities, as well as to conduct a cluster analysis. This will facilitate a comparative characterization of the results obtained not only between specific groups of enterprises, but also between regions.

This research can be useful for professionals, scientists and researchers involved in developing and implementing effective business models and designing the enterprise architecture in order to achieve the company's strategic intentions and to create and maintain competitive market positions.

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