Personalization of Banking Products (Services) using Digitalization Technologies

VITALII RYSIN[1], OLHA PROKOPENKO[2], OLEKSII MURAVSKYI[3], RUSLAN PECHENKO[1],
NATALIIA HOLIACHUK[4], ANDRII ZINCHENKO[5]
[1]Department of Finance,
Lviv Polytechnic National University,
12 Stepan Bandera Street, 79000, Lviv,
UKRAINE

[2]Department of Business Economics and Administration,
Sumy State Makarenko Pedagogical University,
87 Romenska Street, 40000, Sumy,
UKRAINE

[3]Department of Banking and Insurance,
National University of Life and Environmental Sciences of Ukraine,
15 Heroes` Defense Street, 03041, Kyiv,
UKRAINE

[4]Department of Accounting and Auditing,
Lutsk National Technical University,
75 Lvivska Street, 43000, Lutsk,
UKRAINE

[5]Department of Finance,
Admiral Makarov National University of Shipbuilding,
9 Stalingrad Street, 54000, Mykolaiv,
UKRAINE

Abstract: - The aim of the article was to build and test a potential assessment model using digitalization technologies for the personalization of banking products. The methods of graphic modeling, and expert survey were used in the research. The experience and specifics of using digital tools were analyzed, and the appropriateness of their application in bank practice was determined using the example of a Ukrainian bank. The potential of implementing specific technological solutions for the personalization of banking products (services) in the practice of the analyzed bank is determined. The Markowitz Model was applied for the allocation of the investment budget for the implementation of digital technologies with the purpose of improving the personalization of banking products (services). It was shown how the practical implementation of digital technologies and digitization tools will contribute to the growth of the competitiveness of this bank in the highly competitive market of banking products through the personalization of the client experience. Prospects for further research include the identification and structuring of digital tools that can be applied to specific expected personalized experiences.

Key-Words: - Digital technologies, Personalized offers, Banking services, Digital transformation

1 Introduction

In the modern business environment, consumer needs, preferences, and expectations are the basis for building a compelling product and service policy for banks, [1]. In this context, it is the personalized customer experience in banking that is the problem area that is increasingly focused on by academics

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and practitioners. Instead, the solution to this problem is connected with the need to consider the specifics, potential, and limitations of the banking sector, particularly regulatory norms and the possibilities of implementing modern technical and technological solutions. It is also important to identify leading innovative solutions in the organization of activities that can be implemented to solve the problem of personalization of the client experience in the banking sector. At the same time, the specified solutions may be implemented unsystematically, ineffectively, and inconsistently if they do not have proper scientific and methodological justification and development. Given this, the use of tools aimed at meeting the needs and expectations of consumers of banking services as an important element of the product and service policy of banks becomes relevant at the level of a specific banking institution. This allows us to meet these needs and expectations more systematically, consistently, fully, quickly, and effectively, determining the limits of this article's general scientific problem.

Given the rapid development of information technologies, the system of digital technologies, as well as products (services) and solutions based on it, is an environment that is the most interesting from the perspective of the availability of tools capable of creating a personalized offer in the banking sector. At the same time, this environment enables the use of automated systems to achieve the bank's goals and to spread online ways of interaction between businesses and consumers of products and services to quickly scale a personalized experience to a significant part of customers. Organizational and methodical solutions aimed at improving automation, optimization, and personalization of the client experience are important components of the system of tools aimed at meeting the needs and expectations of consumers of banking services as an important element of banks' product and service policy. These decisions require scientific development, justification, and implementation at the level of banking institutions and have a significant potential to increase the efficiency of operations and competitiveness of these institutions. This determines the relevance and necessity of researching the personalization issues of banking products (services) using digitalization technologies in this article. This determines the relevance and need for studying the issues of personalization of banking products (services) using digitalization technologies in this article.

This problem is especially relevant for developing countries and transitive economies because the activities of banks in such countries require the search for effective tools to maintain competitive positions due to:

– High competition in the market of banking products and services, including digital solutions in the banking and financial sector, which are implemented at the international level;

– A relatively weak resource potential — reserves and financial capabilities for maintaining the stability of banks in such countries are much weaker than in developed economies, therefore maintaining market positions and often even survival of these banks depends on their innovativeness and progressiveness in customer perception, which can be implemented through the creation of a personalized experience of interaction with the bank.

Because of this, the study of the state of the application of digitalization tools to improve the personalization of interaction with clients in the banking sector due to the implementation of specific digital technologies is an important scientific problem that should be considered in this scientific article. This problem is especially relevant for countries.

The article aims to study the personalization of banking products (services) using digitalization technologies and identify ways of the most effective use of such technologies within the framework of the strategy of digital transformation of banks. In the process of achieving this goal, the following research problems are expected to be solved:

- Analysis of the experience of involving digital technologies to personalize the customer experience using the example of the bank;

- Determining the development potential of individual areas of digital activity in the analyzed bank using the three-dimensional model proposed by the author;

- Interpretation of the results of the potential assessment and providing recommendations for the implementation of digital technologies aimed at personalizing banking products (services).

The hypothesis of this study is the possibility of improving the personalized experience of bank customers through the implementation of digital technologies, the potential, and structure of investment in the development of which can be substantiated by using the methodological framework, as well as theoretical and practical solutions offered in this article.

2 Literature Review

The concept of specifics plays an increasingly important role in increasing business competitiveness in the current conditions, [2], [3].

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Instead, cost optimization and the possibility of scaling activities, which were previously achieved primarily through product universalization, remain relevant but require a certain revision of the methods of achievement.

In this context, digital technologies enable businesses to scale quickly, providing interaction with a significant number of customers through online access, [4], [5], [6]. At the same time, such technologies create conditions for taking into account the requirements and needs of a specific group of consumers due to the ability to quickly receive information from the customer and quickly analyze it, [7], [8], [9]. This combination of the ability to scale activities and simultaneously offer a personalized product and service determines the success factor of a modern bank that uses digital technologies in interaction with customers, [10], [11]. This, in turn, affects the solution to the problem of creating prerequisites for the development of a modern bank in a highly competitive environment of banking and financial products, in particular, in developing countries, [12], [13]. This opinion is relevant as the resource potential of banks in these countries is quite limited, especially in relation to financing small and medium-sized businesses in these countries, [14], [15].

In this context, modern researchers focus on the strategic aspects of managing the development of banks, given that such development should include digital transformation as one of the main vectors of change, [16], [17]. At the same time, innovations in the digital sphere aimed at improving the personalized experience of customers and creating personalized banking products (services) derive from the growing role of digitalization as a factor in the development of banking, [18]. First of all, such transformations are conditioned by the prospects for the development of mobile technologies on the global market, [19], [20].

Authors considered the problems of the formation and development of banks implementing digital technologies, [12]. The results of the analysis showed that stronger banks pay more attention to the personalization of banking products (services), and thus become more competitive and get better performance.

The studies on the role of establishing an effective innovation process in implementing the conditions for the successful operation of banks and their achievement of competitiveness are worth noting, [21].

It is also important to rely on the research on works on the analysis and creation of models of the effective innovation process in the banking sector of developed countries, [10], and developing countries. So, current research on the issue of personalization of banking products (services) using digitalization technologies quite objectively represents both the essence and the relevance of the implementation of this process. At the same time, the impact of digitalization tools on the behavior of a bank customer through the offer of personalized banking products (services) is a problem that still requires significant understanding, structuring, distinguishing specifics, and finding solutions in theory, methodology, and practice.

3 Methods

The results of a survey conducted in March 2021 by the Deloitte Center for Financial Services, [12], were used as a source of statistics and expert data regarding the consumer attitude to digital technologies in the banking sector, which are used to personalize the customer experience. This survey was conducted by an independent research company for approximately 3,000 U.S. consumers differentiated by generation (Z: 18-23; Millennials: 24-39; X: 40-55; Boomers: 56-74, and the Quiet generation: 75 years or older).

3.1 Research Methods

The work uses the method of graphic modeling to assess the potential of implementing specific digital solutions to improve interaction with customers through digital technologies. The expert survey was used to assess the potential of implementing digital technology aimed at personalizing banking products in accordance with the three-dimensional graphic model proposed in the article with the justification of its blocks as variants of the bank's strategic behavior.

The Markowitz Model was used to justify the allocation of the budget for the implementation of digital technologies to improve the personalization of banking products (services), [22]. This model is based on the assumption that the profitability indicators of different assets of the investment portfolio (in this case – combinations of digital technologies planned for implementation) are interconnected. The increased profitability of the implementation of one technology simultaneously increases the profitability of other technologies, while others remain unchanged, and for some, on the contrary, profitability decreases. Diversification of the portfolio of digital activity (formation of an effective combination of technologies) enables reducing activity risks when implementing digital solutions for personalizing customer experience.

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This model has the following assumptions:

the return on investments $\bar{r}$ is taken as the mathematical expectation of return for n periods:

$$\bar{r} = \left(\sum_{t=1}^{n} r_t\right)/n \qquad (1)$$

the mean squared deviation of profitability over n periods is taken as the risk of investment σ^2:

$$\sigma^2 = \left(\sum_{t=1}^{n}(r_t - \bar{r})\right)/(n-1) \qquad (2)$$

The degree and nature of the relationship between assets i and j is expressed by the covariance:

$$cov_{ij} = \left(\sum_{t=1}^{n}(r_i^t - \bar{r_i})(r_j^t - \bar{r_j})\right)/(n-1) \qquad (3)$$

where i and j vary from 1 to k (if the portfolio includes k assets).

$$cov_{ij} = \left(\sum_{t=1}^{n}(r_i^t - \bar{r_i})(r_j^t - \bar{r_j})\right)/(n-1) \qquad (3)$$

The risk of a portfolio (combinations of digital technologies planned for implementation), consisting of k assets, is calculated by the formula:

$$\sigma_p^2 = \sum_{i=1}^{k} V_i^2 \sigma_i^2 + 2\sum_{i=1}^{k}\sum_{j=1}^{k} V_i V_j \, cov_{ij} \qquad (4)$$

The profitability of such a portfolio is the weighted average yield of the assets of its components:

$$r_p = \sum_{i=1}^{k} V_i \bar{r_i}, \qquad (5)$$

where V_i – the share of the assets included in the portfolio (combinations of digital technologies planned for implementation) is calculated by using the following formula:

$$V_i = \frac{P_i}{P_p}, \qquad (6)$$

where P_i – is the cost of investment in i technology, and P_p – is the total cost of investment in the portfolio of assets (a combination of digital technologies planned for implementation).

3.2 Research Design

The formation of an effective system of interaction between banks and clients and the management of such a system under the modern conditions of the functioning of the banking sector determine the need to study and organize certain elements of this system (approaches, methods, functions, factors), as well as their combination, which, interacting in a complex manner, contribute, with on the one hand - the implementation of the bank's goals of obtaining benefits from the implementation of more personalized banking products and services, minimization and proper compensation of activity costs, on the other hand - the realization of the goals of the consumer of banking services.

The author of this article proposes a three-dimensional model based on the following criteria to assess the potential of implementing a specific digital technology aimed at personalizing banking products (services):

a) the potential of process optimization through the application of a particular digital technology for the personalization of banking products (services);

b) the potential for the formation of new income flows thanks to the application of specific digital technology for the personalization of banking products (services);

c) the potential to improve the bank's image through the creation of a personalized service system focused on meeting specific customer needs.

It is proposed to assess the potential of implementing a specific digital technology by conducting a survey of banking market experts. The survey involves at least five experts — specialists in the banking sector who work in the same bank and are engaged in the implementation of new technologies in their bank.

One of the eight blocks is singled out for decision-making on the necessity, possibility, and specifics of implementing a particular technology depending on the results of the survey, which indicate the potential of implementing a particular digital technology to personalize banking products or services (Figure 1, Table 1).
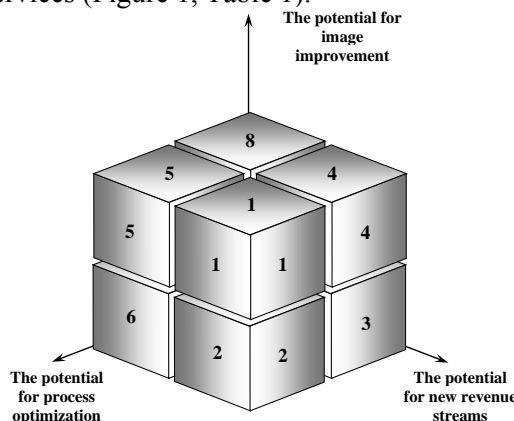

Fig. 1: An integrated three-dimensional model for assessing the potential of implementing digital technology to personalize banking products
Source: Author's Development

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Table 1. Description of the blocks of the three-dimensional model for assessing the potential for the implementation of digital technology to personalize banking products

Process optimization potential	Potential for the formation of new income flows	Potential to improve the bank's image	A block of the model corresponding to the characteristics of the potential	Description of options for actions recommended in relation to the analyzed digital technology
High (3-4 points)	High (3-4 points)	High (3-4 points)	Block 1	Implementation of the technology is recommended
High (3-4 points)	High (3-4 points)	Low (1-2 points)	Block 2	The implementation of the technology is appropriate given additional control over the bank's image
Low (1-2 points)	High (3-4 points)	Low (1-2 points)	Block 3	Implementation of the technology is impractical, it is recommended to focus on other technologies
Low (1-2 points)	High (3-4 points)	High (3-4 points)	Block 4	Implementation of the technology is appropriate given additional control over the efficiency of processes and operations in the bank
High (3-4 points)	Low (1-2 points)	High (3-4 points)	Block 5	Implementation of the technology is expedient under the condition of additional control over the bank's income flows
High (3-4 points)	Low (1-2 points)	Low (1-2 points)	Block 6	Implementation of the technology is impractical, it is recommended to focus on other technologies
Low (1-2 points)	Low (1-2 points)	Low (1-2 points)	Block 7	Implementation of the technology is impractical, it is recommended to focus on other technologies
Low (1-2 points)	Low (1-2 points)	High (3-4 points)	Block 8	Implementation of the technology is impractical, it is recommended to focus on other technologies

Source: Author's Development

In this article, it is proposed to choose ROI as the profitability of digital technologies for personalization of customer experience:

$$ROI = \frac{GP - I}{I}, \qquad (7)$$

where GP is gross profit, I is investment in the development and spread of digital technologies, that contribute to the personalization of the customer experience.

The calculated expected profitability of the ith digital technology ROIi is equal to its average value according to the profitability dynamics of the technology for a time equal to the number of calculation periods n:

$$\overline{ROI}_i = \frac{\sum_{i=1}^{n} ROI_t}{n} \qquad (8)$$

The expected profitability of the portfolio of tools (combinations of digital technologies planned for implementation) for the period is calculated as the weighted average of the expected profitability of the tools included in it:

$$ROI_p = \sum_{i=1}^{k} V_i \overline{ROI}_i \qquad (9)$$

where V_i is the share of digital technology in the portfolio, which is calculated by the formula (6).

This model was tested in practice through a personal survey of five experts holding managerial positions (at least at the level of deputy head of department) in the Ukrainian bank (Joint-Stock Pivdenny Bank Public Joint Stock Company, hereinafter — Pivdenny Bank), [23]. This bank won the category "Banks with Ukrainian capital among large banks" in the nomination "Corporate Bank" of the Banks of 2021 Ranking according to the FinClub edition, [24].

In general, it occupies a solid position in the bank rankings (it ranks 11th in the overall ranking of banks, which includes state banks and banks with foreign capital), has performance indicators allowing for its active development (Moody's A1.ua ranking), and actively implements digital technologies.

Before the survey, each expert (employee of Pivdenny Bank) gave his/her consent to participate in it and was informed about personal data privacy, the procedure, and the subject of the research, followed by the survey itself. The respondents were asked three questions (given earlier in the article before the graphic description of the model) regarding the severity of each of the criteria for

evaluating the potential with "yes" or "no" answers for each of the three digital technologies that were tested for implementation in the bank where the respondents work.

4 Results

Table 2. Results of the assessment of the potential for the implementation of digital technology to personalize banking products (services)

Technology	Evaluation criterion	Ratings of respondents					Average score	Correspondence to the model block (Figure 3)
		Resp. 1	Resp. 2	Resp. 3	Resp. 4	Resp. 5		
A. Using artificial intelligence to analyze personalized customer needs	Optimization of processes	4	3	4	4	3	3.6	BLOCK 1
	Formation of new income flows	3	4	4	4	4	3.8	
	Improving the bank's image	4	3	4	4	4	3.8	
B. Use of scoring systems to calculate personal proposals for bank credit limits	Optimization of processes	4	4	4	4	4	4	BLOCK 5
	Formation of new income flows	2	2	2	3	3	2.4	
	Improving the bank's image	3	3	3	4	3	3.2	
C. Providing personal contact with customers via the bank's messengers	Optimization of processes	2	2	1	1	2	1.6	BLOCK 8
	Formation of new income flows	2	1	2	2	1	1.6	
	Improving the bank's image	4	3	4	4	3	3.6	
D. Providing customers with data regarding their history with the bank	Optimization of processes	3	2	3	3	3	2.8	BLOCK 4
	Formation of new income flows	3	3	4	3	4	3.4	
	Improving the bank's image	4	3	3	4	4	3.6	
E. Regular informing customers about new offers that match their consumer profile	Optimization of processes	3	2	2	2	2	2.2	BLOCK 8
	Formation of new income flows	2	2	2	3	2	2.2	
	Improving the bank's image	4	3	3	3	3	3.2	

Source: created based on the results of an expert survey in accordance with the author's approach

Given a rather positive experience of introducing digital solutions and technologies into the practice of the analyzed bank, a three-dimensional model for assessing the potential of implementing digital technologies to personalize banking products (services) using the example of Pivdenny Bank (Ukraine) was tested in this article. The testing gave the results in Table 2.

Figure 2 shows the correspondence of the tested technologies to the blocks of the integrated three-dimensional model for assessing the potential of implementing digital technology to personalize banking products (services).

The justification of the allocation of the budget for the implementation of digital technologies to improve the personalization of banking products (services) using the Markowitz Model showed the following results (Table 3).

The initial shares Vi of instruments in the portfolio are calculated as shares of investment in the portfolio according to Formula (6), σ_p^2 — according to Formulas (2), (3), and (4), ROIp — according to Formula (14). Next, an active strategy — increasing profitability at a given calculated level of risk — was used.

The optimization model (10) was used. The optimization yielded the following results (Table 4, Figure 3): increased portfolio profitability by 22.2% at the same level of risk.
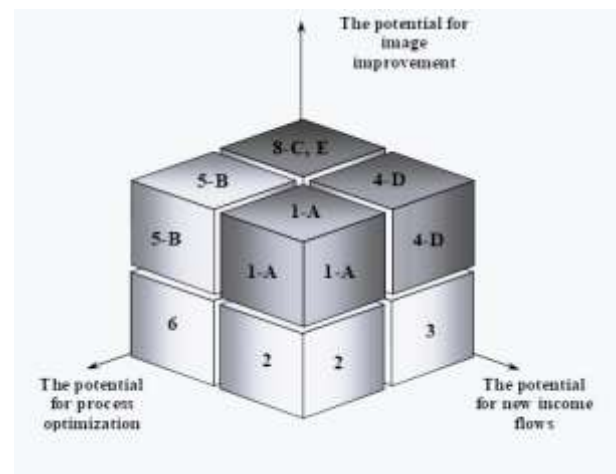

Fig. 2: Correspondence of the tested technologies to the blocks of the integrated three-dimensional model for assessing the potential for the implementation of digital technology to personalize banking products (services).
Source: Created by the author based on the results of an expert survey

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Table 3. Results of the justification of budget allocation for the implementation of digital technologies to improve the personalization of banking products (services) using the Markowitz mode

Indicator	Digital technology, which is planned for implementation in the digital complex of Pivdenny Bank					The average value of indicators
	A. Using artificial intelligence to analyze personalized customer needs	B. Use of scoring systems to calculate personal proposals for bank credit limits	C. Providing personal contact with customers via the bank's messengers	D. Providing customers with data regarding their history with the bank	E. Regular informing customers about new offers that match their consumer profile	
Investment, P_j, UAH million	182.00	341.00	340.00	520.00	180.00	
Gross profit, GP_j, UAH million	318.50	504.68	448.80	1201.20	217.80	
ROI	0.75	0.48	0.32	1.31	0.21	
$\overline{ROI}$	-	-	-	-	-	0.614
Total investment in the development of digital technologies, $\sum P_j$, UAH million	-	-	-	-	-	1563
Initial share of technologies in the investment portfolio, V_i,	0.116	0.218	0.218	0.333	0.115	
$ROI - \overline{ROI}$	0.136	-0.134	-0.294	0.696	-0.404	
σ_p^2	-	-	-	-	-	0.35
ROI_p	-	-	-	-	-	0.72

Source: Author's Calculations

Table 4. Optimization of the digital complex of Pivdenny Bank

| Indicator	Digital technology planned for implementation in the digital complex of Pivdenny Bank					Average value
	A.	B.	C.	D.	E.	
Initial investment portfolio						
ROI	0.75	0.48	0.32	1.31	0.21	-
Initial share of technologies in the investment portfolio, V_i,	0.116	0.218	0.218	0.333	0.115	-
Optimized investment portfolio						
Optimized weight of technologies in the investment portfolio, V_i,	0.560	0.145	0	0.295	0	
$ROI_{p\ initial}$	-	-	-	-	-	0.72
$ROI_{p\ optimized}$	-	-	-	-	-	0.88
Potential change of ROI_p	-	-	-	-	-	**+22%**
Investment portfolio risk $\sigma_{p\ initial}$	-	-	-	-	-	0.59
Investment portfolio risk $\sigma_{p\ optimized}$	-	-	-	-	-	0.59

Source: Author's Calculations
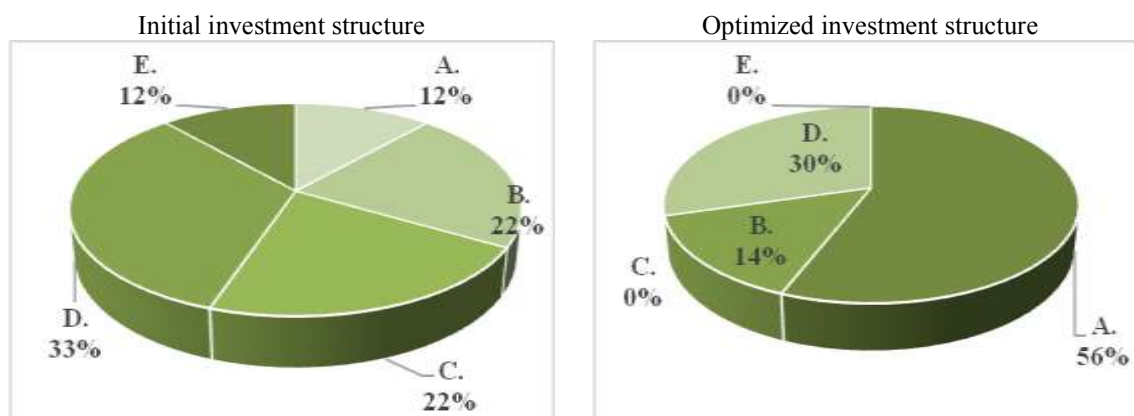
Fig. 3: The initial and optimized structure of investment in the digital complex of Pivdenny Bank
Source: built by the author

This technology has the highest potential for increasing the bank's performance. At the same time, attention should be paid to the potential of these technologies, which is revealed not only through the growing income but also through the improvement of the bank's image and the optimization of banking processes and procedures (see the results of a preliminary expert survey according to the proposed model).

Forming the prerequisites for the effective implementation of certain digital technologies in the bank's operations to personalize the customer experience, it should be noted that in the online environment, banks use these technologies for informational, transactional, and/or analytical purposes. The lack of direct interaction between the bank and customers and non-verbal signals can be compensated by other factors, such as:
– information about banking products (services);
– qualitative factors, such as interactivity functions, so that customers feel part of the process (for example, this can often be implemented with the help of chatbots based on artificial intelligence);
– customer assistance in the search and selection of banking products (services); feedback as a request.
So, to personalize banking products (services), the bank shall differentiate the customer experience and create a unique sales offer that is attractive to the target group(s), which combines a competitive advantage and has value for the customer.

5 Discussion

This article reflects one of the basic aspects that describe the digitalization processes in the banking sector — the personalization of banking products and services using digital technologies. In this context, it should be noted that the digital experience of bank customers under research can be implemented through the implementation of artificial intelligence models to understand the range of emotions experienced by people, which correlates with the study, [25], personalizing the customers' behavior and providing them relevant recommendations. So, personalization has the potential to increase service satisfaction, as the author noted, [26], or the prospect of using other tools, such as customer data analysis, as the researcher discussed, [27]. A personalized approach to savings and lending based on these and other data can make consumers' interactions with banks' digital channels more personal and "human", as found, [28], and more efficient, as work noted, [29], with a better result for banks.

In this context, the results obtained in the work fully correlate with the results of other recent studies, confirming the conclusion that the transformation of banking and the spread of digital technologies within the Open Banking concept is a meaningful strategic process of changes in the banking system in terms of the challenge of the new digital economy, [30], [31].

At the same time, it should be taken into account that the principle of "unity of the optimal management solution" characteristic of the traditional way of management is being replaced in the modern business environment by the principle of "multiplicity of possible solutions" (divergent thinking). The reason is that a large number of possible alternative management solutions are possible in unbalanced, unstable, actively, and often non-linearly developing systems, which is characteristic of the modern banking sector. This provides certain tactical and strategic advantages, which are important to forecast with a certain probability. This is especially relevant for transitive

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economies and developing countries, where the divergence of managerial thinking can become a competitive advantage in the changing business environment of these countries.

In the author's opinion, possible options for management decisions regarding the implementation of specific digital technologies to personalize banking products and services in a turbulent environment should be evaluated based on the critical rationality principle. It implies that one principled disadvantage can outweigh a set of less principled advantages. So, it is appropriate to use the model proposed by the author in this article, which enables weighing the advantages of implementing a particular technology in the specific conditions of the bank and comparing them with possible losses of efficiency. The principle of "non-linearity of management" is also urged in this context. This is a typologically correctly organized management action, implemented through a certain model, which provides for the possibility of variable actions given changes in the environment, which may turn out to be more effective than a strong management influence applied at the wrong time and not in the right place.

The results of the practical application of the approach proposed by the author can be implemented at the level of evaluation tools and methods of justifying management decisions regarding introducing new products (services) to the market and implementing certain digital solutions that contribute to this.

6 Conclusion

This article aims to emphasize the importance of implementing a personalized approach in banking in terms of digital transformation, which requires the selection and structuring of particular digitalization tools that improve interaction with customers through increased personalization of banking products (services). The author of the article proposed a three-dimensional model for assessing the potential of implementing specific digital technology to personalize banking products (services). It is based on the following criteria: the potential for optimizing processes through the application of specific digital technology for personalizing banking products (services); the potential for the formation of new income flows by applying specific digital technology for the personalization of banking products (services); the potential to improve the bank's image through the creation of a personalized service system focused on meeting the specific customer needs. The author

tests this model on the example of assessing the reasonability of implementing five digital technologies in a particular bank (Pivdenny Bank, Ukraine), which are expected to contribute to the improvement of personalization of banking products (services). The potential and appropriateness of implementing each of these technologies were analyzed. The potential for increased profitability of the implementation of these technologies through the reallocation of investment resources for the development of specific technologies was determined.

In general, this study focuses on enriching the understanding of modern economic processes in the banking sector by theoretically summarizing and structuring the issues of personalization of banking products (services) using digitalization technologies, as well as identifying ways of the most effective use of such technologies within the strategy of digital transformation of banks. At the same time, this study relies on the need to ensure competitiveness as a dominant factor in the development of a modern bank in market conditions. This is especially relevant for banks in developing countries or transitive economies with quite a weak resource potential, where the institutional conditions for development are often unfavorable.

The implementation of the model proposed by the author (the practical value of which is confirmed by testing on the example of a specific bank), as well as the structure of the investment portfolio proposed by the author in the implementation of digital technologies aimed at personalizing banking products, allows to form a systematized and justified system of decision options under certain conditions at the bank level. Such a scientific and practical toolkit can effectively stimulate the development of the bank's activities to improve interaction with clients. It will allow the combination of the latest digital technologies and business solutions to improve the bank's performance of its basic functions.

The theoretical and practical value of the solutions and proposals for the development of banking practice presented in this article implies the possibility of using the three-dimensional model proposed in the article to justify the appropriateness of implementing digital technologies in a particular bank, which should improve personalization of banking products (services), as shown by testing of this model.

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