

Assessment of the Level of Digital Maturity of the Financial Institute, Depending on the Modification of the Available Banking Products and Services

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ABSTRACT

The work reveals the relationship between the development of a cross-channel and digital competencies, as an opportunity to involve new knowledge in the development of information technology. The study substantiates the concept of an economic and mathematical model for assessing a cross-channel information system, which provides information on the change in the level of digital maturity of a financial institution, depending on the quantity and quality of modification of existing banking products and services.

The practical use of a conceptually new model makes it possible to carry out a mass assessment of a unified cross-channel information system, depending on the analysis of the adequacy of empirical distributions of the values of potential losses when they are reduced. Another advantage of the model is not only the accuracy of the results obtained, but also their interpretability in order to understand the key drivers of the development of certain competencies on the scale of the credit and financial sector of the Russian Federation, which are in demand in modern conditions of digitalization.

Keywords: *digital competencies, cross channel, information system, financial institutions, commercial bank, integration*

1. INTRODUCTION

Integration of social media (SM) and customer relationship management (CRM) is the new and most advanced digital transformation business strategy for the development of new cross-channels of global financial institutions.

The scientific paradigm and social media (SM) significance is described in the works of certain authors, performing studies at the intersection of social content and digital technologies. Susan Ward, Ron Jones, Joe Cotrell, Jeanie Dietrich and Rebecca Lieb are among them.

In our opinion, the most effective strategy is to adapt the cross channel information system not so much to a particular business needs, but to further development of internal competencies, providing for the active development of digital technologies and introduction of global information platforms.

The experience of finance leaders who applied this digital transformation strategy shows that significant benefits, including increased access to data, can come from efforts to use resources more efficiently and reduce operating costs. An additional benefit can be represented by optimized access of cross-channel information system to automated data flows; banks can significantly reduce the time spent on data collection by freeing up resources used for data analysis, thus improving its management quality.

Digital integration between social networks and customer relationship management based on digital competencies of

a financial institution allows not only obtaining new cross-channels, but also creating additional effects, namely:

- Improve the quality and quantity of interactions with customers, suppliers, and partners;
- Improve the business reputation of financial institutions and brand loyalty;
- Get effective feedback between financial institutions and customers;
- Use customer profiling as a prototype for a next-generation ecosystem.

Thus, digital integration solves the problem of developing new cross-channels in a fundamentally new way, since:

1. Social media is an addition to the already formed cross-channels.
2. Digital integration is an alternative way to interact with customers.
3. Digital integration is a new direction in non-contact sociology.
4. Cross-channels of the information system as transmission links are associated with digital competencies, their terminological structure includes two main elements: "digital", relevant to "involvement or use of computer technology", "indicating the sufficiency of knowledge and skills that allow management to act successfully and effectively" (Golden M., 2011.). In the absence of digital competencies, new cross-channels will not develop, and vice versa, the development of new cross-channels calls for transformation of current digital competencies both at the

level of individual financial institutions and the credit and financial sector as a whole. Thus, there is a direct relationship between cross-channel development and digital competencies as an opportunity to involve new knowledge in the information technology development.

The development of the above hypothesis allowed us to form a qualitatively new model to assess the cross-channel information system of financial institutions, consisting of a series of sequential steps:

1. Self-assessment of internal processes, their automation level and banking services, affecting digital competencies.
2. Calculation of a digital integration rating to determine main disadvantages in the development of a financial institution due to absence of clear targets for the adaptation of digital technologies.
3. Assessment of the digital maturity of a cross-channel information system to identify new digital initiatives and possible integration of digital functions with current business processes of financial institutions. In other words, a conclusion is made on the need to develop qualitatively new cross-channels.
4. The model is tested, acceptable boundaries for the simulation are determined, i.e. changes in the basic conditions for product sale and forms of interaction with customers.
5. Depending on the change in basic conditions, the test result, its practical interpretation is determined, a conclusion is formed about the change in the digital maturity level of a financial institution.

2. RESULTS

The preliminary stage for model construction is represented by self-assessment of the automation level of internal processes, qualifications of specialists and development of talents associated with digital competencies, the automation level of banking processes according to provided services. We propose to use a three-dimensional approach to self-assessment, consisting of a series of sequential stages using an expert method. The expert self-assessment method is based on the assumption that there is a risk of a lack of digital competencies of a financial institution, that can be estimated by a point number from 0 to 1. This logic is useful for conversion of clear numerical results into low, medium and high risk categories. Every risk category can be

considered as a fuzzy set on [0,1]. Finally, the risk assessment will determine the promising level of digital integration of a financial institution for introduction of an economic and mathematical model for assessment of a cross-channel information system.

Let us analyze all self-assessment stages in sequence.

The automation level of internal processes of a financial institution

This stage includes such aspects as the level of digital technology use for own internal processes, such as invoicing, inventory management, staff performance monitoring and performance tracking, protection of their digital identity, including presence in social networks.

Availability of skilled specialists and talent development related to digital competencies

This stage includes such aspects as the number of qualified personnel with relevant qualifications, availability of high-quality training content on the digital information analysis and processing, online training organization.

The automation level, associated with banking processes and provided banking services

The level of client-side automation, access to automated banking tools, staff training in new functions, digital data processing, analysis of the quality of used digital and information technologies.

A preliminary self-assessment for the implementation of an economic and mathematical model to assess a cross-channel information system can be performed based on calculation of the score of digital competencies using linear multiple regression:

$$Szk = w0 + w1x1 + w2x2 + \dots + wnxn,$$

where Szk is the self-assessment rating of digital competencies; w is a scoring point; x - indicators.

The assessment scale ranges from 1 to 7 points, the maximum number of scored points is determined by measuring digital competencies. The greater the number, the greater the number of points scored.

The automation level of internal processes of a financial institution

This self-assessment stage shall consider the degree of digital and information technology, used by the financial institution, and related processes for its own operations, from data management system automation to cloud-based data backups. Also, at this stage, data security and confidentiality issues shall be considered (Table 1).

Table 1 Self-assessment of internal processes automation of a financial institution based on measuring digital competencies

Measurement of digital competencies	Basis for scoring points/scoring point	Actual scoring points/scored point
(1) Digital maturity management 1. The financial institution has a registered domain name 2. It uses corporate domain identifier for external correspondence 3. The financial institution has a proven social media presence	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 3
(2) Automation of business processes 1. The financial institution uses automation for: attendance system control, financial and human resource management, information exchange 2. The financial institution has a centralized file storage/server 3. Internal business processes and workflow are managed using a digital control system 4. Available digital database of customers and provided banking services, maintained and updated	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 4

Continuation of Table 1

<p>(3) Data availability support 1.Data is backed up in the cloud/offline to another location based on periodic updates.</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 1</p>
<p>(4) Information data security is performed: 1. Using a disk encryption disk 2. Using remote security points 3. Using remote channels for information data copying</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 3</p>
<p>(5) Information data security 1. Main communication channels are digitally protected (using digital signatures or passwords/other security mechanisms) 2. Access to the Internet is restricted only when necessary, data exchange is performed by corporate firewalls. 3. The financial institution uses a deployed security system on all computers and remote devices (including access control to information data)</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 3</p>
<p>(6) Digital and electronic calculations Financial transactions are performed using digital settlement and payment systems with two-factor authentication. 1. From 15% to 40% of all settlements are performed using digital settlement and payment systems 2. From 40% to 75% of all settlements are performed using digital settlement and payment systems 3. More than 75% of all settlements are performed using digital settlement and payment systems (% refers to the volume of calculations)</p>	<p>Less than 15% - 0 points 15% - 40% - 1 point From 40% to 75% - 2 points Over 75% - 3 points</p>	<p>The maximum number of points shall not exceed 3</p>
<p>(7) Use of licensed software, including for banking functions</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 1</p>
<p>(8) Use of digital content for internal and external communications 1. The Intranet portal is supported by updated content related to banking functions. 2. A digital knowledge base is used. 3. Evaluation of staff performance is performed online 4. The mail server is managed by an internal/third party provider with scheduled backup/storage options allowing it to be kept for a specified period of time.</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 4</p>
<p>(9) Financial and personal data security within the framework of the used privacy policy 1. The financial and personal information in electronic form is protected from unauthorized access 2. Verification of customer data is performed using social networks with an information security system 3. The employees are informed of due care for sharing specific financial and customer information</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 3</p>
<p>(10) Online digital scanning for unsuitable content 1. Does the financial institution perform online digital content scanning to track adverse information background independently or through a third party?</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 1</p>
<p>(11) External verification/certification for information data security 1 Is the financial institution subject to external verification/certification for data protection, such as ISO 27001 (Note: ISO 27001 is an international standard developed by the International Organization for Standardization that describes how to manage information security in a company)?</p>	<p>For each “Yes” answer - 1 point For each “Yes” answer - 0 score</p>	<p>The maximum number of points shall not exceed 1</p>
<p>sum</p>		<p>The total possible number of points is not more than 27</p>

Availability of relevant digital competencies
This self-assessment stage covers aspects related to staff qualifications relative to information and communication

technologies (ICT), as well as the availability of investments by the financial institution for appropriate training and advanced staff training. (Table 2).

Table 2 Self-assessment for digital competency

Measurement of digital competencies	Basis for scoring points/scoring point	Actual scoring points/scored point
(1) Availability of qualified resources and staff to manage digital infrastructure 1. The financial institution supports cloud technologies provided by appropriate staff (cloud administrators) 2. The financial institution has a formalized agreement with digital service providers to support existing information systems	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 2
(2) Staff training/skills related to workflow digitalization 1. Software skills 2. Skills with spreadsheets 3. Database/data analysis skills 4. Skills with electronic and digital means of communication 5. Use of automated workflow management system (Each employee's skills can only be counted once)	From 0 to 30% of staff - 0 points From 30% to 60% of staff - 1 point More than 60% of staff - 2 points	The maximum number of points shall not exceed 2
(3) Skills related to digital media environment analysis/information systems analysis. 1. If employees, including financial management, have one or more of the following qualifications: 2. Diploma in Financial Control of Information Systems (DISA) 3. Certified Financial Information Systems Controller (CISA) 4. Certified Specialist in Risk and Information Systems Control (CRISC) 5. Certified Financial Evaluator (CFE) 6. Any other relevant information systems analysis certificates (Only qualified staff shall be counted)	From 0 to 30% of staff - 0 points From 30% to 60% of staff - 1 point More than 60% of staff - 2 points	The maximum number of points shall not exceed 2
(4) Digital rules for the banking environment. 1. Are the financial institution rules formalized for all forms of digital communications, considering banking environment characteristics?	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 1
(5) Protection against digital threats. Does the financial institution check issues such as: - Cyberbullying - Phishing attacks/phishing attacks at financial management and key company employees? - Is the anti-virus equipment functioning?	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 1
(6) Delivery of content by digital platforms. 1. Is there a remote on-demand training channel that employees can access from anywhere in the world? 2. Not less than 50% of the total amount of media content comes through digital channels, accessed remotely 3. Does the financial institution operate digital learning platforms from professional organizations to improve the skills of its employees?	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 3
(7) Common access to the knowledge base, content search on the Internet and content evaluation before use. 1. Access to the information database on business knowledge, market factors and technologies used in the banking industry 2. Does the management search for content related to the methods of information source authentication? 3. Is digital content analyzed for legal expertise (intellectual property rights)	For each "Yes" answer - 1 point For each "No" answer - 0 score	The maximum number of points shall not exceed 3
(8) Creative use of digital technologies. Is the use of digital technologies encouraged in the financial institution to create new forms of reporting, data analysis, financial information update to reduce transaction costs and eliminate manual labor?	If at least 1 such technology functions - 1 point In the absence of such technologies - 0 points	The maximum number of points shall not exceed 1
sum		The total possible number of points is not more than 15

The automation level, associated with banking processes and provided banking services
The final stage of self-assessment covers the automation of the financial institution and its operating functions, the

automated tools used to simplify analytical processes, mainly concentrated in the banking environment management (Table 3).

Table 3 Self-assessment of the automation level of financial institution processes according to provided banking services

Measurement of digital competencies	Basis for scoring points/scoring point	Actual scoring points/scored point
(1) Use of digital products for automated planning of financial institution functions. 1. Does the financial institution use any application software/digital planning tool, including resource analysis, inventory analysis, tracking of hours/days spent versus scheduled time. 2. Is remote access applied to digital products of the financial institution.	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 2
(2) Use of ready digital tools for data extraction, sampling and analytics. 1. Does the financial institution use digital tools for data extraction, sampling (Benford's law, RSF), analytics (such as ACL, IDEA, etc.) 2. If the staff qualified enough to use digital tools and interpret their results 3. Does the financial institution use digital evidence related to its activities? 4. Are there fully automated processes, i.e., the use of which completely excludes manual labor use?	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 4
(3) Use of integrated digital tools/capabilities for the financial institution in client systems such as ERP. 1. Does the financial institution use integrated management capabilities in client applications, for example, the financial management module in SAP, Oracle Financials, etc.	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 1
(4) Design of financial control levels 1. Does the financial institution develop applications to implement integrated financial controls in software? 2. Are financial and accounting, inventory management, payroll accounting, etc. automated?	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 2
(5) Information risk assessment to plan financial institution functions 1. Is there an established IT control and failure risk process, affecting planning of the financial institution functions, including, but not limited to, selection of the control level, the main areas of financial analysis, etc.	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 1
(6) Control over current information systems 1. Does the financial institution perform financial audits related to: - Information security - Investigation of financial fraud using digital and financial expertise - Vulnerability assessment, web application security testing, etc. - Compliance with ISO 27001 requirements (Note: ISO 27001 is an international standard developed by the International Organization for Standardization that describes how to manage information security in a company)	If "Yes" answer - 1 point If "No" answer - 0 score	The maximum number of points shall not exceed 1
sum		The total possible number of points is not more than 11

Based on self-assessment results, a rating is formalized, demonstrating a promising digital integration level of a financial institution for implementation of an economic and

mathematical model to assess a cross-channel information system (tab. (Table 4).

Table 4 Rating of the perspective level of digital integration

Self-assessment stage	Total possible points	Comments on assessment	Level
Stage 1	27	Less than 9 points = or > 9 to 18 points > 18 points	Level 1 (low) Level 2 (intermediate) Level 3 (high)
Stage 2	15	Less than 5 points = or > 5 to 9 points > 9 points	Level 1 (low) Level 2 (intermediate) Level 3 (high)
Stage 3	11	Less than 4 points = or > 4 to 8 points > 8 points	Level 1 (low) Level 2 (intermediate) Level 3 (high)

Level 1 indicates that the financial institution is in at early stages of SMCRM and digital technologies adaptation. Compliance with this level determines the need to improve the quality of digital competencies and staff functions. Level 2 defines an intermediate stage of adaptation to application of SMCRM and digital technologies, requiring achievement of a higher level of digital competencies. Level 3 shows that the financial institution has adapted not only information and communication technologies, but also digital technologies. The most perspective cross-channel will be represented by use of digital technologies such as artificial intelligence and financial innovation for banking functions. This approach makes it possible to determine main disadvantages in the development of a financial institution

due to absence of clear targets for the adaptation of digital technologies. At the next stage, the digital maturity of the cross-channel information system is assessed using weights. As part of a model construction on an expert basis, six main types of digital competencies are formalized, characterizing the maturity of the already formed cross-channels of the information system. Each of six types has its own weight in the overall assessment level from 10 to 30%, making up 100% in total. Based on the assigned rating, the digital maturity of the cross-channel information system is assessed using the following weights (Table 5).

Table 5 Assessment of the digital maturity level of a cross-channel information system

Digital competence	Low level	Intermediate level	High level	Weight
(1) Use of digital products for automated banking functions				30%
Integration of digital products into individual automated procedures	1	2	3	30%
Integration of digital products into the main operational process	1	2	3	30%
Use of digital products in the organization of related business processes	1	2	3	10%
(2) Use of ready digital tools for data extraction, sampling and analytics.				20%
Formation of new banking tools	1	2	3	20%
Development of new competences	1	2	3	20%
Consolidation of new functions	1	2	3	10%
(3) Use of integrated digital tools/capabilities in client systems such as ERP				20%
Formation of new banking tools	1	2	3	20%
Development of new competences	1	2	3	20%
Consolidation of new functions	1	2	3	10%
(4) Design of financial control levels				10%
Development and design of new approaches to financial control in the decision-making process	1	2	3	50%
Assessment of the financial control quality	1	2	3	30%
Assessment of new competences in financial control	1	2	3	20%
(5) Assessment of information risks to develop banking functions				10%
Complete registration of information risk analysis results	1	2	3	30%
Disclosure of information on risks and their management in reporting	1	2	3	20%
Systematization of information about risks in internal databases	1	2	3	10%
(6) Control over current cross-channels of the information system				10%
Generation of indicators for cross-channels control	1	2	3	30%
Assessment of the cross-channel management quality	1	2	3	20%
Assessment of competence in cross-channel management	1	2	3	10%

The maturity level of the cross-channel information system is calculated for each component as a weighted average of the digital maturity levels, identified for each criterion with the weights, shown in Table 5.

$$ZsK = \sum_{i=1}^N w^i * x^i$$

Where ZsK is the level of component digital maturity, w^i – is criterion weight in the component, x^i is the

maturity level within the criterion, N is the number of criteria for this component.

The total maturity level of the cross-channel information system is calculated for each component as a weighted average of the digital maturity levels, with the weights, shown in Table 5.

$$ZsS = \sum_{i=1}^6 y^i * X^i$$

Where ZsS is the digital maturity level of the cross-channel information system, y^i is the component weight in the total maturity level, X^i is the maturity level of an individual component

From our point of view, the digital maturity level of a cross-channel information system is calculated to identify new digital initiatives and possible integration of digital functions with current business processes of financial institutions. In fact, the calculation of the digital maturity level identifies development directions of fundamentally new cross-channels.

Within the framework of the developed economic and mathematical model of a cross-channel information system, it will be allowed to consider that stability level of its operation at which additional simulations do not lead to significant changes in the final value of the digital maturity level (hereinafter referred to as ZsS). By simulation we mean the maximum modification of current banking products and services (i.e., capability of a financial institution to quickly design a new product or service when the basic conditions change) and testing efficiency of new cross-channels for product sale and forms of interaction

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- with customers. In this regard, as part of the model testing, it will be necessary to calculate relative changes ZsS a predetermined increment in the number of simulations:
- $$\Delta_i = \frac{ZsS_{sim_i} - ZsS_{sim_j}}{ZsS_{sim_i}}$$
- where ZsS_{sim_i}, ZsS_{sim_j} are digital maturity level values when sim_i and sim_j simulations are performed respectively.
- We conclude on the change in the digital maturity level of a financial institution, depending on modification quantity and quality of current banking products and services, the test result and its practical interpretation are determined.
- The practical use of a conceptually new model allows for an extended assessment of a unified cross-channel information system, depending on the analysis of the adequacy of empirical distributions of the values of potential losses when they decrease. An additional advantage of this model is represented not only by results accuracy, but also their interpretability for understanding of key drivers of the development of certain competences in the credit and financial sector of the Russian Federation, relevant in modern digitalization conditions.
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