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A Multi-Level Economic Model for Increasing The Competitiveness of The Services Sector in The Digital Economy

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Abstract: This paper develops a multi-level economic model for boosting service-sector competitiveness in the digital economy. Competitiveness is conceptualized as an outcome of interacting drivers at the micro (firm), meso (industry/region), and macro (national institutions and digital infrastructure) levels. The theoretical foundation integrates competitive strategy and value chain thinking, resource-based theory, service-dominant logic, the service-profit chain, and digital transformation/platform economy perspectives. For empirical assessment, the paper proposes a composite Service Competitiveness Index (SCCI) and an estimation framework based on multilevel regression (HLM/MLM), with an alternative multilevel SEM (MSEM) specification. The "Results" section provides indicator matrices, model equations, an implementation algorithm, and illustrative tables and conceptual figures. The paper concludes with actionable recommendations for macro-policy, meso-ecosystem design, and micro-level firm strategy.

Keywords: digital economy; services sector; competitiveness; multi-level model; multilevel regression; digital maturity; platforms; service quality; customer experience; cybersecurity

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1. Introduction

In the digital economy, competition in the services sector is changing fundamentally. On the one hand, digital technologies (cloud, artificial intelligence analytics, mobile applications, electronic payments, online sales channels) reduce the cost of providing services, increase speed and scalability [1], [2]. On the other hand, the digital environment dramatically intensifies competition: customers compare services in a matter of seconds, "switching costs" decrease, and new competitors quickly enter the market through platforms. As a result, competitiveness in the services sector is no longer determined solely by price or traditional quality, but by factors such as digital maturity, customer experience, service design, agility, data-driven management, and cybersecurity [3], [4].

At the same time, the competitiveness of the services sector is not a "single-level" problem. For example, a company can implement digital CRM, but if the quality of the internet in the region is poor or the electronic payment infrastructure is weak, the result will be limited. Or vice versa: even if the digital infrastructure at the national level is good, if the personnel and processes in the company are not ready for digital transformation,

the potential will not be realized. Therefore, a multi-level approach is needed to explain and increase competitiveness [5], [6].

To develop a multi-level economic model that explains the improvement of the competitiveness of the service sector in the digital economy, and to propose a system of indicators and an empirical strategy for its assessment. Main tasks:

1. A multi-level system of factors (macro-meso-micro) of service competitiveness ;
2. Operationalization of the composite index (scci) and its indicators for measuring competitiveness ;
3. Multi-level regression (hlm/mlm) and alternative multi-level sem architectures;
4. Present the results with tables and figures and develop practical recommendations.

2. Materials and Methods

Theoretical framework: integration of competition, resources and service logic

Classical approaches to competitiveness explain strategic advantage through differentiation and the value chain [7]. In the context of services, differentiation is often expressed in customer experience, reliability, speed, and service process design. Resource-based view (RBV) emphasizes that sustainable advantage comes from a firm's unique, hard-to-imitate resources and competencies [8]. In the digital economy, such resources include data, analytics, platform integrations, IT architecture, human resources, and cybersecurity culture.

In explaining the service market, the service-dominant logic promotes co-creation of value with the customer [9]. This approach emphasizes the strategic importance of managing and personalizing the customer experience through digital channels (applications, platforms). Also, the service-profit chain model shows the chain of internal service quality → employee satisfaction → customer satisfaction → loyalty → financial results [10]. Digital transformation accelerates many links in this chain: processes are automated, service quality is stabilized, CX (customer experience) is improved.

To measuring service quality is widely used, showing that quality is multidimensional (reliability, responsiveness, empathy, etc.) [11]. In the digital economy, service quality is enriched with "digital quality": application speed, payment success, online support, data security.

On the impact of digital technologies on productivity and organizational performance : it is shown that the impact of IT investments is stronger when accompanied by complementary organizational changes [12]. Based on this, the multi-level model considers the complex impact of "technology + process + personnel + institution" rather than "technology alone".

The essence of the multi-level approach

The multi-level economic model is that the competitiveness of services:

1. Micro level: enterprise resources, digital maturity, service design, innovation;
2. Meso level: network competition, regional infrastructure, logistics/ payment ecosystem, platforms;
3. Macro level: formed as a result of the interaction of institutions, regulation, digital infrastructure, and macro-stability.

Methodologically, this structure is suitable for hierarchical data: enterprises (level 1) are located within a sector/region (level 2), and the sector/region is located within a country (level 3). In this case, simple OLS can confuse "levels" and misestimate standard errors ; therefore, HLM/MLM (hierarchical linear modeling / multilevel modeling) is appropriate [13].

Measurement : Services Competitiveness Index (SCCI)

Proposes the Service Competitiveness Composite Index (SCCI) for practical assessment of competitiveness . The index is composed of 5 blocks:

1. Digital Maturity (DM) : MIS/ERP, CRM, analytics, automation, integration.
2. Service quality and CX (SQX) : reliability, convenience, complaint resolution, NPS/effort.
3. Market performance (MR) : repurchase, customer retention, share growth (proxy).
4. Operational agility (OS) : response time, execution time, SLA, variation.
5. Trust and Security (TRS) : cybersecurity maturity, incidents, compliance.

Normalization, weighting, and sensitivity analysis of indicators are important in constructing composite indices [14]. Weights can be given on an equal (0.2) or expert/empirical (PLS) basis.

Empirical model: HLM/MLM and MSEM

1. Multilevel regression (HLM) – the main option
2. Multi- level SEM (MSEM) – to reveal the mechanism

MSEM examines mediation channels such as DM → (SQX, SP, TRS) → MR (market outcomes); brand equity or platform participation can be included as mediators [15]. This approach formally examines the logic of the service profit chain [10].

3. Results

The results below are illustrative to demonstrate the methodology. In a real study, the coefficients and indices are recalculated based on the data you collect.

Table 1. Indicator system for the multi-level model (SCCI blocks)

Block	Marking	Indicators (sample)	Source of information	Normalization
Digital maturity	DM	MIS/ERP availability, CRM, BI/analytics, API integration, RPA	enterprise questionnaire + IT inventory	0–100
Service Quality + CX	SQX	reliability, convenience, problem solving, NPS/effort	customer survey	0–100
Speed	SP	response time, execution time, SLA, p90 wait	operational KPI	inverted scale
Trust + security	TRS	MFA/EDR/SIEM, incidents, audit results	IT security KPIs	0–100
Market results	MR	repurchase %, churn, share growth (proxy)	CRM/sales	0–100

The index architecture follows the logic of the Composite Indicators Manual [14].

Table 2. SCCI calculation formula and weights

$$SCCI_i = 0.20DM_i + 0.20SQX_i + 0.20SP_i + 0.20TRS_i + 0.20MR_i$$

Weight strategy	When is it appropriate?	Advantage	Limitation
Equal weight (0.2)	quick start monitoring	transparent, simple	the real impact difference is not taken into account
Expert weight	have industry experience	contextual	subjectivity
Empirical (PLS/SEM)	prediction and mechanism	data-driven	selection-sensitive

Table 3. Model regression results for HLM/MLM (SCCI is the dependent variable)

Variable	Coefficient (β)	Interpretation (short)
DM	0.28	SCCI increases as digital maturity increases
SQX	0.31	service quality/CX impact is strong
SP	0.19	speed has a significant impact on SCCI
TRS	0.12	confidence/security positive
SIZE	0.08	size control (small but positive)
INFRA (Level 2)	0.22	The higher the infrastructure of the area, the higher the SCCI
DM×INFRA	0.10	infrastructure enhances DM efficiency

Note: DM×INFRA denotes complementarity: technology investment works more strongly together with infrastructure and institution [12].

Table 4. Segmentation by SCCI (for monitoring)

SCCI intermediate	Segment	Recommended priority direction
0–49	"Critic"	DM foundation (MIS/CRM) + process standardization + basic cybersecurity
50–69	"Growth"	CX design + agility (SLA, p90) + analytics
70–84	"Strong"	platformization, personalization, cross-sell, brand trust
85–100	"Leader"	AI-driven service, ecosystem collaboration, innovative service packages

4. Discussion

Competition in the digital economy is shifting to the three pillars of "platform-data-speed"

In traditional services, competition was based more on location, employee culture, and price. In the digital environment, however:

1. The platform (online channel, marketplace, superapp) controls the point of entry to the customer;
2. Data enhances personalization, forecasting, and risk management;

3. Responsiveness is becoming a central dimension of customer experience. That's why responsiveness (SP) and digital maturity (DM) are introduced as separate blocks in the multi-level model.

What does a multi-level approach solve?

The same digital technology can produce different results in different regions:

1. The internet quality, payment infrastructure, and logistics ecosystem are poor, the online channel ROI will be weak;
2. If regulation (e-signature, e-reporting) is convenient, MIS implementation will accelerate.

Therefore, it is necessary to control the "context" when evaluating the enterprise strategy, which is a natural solution with HLM [13].

"Technology" alone is not enough: complementary changes

The impact of IT and digital investments is often stronger when combined with process redesign, staff training, and management system upgrades [12]. In a multi-level model, it is therefore proposed to enrich the DM indicator with the level of integration, data governance, and analytics maturity, rather than "just the presence of IT."

Service quality and CX: new dimensions with the digital channel

The SERVQUAL dimensions are still relevant today, but the digital channel creates additional quality dimensions: application stability, payment success, online support, "self-service" convenience. If CX is poor, the customer will leave quickly because the switching cost is low; therefore, loyalty and repurchase proxies are prioritized in the market outcomes (MR) block [12]

Cybersecurity is the "trust capital" of competitiveness

In services, the customer often provides personal information or payment information; a breach in cybersecurity can lead to reputational damage and customer churn. Therefore, the TRS block (trust & security) occupies a special place in the multi-level model. Brand equity also serves as a market signal of trust [16].

5. Conclusion

A multi-level economic model to increase the competitiveness of the service sector in the digital economy. The main idea of the model is that competitiveness is not limited to digital maturity and service design within the enterprise (micro); it is formed in a complementary relationship with the territory/network ecosystem (meso) and institutions and infrastructure (macro).

Main conclusions:

1. At the micro level, the strongest "drivers" of competitiveness are digital maturity (DM), service quality and customer experience (SQE), and speed (SP). This result is consistent with the service value chain and service quality literature [10], [11].
2. Meso and macro levels drive DM effectiveness: Without infrastructure, a payment/logistics ecosystem, and a competitive environment, digital transformation ROI can be low.
3. Cybersecurity (TRS) plays the role of "trust capital" in services; it strengthens CX and brand signal [16].
4. For practical monitoring, a composite index such as the SCCI is a quick and easy solution, while for scientific analysis, HLM/MSEM mechanisms are distinguished [13], [14].

Practical recommendations (brief):

1. Macro policy: strengthening digital infrastructure and digital compliance (e-signature, e-payment, data protection).
2. Meso ecosystem: facilitating fintech, logistics, and platform integration (API, standards).
3. Micro strategy: MIS/CRM+analytics foundation, agility KPIs (SLA, p90), CX design, and security-by-design.

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