BETWEEN READINESS AND RISK: DESIGNING DECISION-MAKING MODELS FOR ADVANCED COMPANIES IN A DYNAMIC DIGITAL ECONOMY

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Abstract

Our study examines institutional innovation management systems in the context of global digital transformation. The primary objective was to establish theoretical and methodological foundations and to offer practical recommendations for enhancing innovation management mechanisms—an endeavor that requires integrating digital resources with risk management. The study yielded several key findings: first, the development of assessment frameworks to gauge institutional readiness for digital transformation using DP and DM indicators; second, the adoption of process transformation models, specifically the Osterwalder model; third, the application of methodological approaches to identify project threats and opportunities; and fourth, the implementation of specific systems or mechanisms for risk management. This study was conducted at leading institutions in the North Caucasus region.

Keywords : Digitalization ; innovation ; risks ; digital maturity ; digital transformation indicators. Introduction and Theoretical Framework

1.1. Significance of the Study

One characteristic of economic development is the adoption of various models, wherein digital information and communication technologies (ICT) serve as the foundation for competitiveness [1,2], [3]. Despite the implementation of digital solutions across business operations, adoption rates in Russia remain uneven [4,9];

consequently, the management of economic enterprises needs to develop its approaches across the board.

1.2 Theoretical Perspective and the Model for Transforming Innovative Activity

Drawing upon the classical understanding of innovation as a product of "creative destruction" [5] and the principles of open innovation systems [6], and within the context of digitalization, innovative activity in the digital environment is defined as a set of organizational and economic measures involving resources, competencies, and technologies aimed at creating competitive products [7]. Based on the specific characteristics of digitalization, a model has been developed to adapt innovative activity to the standards of the digital environment (Figure 1).

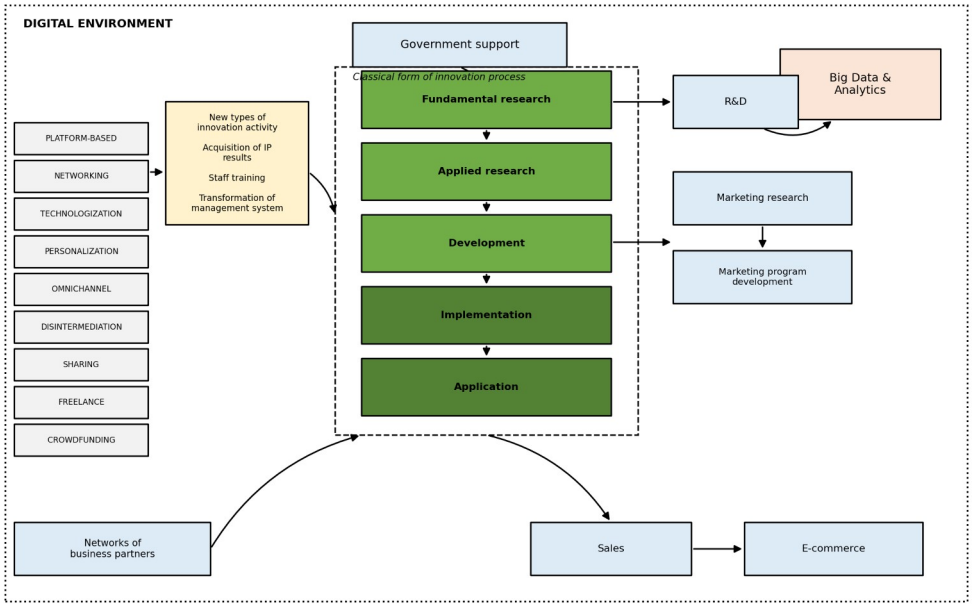

Figure 1 — Model of the transformation of enterprise innovation activity in the context of economic digitalization.

1.3 Multi-level Innovation Management Mechanism System

The innovation mechanism system is structured hierarchically, based firstly on the enterprise system model [8,9,10], and secondly on organizational and methodological

tools operating at federal, regional, and local levels (State → Region → Enterprise). Table 1 illustrates the shift towards digital transformation, the evolution of key organizational mechanisms for innovation management, and the development of blockchain tools and asset tokenization [11].

Table 1 — Transformation of innovation management mechanisms

Mechanism	Sub-type	Characteristic	Innovations under digitalization
Organization mechanisms	Creation	Formation of new companies focused on innovation activity	Development of digital enterprises, innovation ecosystems
	Absorption	Merger of large business with small organizations most successful in innovation activity	Digital technologies act as both target and mechanism of absorption
	Merger	Interaction via contractual relations in a shared market between large and small business	Formation of corporate accelerators (joint business of several companies); development of digital platforms and innovation ecosystems
	Spin-off	Separation of a structural unit oriented to innovation activity from an existing entity	Separation of IT units specializing in development and implementation of software
Development & realization mechanisms	Search	Process of searching for innovative concepts	Innovative ideas linked to digitalization of space; they constitute intellectual property; technological scouting
	Development	Formalizing an innovative idea as an innovation project	Digital design and modeling
	Realization	Process of implementing the innovation and bringing it to market	Accelerated monetization terms; digital twins; digital ecosystems; single sign-on technology; online communities

Financing & stimulation mechanisms	Attraction of funds	Bank lending, loans; subsidies and grants for R&D; public-private partnership	Grants for digital solutions; crowdfunding; development of the digital-currency market
	Own funds	Large companies: capital increase via share issue, bonds, IPO. Small companies: development of venture financing	IP object may be used as initial capital; ICO (Initial Coin Offering)
	Taxation	Stimulating innovation activity via tax reduction proportional to R&D expenditure	Increase in the number of R&D types eligible for tax reduction; VAT abolition, preferential income-tax and insurance-contribution rates for IT companies
Technology transfer mechanism	—	Transition of state-developed technologies to private-producer use; compensated technological transfer: information/personnel exchange, sale of licenses/patents/know-how, joint projects and enterprises, contract work, engineering, franchising	Mobility of technologies in state–private interaction; digital solutions simplify access to state services; data sharing; development of digital platforms and ecosystems; creation of cloud-data ecosystems
Intellectual-property (IP) mechanism	—	Innovation as a result of intellectual activity; the state supports development of intangible assets and provides legal protection; a monetized IP object is itself a profitable innovation	Introduction of new IP objects — copyright and exclusive rights on the internet; use of blockchain networks; new digital standards for describing IP objects

It outlines the approaches to innovation management mechanisms within private sector companies. One such tool is the mechanism of establishing and developing a legal framework, And plays a role by—firstly—regulating the terms of government support and resource sharing, and—secondly—being closely linked to intellectual property. Furthermore, the strategic selection of specific management mechanisms at particular stages of the innovation lifecycle ensures the successful digital transformation of innovation.

2. Methodology and Results.

2.1 Digital Transformation Assessment Methodology

An integrated methodology has been developed to assess organizational readiness for digital transformation. This methodology relies on calculating two complementary indices: first, the Digital Potential (DP) index, which determines the availability of resources required to develop information and communication technology (ICT) solutions; and second, the Digital Maturity (DM) index, which indicates the extent to which technology is genuinely integrated into business processes. The integrated Digital Transformation (DT) index is calculated using the formula: $DT = \sqrt{(DP \times DM)}$, with the DT value ranging from 0 to 10.

Table 2 — Digital Transformation Maturity Rating Scale

DP Index range	DM Index range	Maturity level	Interpretation
[0–3)	[0–2)	Lagging	Classical business models. Low digital-transformation potential. Complete absence of technological solutions within innovation activity.
[4–5)	[3–4)	Emerging	Implementation of general technologies into production mechanisms. Management decisions based on understanding the need for innovation development that accounts for digitalization of individual business processes.
[6–7)	[5–6)	Progressing	Gradual implementation of technologies across various business processes. Growing digital competence of management. Creation of a knowledge base.
[8–9)	[7–9)	Advanced	Implementation of technologies and innovation is directly linked to company strategy and goals. Staff training in digital transformation. Formation of an electronic, customer-oriented system.
10	10	Leading	A systematized, unified knowledge base and digital business model have been formed. Technologies ensure the full production/service cycle. Complexity and customer-centricity. Own innovative developments.

There are two indicators: first, Digital Potential (DP—resource readiness), and second, Digital Maturity (DM—the actual scope of technology application). The Digital Maturity indicator categorizes status across five levels—ranging from "Lagging" to "Leading"—and identifies the path to bridging the digital transformation gap.

2.2 Experimental Results

We examined the various trends that have deepened the innovation sector, utilizing data from the North Caucasian Federal District—specifically, Stavropol Krai (Figure 2).

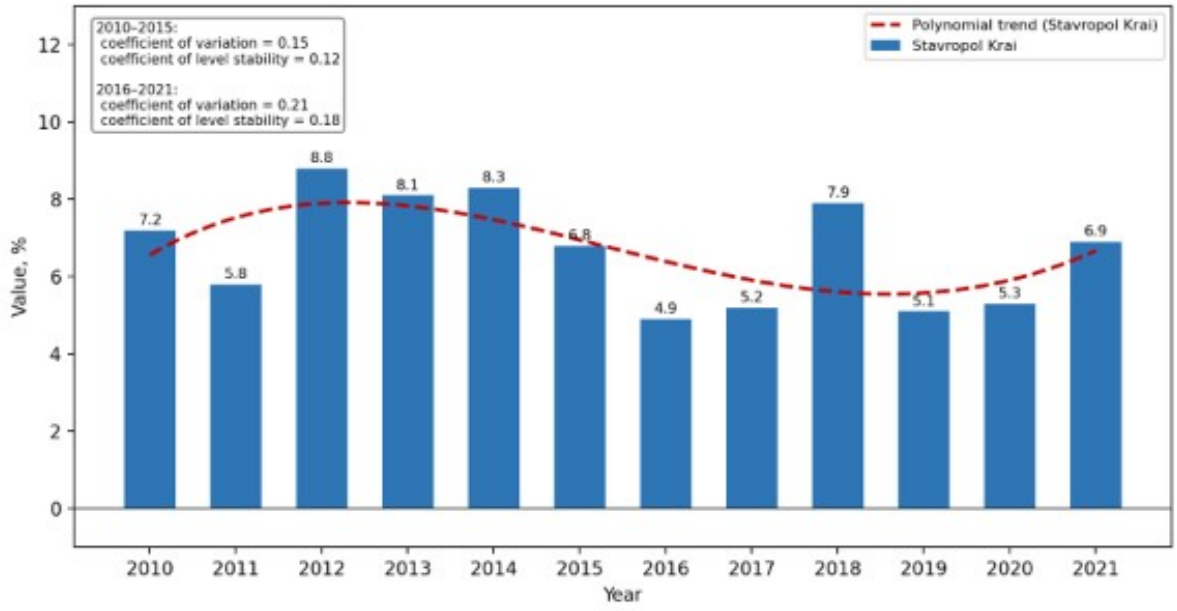

Figure 2 — Dynamics of the innovation activity level of enterprises in Stavropol Krai, 2010–2021

Table 3 presents the implementation and assessment of digitalization for advanced companies in the Stavropol region of Russia.

Table 3— Assessment of digital transformation in enterprises in the Stavropol region, Russia.

Economic entity	DP	DM	DT index	Level (per Table 2)

LLC “Gazprom Transgaz Stavropol”	8.68	9.625	9.14	Leading
JSC “Electroavtomatika”	8.4	9.438	8.90	Advanced
LLC “Stavropolskoe Podvorye”	6.47	4.625	5.47	Progressing
LLC “DS-Agro”	5.65	3.875	4.68	Emerging
LLC “VODA-KMV”	4.98	3.25	4.02	Emerging
JSC “ARNEST”	9.7	9.813	9.76	Leading
PJSC “Signal”	8.47	8.563	8.52	Advanced
LLC “Amaneidzh”	6.83	3.25	4.71	Emerging
LLC “Stavropol Brewery”	7.58	7.688	7.63	Advanced
JSC “Electrotechnical Plants ‘Energomera’”	8.39	8.188	8.29	Advanced

We have observed that major companies (Arnest, Electroautomatika, Signal, Energomera) achieved high scores in digitalization indicators; consequently, we conclude that small and medium-sized enterprises need to improve their innovation management.

3. Developing Management Tools: Business and Risk Modeling.

Leading organizations in innovation management adopt a methodology that addresses both risks and opportunities, as illustrated in Figure 3. Various factors have been established to identify opportunities and threats, and their application and effectiveness within organizations have been evaluated. This facilitates the selection of appropriate indicators to identify process-related opportunities or issues, thereby enabling innovative organizations to readily enhance their risk management processes [11,12]. An example of this is a project focused on developing remote equipment control

systems within organizations (see Table 4, where P = probability of occurrence [0–1] and I = degree of impact [0–1]).

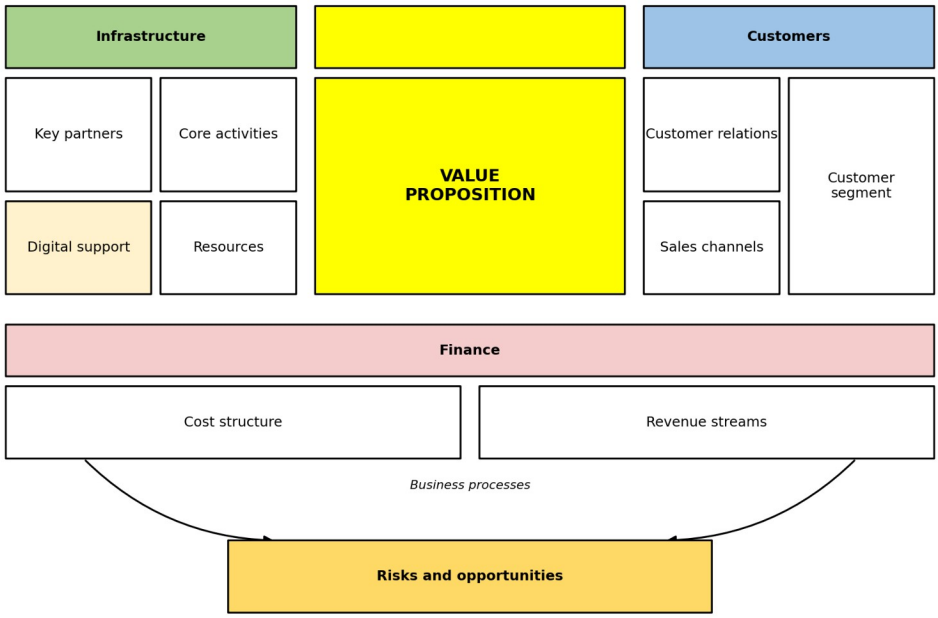

Figure 3 – The Ostwald-Bergenur model of risks and opportunities.

Table 4 — Threats and Opportunities Register for the "Electroavtomatika" JSC Innovation Project

Factor	Threat	P	I	Opportunity	P	I
HR (internal)	Threat of staff incompetence	0.2	0.4	Opportunity to train staff in new skills	0.8	0.3
Strategic (internal)	Threat of an incorrect project decision	1	1	Opportunities of predictive analytics	1	1
Production (internal)	Threat of equipment–platform incompatibility	0.3	0.9	Opportunity to expand production	0.7	1
Organizational (internal)	Threat of misalignment between management and staff	0.4	0.5	Use of the platform to strengthen process control	0.5	0.85

Innovation (internal)	Threat of insufficient IT-sphere development	0.6	0.85	Opportunity to use platform-based solutions	1	1
Technological (internal)	Threat of equipment failure	0.3	0.9	Opportunity to use extensive platform functionality	1	1
Financial (internal)	Threat of high costs	1	1	Opportunity to reduce costs	1	1
Consumer (external)	Threat of lack of customer interest	0.75	1	Opportunity to find new customers	0.5	0.5
Resource (external)	Threat of insufficient staff numbers	0.25	0.5	Opportunity to obtain state grant support	1	1
Market (external)	Threat of sanctions impact	0.85	0.8	Development of the import-substitution market	0.85	0.9
Partnership & competition (external)	Threat of competition with long-established analogues	0.15	0.3	Opportunity for superiority over competing platforms	1	1
Aggregate score (0–10)		5.8	8.15		9.35	9.55

From the table above, we observe that implementing innovation management within organizations involves identifying points of failure in operations and subsequently resolving or eliminating them; this has helped enhance organizational investment. Furthermore, the data regarding the proportions of opportunities and threats indicates a balance between the two within the projects.

Additionally, qualitative and quantitative risk management indicators were evaluated for Compressor-Techcenter's innovation project (involving the expansion and modernization of a production line using digital technologies). The initial investment amounted to 23 million Russian rubles; the Net Present Value (NPV) was 2,991 thousand rubles; the Internal Rate of Return (IRR) was 34% (with a discount rate of 16.4%); and the profitability index was 1.7. Risks associated with insufficient funding and cash flow volatility were assessed using simulation modeling (Figure 4). Based on scenario analysis results and a macroeconomic approach to digital transformation risk management [12,13], a mechanism was developed to select a risk management strategy

(passive, optimal, or active) for the Compressor-Techcenter LLC project; a strategy combining passive and active risk management measures was recommended.

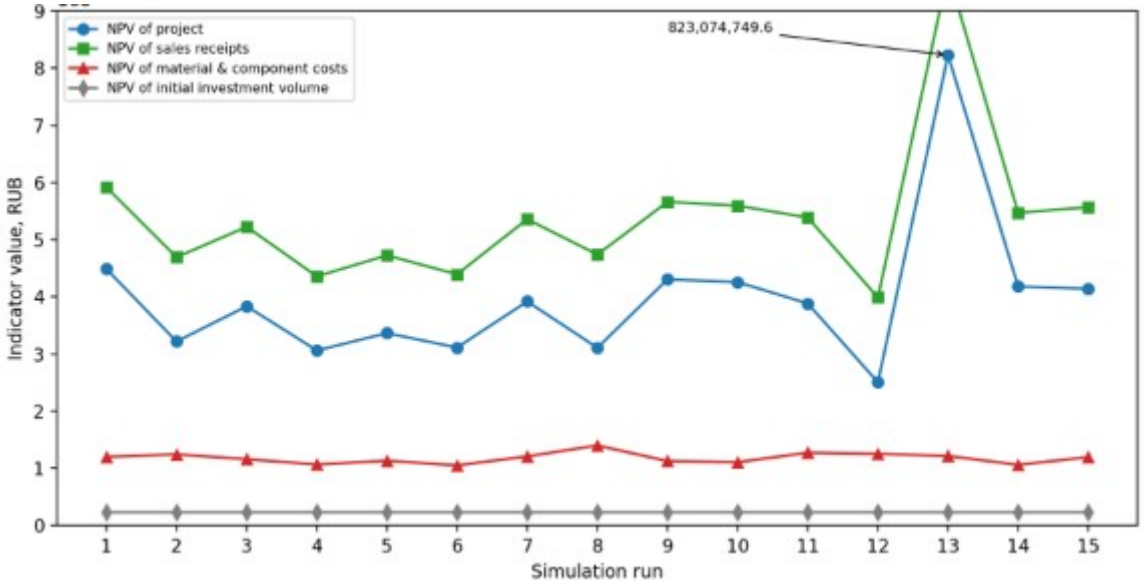

Figure 4 — NPV of the Innovation Project of LLC "Compressor-Techcenter" under Risk Simulation

4. Conclusion

From a theoretical perspective, the digital transformation of innovation requires redefining management tools—incorporating technical applications of information and communication technology (ICT) alongside organizational, human, and strategic dimensions. We also determined that companies can be distinguished using the DP and DM indicators.

The practical analysis revealed that several Russian companies—particularly small and medium-sized enterprises—are in the early stages of innovation management; consequently, the government should provide support for their systems.

Furthermore, our study identified various approaches for managing threats and opportunities within organizations and assessed their effectiveness in projects.

From a strategic perspective, we developed a modern, effective strategy for risk management in digital enterprises—one that identifies both negative and positive aspects—thereby ensuring progress within the digital economy.

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