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ASSESSMENT OF THREATS TO THE FINANCIAL AND INNOVATIVE SECURITY OF HOTEL AND RESTAURANT ENTERPRISES AT THE MICRO AND MACRO LEVELS

ABSTRACT

The article examines threats to the financial and innovative security of hospitality enterprises at the micro and macro levels. The relevance of the topic is due to the fact that the functioning of enterprises in this sector occurs under conditions of prolonged post-crisis pressure, which was formed under the influence of the consequences of the COVID-19 pandemic, full-scale invasion, inflationary and price instability, infrastructure restrictions, personnel losses, and the accelerated spread of technologies based on artificial intelligence. The purpose of the study is to assess threats to the financial and innovative security of hospitality enterprises and to form a hierarchical model of their relationships to determine the priority of managerial response. The research methodology combines a systemic approach, analysis and synthesis, classification, induction and deduction, formalization, expert evaluation, graphical and tabular methods, as well as hierarchical modeling based on graph theory, binary dependency matrices, and reachability matrices. The study identified the following external threats at the macro level, namely military and security instability, inflationary and price pressures, reduced effective demand and consumer mobility, energy and infrastructure failures, limited access to credit and investment resources, personnel and migration pressure, technological lag, and unequal access to artificial intelligence-based technologies. Internal threats at the micro level include insufficient working capital, instability of cash flows, high dependence on external financing, personnel instability, weak accounting and analytical support for management, low level of digital maturity, and insufficient readiness to implement artificial intelligence-based technologies. The threat hierarchy is established in such a way that the base level is formed by primary destabilizers, and it is they who launch chains of secondary and derivative threats. As a result, it was found that for enterprises in the hotel and restaurant sector, the combination of external crisis pressure with internal financial, personnel, analytical, and digital vulnerability is of critical importance. The proposed approach provides an opportunity to increase the validity of management decisions regarding strengthening the financial and innovative security of enterprises, and also forms the basis for further empirical filling of the model and practical use of its results in the anti-crisis management system.

Keywords: financial security, innovative security, hotel and restaurant sector, threats, hierarchical modeling, macro level, micro level, enterprises

JEL Classification: L83, G32, O31, D81, C63

INTRODUCTION

In recent years (2022-2025), hospitality businesses have found themselves in an environment of multi-layered external and internal pressure, which has significantly complicated their financial and innovation security. Initially, the COVID-19 pandemic caused a sharp drop in demand, restrictions on population mobility, disruptions in supply chains, loss of liquidity, reduction in income, and changes in consumer behavior. Later, the full-scale invasion further exacerbated instability due to the physical destruction of infrastructure, business relocation, personnel losses, disruption of logistics, increased costs for energy supply, security, rent, imported resources, and the restoration of operational activities. At the same time, even those business entities that have retained a market

presence have had to not only maintain solvency but also adapt their own business models to the new competitive conditions. In such conditions, financial security can no longer be considered only as the ability to maintain profitability or avoid losses, since it is increasingly closely associated with the stability of cash flows, access to investment resources, flexibility of spending policy, the ability to quickly reformat services and the ability of the enterprise to respond to crisis changes simultaneously at the micro and macro levels. That is why for enterprises in the hotel and restaurant sector, the need for a comprehensive threat assessment is becoming more urgent, which would reflect not only the impact of internal management weaknesses, but also the strength of external shocks that are formed under the influence of epidemiological, military, economic, social, and technological factors.

At the same time, the modern stage of development of the hotel and restaurant sector is also determined by the mass introduction of technologies based on artificial intelligence, which, on the one hand, provide new opportunities for automation of reservations, inventory management, personalization of service, demand forecasting, marketing communications and cost optimization, and on the other hand, create a new vector of risks for the innovative security of enterprises. This is about the growing dependence on external digital platforms, the need for significant investments in software and digital infrastructure, the threat of data leakage, technological lag, algorithm errors, a shortage of employees with digital competencies, and uneven access to innovations between large networks and small business entities. Under such conditions, innovative security is no less important than financial, since it is on it that the ability of an enterprise often depends not only on modernizing individual operations, but also on maintaining competitiveness in a changed market environment. Despite the significant attention of scientists to crisis phenomena, digital transformation, and industry resilience, the issue of a holistic assessment of threats to the financial and innovative security of enterprises in the hotel and restaurant sector, namely at the micro and macro levels, has not yet received sufficient systematic consideration. Thus, this makes the research aimed at forming a basis for identifying, systematizing, and assessing threats that simultaneously affect the current sustainability, investment attractiveness, innovative development, and long-term viability of enterprises in this area highly relevant.

LITERATURE REVIEW

Scientific works on the chosen topic form 2 interrelated directions. The first direction focuses on innovative capacity and factors that determine the performance of hotel enterprises. In this vector, innovative capacity is considered as one of the key prerequisites for modernization, market adaptability and increased performance, and among its main drivers are innovative culture, internal marketing and market orientation, and not isolated resources, but their interaction within the enterprise, which directly affects market results and customer value, are of particular importance, as shown by Pascual-Fernández et al. (2021). A similar position is developed by Hu et al. (2020), who prove that process, product, marketing, and organizational innovations are statistically significantly related to hotel performance.

At the same time, Al-Sabi et al. (2023) show the importance of quality management practices, in particular quality policy, quality commitment, and staff training, as well as the role of employee empowerment in enhancing innovative performance.

In a related vein, Kanaan et al. (2023) show that digital marketing, innovative performance, and knowledge sharing are directly related to revenue growth in hotel restaurants, and Galarza et al. (2023) highlight the positive impact of process and service innovations on non-financial and financial performance in tourism through organizational learning.

Sebova, Shvets, and Khovanova also add an important component, arguing that process management and performance assessment systems should be considered as a strategic tool for strengthening the innovativeness and competitiveness of hotels, and not only as a technical control tool (Sebova et al., 2025). Taken together, these works provide grounds to argue that the innovation security of enterprises in the hotel and restaurant sector is determined not only by the presence of innovations as such, but also by the ability of the enterprise to maintain an internal organizational environment in which innovations are systematically created, disseminated, implemented, and transformed into sustainable financial results.

The second strand of literature focuses on the financial flexibility, financial stability, and crisis resilience of hospitality industry enterprises. Chang and Wu (2022) emphasize the nonlinear nature of the relationship between financial flexibility and the performance of hospitality enterprises, which in itself indicates the complexity of assessing financial security in conditions of instability.

Zhang et al. (2022) develop this position and show that during the COVID-19 period, the impact of financial flexibility on hotel performance is threshold in nature, and its importance increases in crisis conditions. Tascón et al. (2024) prove that

the financial resilience of enterprises depends on both their pre-crisis financial characteristics and external financing constraints, in particular interest rates, which brings the problem to the macro level. Lee et al. (2024), comparing the 2008 crisis and the COVID-19 pandemic, emphasize that the resilience of hospitality enterprises depends on a combination of financial characteristics of the firm and strategic decisions, and not on one single indicator. At the same time, Aydogan et al. (2024) show that crisis-resistant organizations in the hospitality sector are distinguished not only by better financial parameters but also by a stronger brand, higher service quality, domestic market orientation, digital adaptation, product and market diversification, and the ability to restructure debt. A close look is the study of Ledi et al. (2024), where strategic thinking and innovation appear as interrelated factors in increasing the performance of hotels in a turbulent environment.

Also, our domestic Ukrainian scholarship is highly relevant to the topic, since it addresses the economic security of hotel and restaurant enterprises, the specific features of innovation activity, and the directions of hospitality-sector modernization under unstable conditions. In particular, Mykolaichuk and Zamanov (2023) reveal the economic essence and specific features of forming the system of economic security of hotel and restaurant business enterprises, emphasizing the need to protect the enterprise from negative influences of both the external and internal environment.

Sereda and Piiurenko (2023) examine innovation activity in the hotel and restaurant business and show that innovation development in this sector is connected not only with service renewal but also with the mechanisms of implementing innovation projects.

Khovrak (2020), using a statistical and econometric approach, substantiates the importance of sustainable development management in hotel enterprises and demonstrates the significance of quantitative analysis for assessing their resilience.

Tokareva et al. (2024) focus on innovative technologies in the hotel and restaurant business and stress that digitalization, automation, and the use of artificial intelligence-based technologies are becoming increasingly important for enterprise competitiveness. Thus, domestic academic literature not only complements foreign approaches but also forms an important basis for adapting the assessment of threats to the realities of our country.

Therefore, financial security in the modern hotel and restaurant sector cannot be interpreted only as liquidity, solvency, or financial flexibility, since it is formed under the influence of a wider complex of crisis, organizational, and strategic factors, some of which belong to the internal environment of the enterprise, and some to the external macroeconomic environment.

AIMS AND OBJECTIVES

The purpose of the study is to assess threats to the financial and innovative security of hotel and restaurant enterprises at the micro and macro levels, as well as to form a hierarchical model of their relationships to determine the priority of managerial response in conditions of post-crisis instability, military pressure, and accelerated spread of technologies based on artificial intelligence. To achieve the goal, the following tasks are solved in the article:

1. To generalize scientific approaches to the interpretation of the financial and innovative security of hotel and restaurant enterprises.
2. To identify external threats at the macro level and internal threats at the micro level, which have the greatest impact on the financial and innovative security of enterprises.
3. To substantiate the criteria for selecting the most significant threats and to encode them for further modeling.
4. To construct binary dependency matrices and reachability matrices for external and internal threats.
5. To determine the levels of the threat hierarchy based on a formalized procedure of successive iterations.
6. To show the practical application of the proposed methodology on a sample of enterprises in the hotel and restaurant sector using financial and innovation indicators.
7. To formulate practical recommendations for strengthening the financial and innovation security of enterprises in the hotel and restaurant sector.

METHODS

The research methodology is based on a systemic approach, which allows us to consider the financial and innovative security of hotel and restaurant enterprises not as isolated states, but as the result of the interaction of external and internal threats, which are amplified under the influence of crisis and transformation processes. This approach is consistent

with the logic of the samples, where the methodological part combines analysis and synthesis, deduction and induction, classification, tabular and graphical methods, as well as modeling and strategic planning. Within the framework of our study, the systemic approach makes it possible to combine macro-level external threats, which are formed under the influence of the consequences of the COVID-19 pandemic, full-scale invasion, inflationary and price pressure, infrastructural instability and accelerated digital transformation, with micro-level internal threats, which reflect financial vulnerability, personnel instability, weakness of accounting and analytical support, insufficient digital maturity and low readiness for the implementation of technologies based on artificial intelligence.

To achieve the set goal, a set of general scientific and special methods was used. The analysis method was used to identify key external and internal threats to the financial and innovative security of enterprises in the hotel and restaurant sector.

The synthesis method was used to combine these threats into a holistic two-layer system, in which macro-level factors form the pressure environment, and micro-level ones reflect the real degree of internal vulnerability of the enterprise.

The classification method allowed us to group threats by content areas and attribute them to the macro or micro level.

The induction and deduction methods were used to move from individual observations and expert assessments to generalized conclusions about the nature of threats and their place in the overall security system. Formalization ensured the transition from a substantive description of threats to their conventional designation and further mathematical processing. This approach corresponds to the presentation of samples in which the methodology is not reduced to a single tool, but is formed as a consistent combination of complementary methods.

The basic special research method is hierarchical threat modeling based on graph theory, binary dependency matrices, and reachability matrices. At the first stage, a set of threats is formed, and connections between them are established, where one threat can act as a cause, catalyst, or strengthening factor for another. At the second stage, these connections are converted into a binary dependency matrix, which reflects the presence or absence of a direct influence between threats. At the third stage, a reachability matrix is calculated, which allows us to identify not only direct but also indirect connections, that is, those cases when one threat strengthens another through intermediate factors. At the fourth stage, through successive iterations, the levels of the hierarchy are determined, as a result of which the basic threats are separated from the derivatives. This technique allows us to identify which factors form the core of destabilization in the field of financial and innovative security, and which only reflect the result of the action of deeper causes. This logic is well consistent with the examples, where significant attention is paid to the construction of a formalized model, multi-component measurement of the phenomenon, and the avoidance of a simplified approach to complex systemic processes.

Expert assessment is used as a tool for the initial establishment of connections between threats, which is especially important for the topic, where some of the impacts do not have a directly observable numerical form. It is advisable to involve managers of hotel and restaurant enterprises, financial managers, analysts, specialists in the field of digital transformation, and scientists in the expert environment. It is such a group that is able to give a reasoned assessment of which threats are primary, which are secondary, and which are of a combined nature.

The involvement of experts within the framework of our methodology does not replace formalized analysis, but forms the initial information basis for building a graph of connections and further matrix processing. This is especially appropriate when assessing such complex phenomena as technological lag, innovation inertia, personnel instability, and weakening access to financing under the influence of war and post-pandemic market transformation.

RESULTS

The hierarchical modeling procedure itself in our article is implemented as follows. Let the set of threats have the form:

$$T=\{T_1, T_2, \dots, T_n\},$$

where T_i is a separate threat to the financial and innovative security of enterprises in the hotel and restaurant sector.

At the first stage, a matrix of direct dependencies $A=[a_{ij}]$ is formed, in which the element a_{ij} equals 1 if the threat T_i directly generates or strengthens the threat T_j , and 0 if there is no such direct connection. At the second stage, a reachability matrix $R=[r_{ij}]$ is constructed, which reflects not only direct, but also indirect connections. It is determined on the basis of the transitive closure of the matrix A :

$$R=(A+I).$$

Within the framework of our study, the financial security of hotel and restaurant enterprises is a generalized ability of the enterprise to maintain the stability of its functioning, solvency, competitiveness and manageability of development in an unstable external and internal environment, while investment security is its specialized component, reflecting the ability of the enterprise to attract, retain and effectively use investment resources without excessive increase in financial risks, loss of liquidity, technological dependence or innovation lag. Therefore, in our work, economic security covers a broader system of financial, personnel, organizational, and innovation stability, and investment security specifies the extent to which the enterprise is able to implement updates, digitalization, modernization of service, and implementation of technologies based on artificial intelligence without entering the zone of critical vulnerability. For direct modeling, it is advisable to take 7 external threats that most fully reflect the current state of the hotel and restaurant sector under such conditions, when, after the COVID-19 pandemic, the industry is simultaneously experiencing military and security pressure, macroeconomic instability, and the accelerated spread of technologies based on artificial intelligence (Table 1).

Table 1. Initial subset of external threats.

Code	Threat name
T1	Military and security instability
T2	Inflationary and price pressure
T3	Reduction in solvent demand and tourist mobility
T4	Energy and infrastructure disruptions
T5	Restricted access to credit and investment resources
T6	Personnel and migration pressure
T7	Technological lag and unequal access to technologies based on artificial intelligence

The selection of exactly 7 external threats is not arbitrary. At the first stage, an expanded list of external destabilizers was formed based on an analysis of the literature, industry specifics, and current operating conditions for hotel and restaurant enterprises. At the second stage, each potential threat was evaluated according to 3 criteria, namely, the frequency of mention in scientific sources, expert assessment of relevance for the industry, and the expected impact on financial and innovative security. The final set included those threats that received the highest composite scores and, at the same time, reflected the security, macroeconomic, market, infrastructure, financial, resource, human resources, and technological directions of external pressure. So, for example, threat T1 reflects the deepest external shock of a security nature. Threat T2 shows a macroeconomic weakening of solvency and an increase in costs. Threat T3 already captures the market consequence of previous crisis impulses, i.e., a decrease in demand and customer mobility. Threat T4 concentrates on the infrastructure dimension, which is critically important for the hotel and restaurant sector due to its dependence on electricity, logistics, water supply, the Internet, and transport. Threat T5 reflects financial access to resources for development and survival. Threat T6 captures the weakening of business by personnel and migration. Threat T7 is a modern innovation threat, which is associated not only with the lack of new technological solutions, but also with inequality of access to tools based on artificial intelligence, financial barriers to their implementation, and a lack of relevant competencies. At the same time, Threat T3 depends on T1 and T2, since the reduction in demand and mobility in the hotel and restaurant sector is a consequence of a combination of security risks and inflationary pressure. Threat T4 depends on T1, because infrastructure and energy disruptions under such conditions become mainly derived from security destabilization. Threat T5 depends on T1 and T2, since access to credit and investment resources deteriorates both due to increased business risk and macroeconomic instability. Threat T6 also depends on T1 and T2, because labor migration is intensified both due to security conditions and due to the deterioration of real incomes. The most complex nature is that of T7, which depends on T2, T4, T5, and T6.

First, let us present a binary matrix of external threat dependencies. This matrix reflects direct dependencies. For example, in row T7, there is a unit under T2, T4, T5, and T6, which means that technological lag and uneven access to technologies based on artificial intelligence are exacerbated by inflationary and price pressures, infrastructure failures, financial barriers, and personnel restrictions (Table 2).

Table 2. Binary matrix of external threat dependencies.

	T1	T2	T3	T4	T5	T6	T7
T1	0	0	0	0	0	0	0
T2	0	0	0	0	0	0	0
T3	1	1	0	0	0	0	0
T4	1	0	0	0	0	0	0
T5	1	1	0	0	0	0	0
T6	1	1	0	0	0	0	0
T7	0	1	0	1	1	1	0

The reachability matrix reflects not only direct, but also indirect dependencies. The most interesting is row T7, where it is seen that this threat ultimately reaches T1 through chains of dependencies. This means that technological lag in the modern external environment is not an autonomous problem, but arises as a consequence of deeper security, macroeconomic, infrastructure, financial, and personnel processes (Table 3).

Table 3. Matrix of accessibility of external threats.

	T1	T2	T3	T4	T5	T6	T7
T1	1	0	0	0	0	0	0
T2	0	1	0	0	0	0	0
T3	1	1	1	0	0	0	0
T4	1	0	0	1	0	0	0
T5	1	1	0	0	1	0	0
T6	1	1	0	0	0	1	0
T7	1	1	0	1	1	1	1

For each threat T_i , based on the reachability matrix $R=[r_{ij}]$, 3 sets are defined. First, the set of reachable vertices:

$$S(T_i)=\{T_j|r_{ij}=1\},$$

reflects those threats to which it is possible to move from the threat T_i . Second, the set of predecessors

$$P(T_i)=\{T_j|r_{ji}=1\},$$

reflects those threats from which it is possible to reach T_i . Thirdly, the intersection set

$$Q(T_i)=S(T_i) \cap P(T_i)$$

is used to highlight the current level of the hierarchy. If the condition

$$P(T_i)=Q(T_i).$$

is met for a certain threat, then such a threat belongs to the current, i.e., the lowest level of the hierarchy available at this iteration. It is according to this rule that in the first iteration, for external threats, T_3 and T_7 were highlighted, since they turned out to be derived from deeper reasons. This means that the reduction in effective demand and consumer mobility is not a primary shock, but is formed under the influence of military-security and inflationary-price pressure. Similarly, technological lag and unequal access to AI-based technologies arise as a result of the accumulation of infrastructural, financial, personnel, and price constraints. After removing the threats of the current level, the procedure is repeated for the reduced matrix, which allows us to consistently build a complete hierarchy of external and internal threats.

For each threat, we define (1): $S(T_i)$ as a set of achievable peaks, that is, those threats to which one can move from T_i , and $P(T_i)$ as a set of precursors, that is, those threats from which it is possible to achieve T_i . In the first iteration, the condition $P(T_i)=Q(T_i)$ is fulfilled for T_3 and T_7 . They form the lowest level of the hierarchy, that is, the level of derived

external threats. This result has good substantive logic. The reduction in demand and customer mobility is not a primary shock, but is a consequence of security and price pressure. Similarly, technological lag does not form by itself. It grows when the infrastructure weakens, innovations become more expensive, financial resources narrow, and personnel support deteriorates (Table 4).

Table 4. The first iteration of building a hierarchy of external threats.

i	S(Ti)	P(Ti)	Q(Ti) = S ∩ P
T1	T1	T1, T3, T4, T5, T6, T7	T1
T2	T2	T2, T3, T5, T6, T7	T2
T3	T1, T2, T3	T3	T3
T4	T1, T4	T4, T7	T4
T5	T1, T2, T5	T5, T7	T5
T6	T1, T2, T6	T6, T7	T6
T7	T1, T2, T4, T5, T6, T7	T7	T7

In the second iteration, the condition is met for T4, T5, and T6. Thus, they form the second level of the hierarchy. Analytically, this means that energy and infrastructure disruptions, restrictions on access to financing and personnel, and migration pressure are no longer pure consequences, but also not the basic sources of the entire threat system. They occupy an intermediate position. It is through them that basic macroshocks are transformed into applied losses for enterprises (Table 5).

Table 5. Second iteration of building a hierarchy of external threats.

i	S(Ti)	P(Ti)	Q(Ti) = S ∩ P
T1	T1	T1, T4, T5, T6	T1
T2	T2	T2, T5, T6	T2
T4	T1, T4	T4	T4
T5	T1, T2, T5	T5	T5
T6	T1, T2, T6	T6	T6

Thus, it is military and security instability and inflationary and price pressure that appear as the basic external causes of systemic destabilization. It is they who trigger chains of infrastructure deterioration, narrowing of funding, loss of personnel, reduction in demand, and technological lag. At the macro level, not only are direct market symptoms of key importance, but primarily those threats that set the general trajectory of deterioration in the financial and innovative security of enterprises in the hotel and restaurant sector (Figure 1).

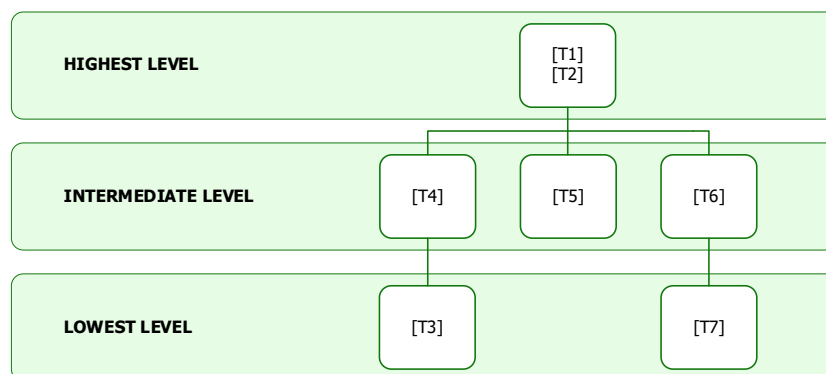


Figure 1. Summary hierarchy of external threats.

It is also advisable, within the framework of our modeling, to take a subset of the most significant internal threats (T8–T14). Threats T8, T9, and T10 reflect internal financial vulnerability. Threat T11 concerns the human resources base of the service business. Threat T12 reflects the quality of accounting and analytical support for decisions. Threat T13 shows

the level of internal digital maturity. Threat T14 already captures the most modern innovative vulnerability, namely the inability to implement solutions based on artificial intelligence without critical losses for the enterprise (Table 6).

Table 6. Initial subset of internal threats.

Code	Threat name
T8	Insufficient own working capital
T9	Instability of cash flows
T10	High dependence on external financing
T11	Personnel instability and staff turnover
T12	Weak accounting and analytical support for management
T13	Low level of digital maturity of the enterprise
T14	Insufficient readiness to implement technologies based on artificial intelligence

T8 depends on T12, since the lack of its own working capital is often the result of weak planning, cost control, and low-quality analytics. T10 depends on T8 and T12, because high dependence on external financing increases when there is a lack of own resources and when management does not have a high-quality analytical base for managing financial flows. T9 depends on T8, T10, and T12, because the instability of cash flows is the result of a combination of a weak own resource base, debt dependence, and poor management support. T13 depends on T8, T11, and T12, because the low level of digital maturity is due to a lack of resources, problems with personnel, and weak analytics. The most derived is T14, which depends on T8, T11, T12 and T13 (Table 7).

Table 7. Binary matrix of dependence of internal threats.

	T8	T9	T10	T11	T12	T13	T14
T8	0	0	0	0	1	0	0
T9	1	0	1	0	1	0	0
T10	1	0	0	0	1	0	0
T11	0	0	0	0	0	0	0
T12	0	0	0	0	0	0	0
T13	1	0	0	1	1	0	0
T14	1	0	0	1	1	1	0

The reachability matrix shows that T14 immediately reaches several other internal threats, and therefore, it cannot be interpreted as basic. On the contrary, it is the final manifestation of the enterprise's systemic internal immaturity. At the same time, T12 has a minimal set of attainable vertices, but a large number of predecessors, which brings it into the group of more fundamental threats (Table 8).

Table 8. Matrix of accessibility of internal threats.

	T8	T9	T10	T11	T12	T13	T14
T8	1	0	0	0	1	0	0
T9	1	1	1	0	1	0	0
T10	1	0	1	0	1	0	0
T11	0	0	0	1	0	0	0
T12	0	0	0	0	1	0	0
T13	1	0	0	1	1	1	0
T14	1	0	0	1	1	1	1

In the first iteration, the condition is met for T9 and T14. They form the lowest level of the internal hierarchy. This result is logical. The instability of cash flows is a consequence of weak financial planning, a shortage of working capital, and

external debt dependence. Insufficient readiness to implement technologies based on artificial intelligence is also a derivative of weak digital maturity, personnel problems, lack of resources, and low quality of the analytical basis of management (Table 9).

Table 9. The first iteration of building a hierarchy of internal threats.

i	$S(T_i)$	$P(T_i)$	$Q(T_i) = S \cap P$
T8	T8, T12	T8, T9, T10, T13, T14	T8
T9	T8, T9, T10, T12	T9	T9
T10	T8, T10, T12	T9, T10	T10
T11	T11	T11, T13, T14	T11
T12	T12	T8, T9, T10, T12, T13, T14	T12
T13	T8, T11, T12, T13	T13, T14	T13
T14	T8, T11, T12, T13, T14	T14	T14

In the second iteration, T10 and T13 stand out. They form the second level of the internal hierarchy. This means that dependence on external financing and low digital maturity are no longer the ultimate symptoms, but also not the deepest causes of loss of sustainability. They occupy an intermediate position between basic internal weaknesses and ultimate manifestations of instability (Table 10).

Table 10. Second iteration of building a hierarchy of internal threats.

i	$S(T_i)$	$P(T_i)$	$Q(T_i) = S \cap P$
T8	T8, T12	T8, T10, T13	T8
T10	T8, T10, T12	T10	T10
T11	T11	T11, T13	T11
T12	T12	T8, T10, T12, T13	T12
T13	T8, T11, T12, T13	T13	T13

Weak accounting and analytical support for management appears to be the basic internal threat. It is this that weakens the resource base, worsens flow management, contributes to debt dependence, reduces the quality of digital solutions, and ultimately inhibits innovative adaptation. The next level is formed by a lack of own working capital and personnel instability, because they directly generate a deficit of sustainability and the ability to modernize. Even lower are dependence on external financing and low digital maturity, and the most significant are the instability of cash flows and insufficient readiness for technologies based on artificial intelligence (Figure 2).

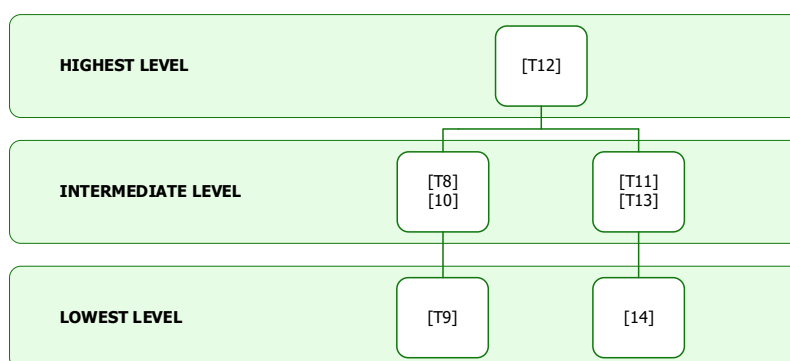


Figure 2. The final hierarchy of internal threats.

As a result, the external and internal hierarchies form a very clear two-layer model. At the macro level, the main pressure comes from military-security instability and inflationary price pressure. At the micro level, the main internal cause of loss of stability is concentrated in weak accounting and analytical support, and then in the lack of own resources and personnel

instability. Therefore, the level of financial and innovation security of hospitality enterprises decreases not when a separate local symptom appears, but when external shocks meet with internal immaturity of the management system (Figure 3).

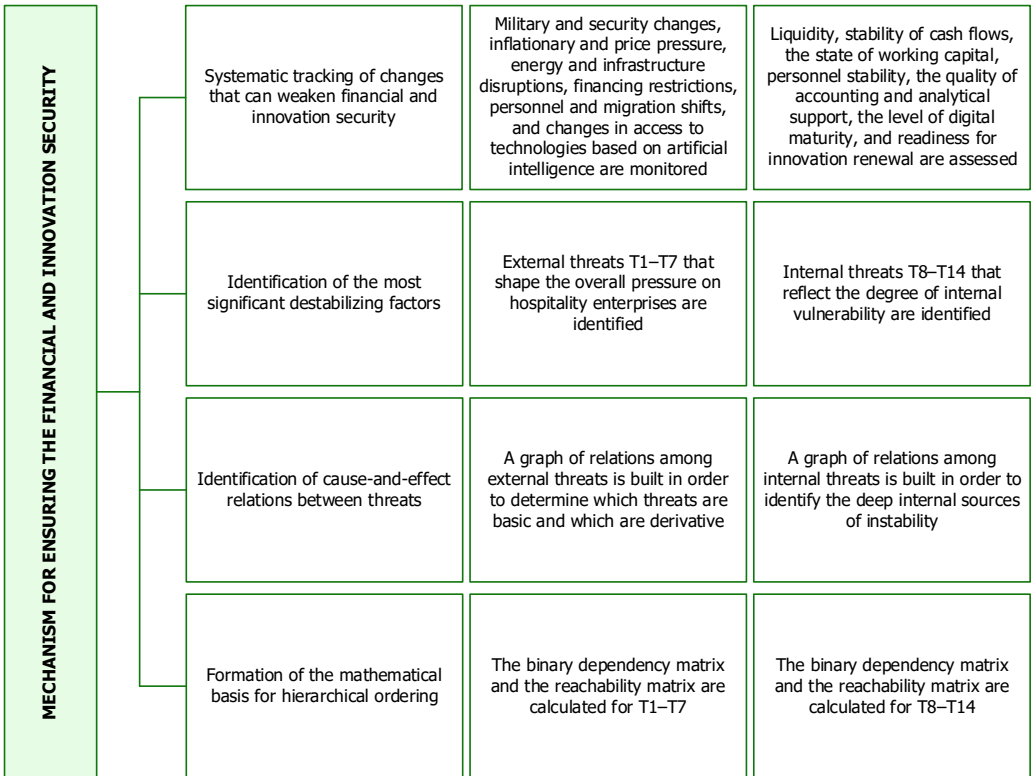


Figure 3. Mechanism for ensuring the financial and innovation security of hospitality enterprises at the macro and micro levels.

Financial security and innovation security do not exist separately. If an enterprise does not have sufficient financial flexibility, it loses the opportunity to invest in service updates, digital infrastructure, and modern solutions based on artificial intelligence. At the same time, if an enterprise postpones innovative updates for a long time, this begins to negatively affect its financial stability, as competitiveness decreases, service quality deteriorates, and the speed of adaptation to market changes decreases. Thus, the proposed mechanism reflects a single security system in which external shocks pass through the internal capabilities of the enterprise, and the effectiveness of the response is determined by the ability to work simultaneously with both adaptation and internal strengthening.

DISCUSSION

The results obtained confirm that for enterprises in the hotel and restaurant sector, resilience in a crisis environment is determined not by a single factor, but by a combination of external pressure and internal organizational capabilities. In our study, the highest level of macro-level threats was formed by military-security instability and inflationary-price pressure, while at the micro level, the basic internal threat was weak accounting and analytical management support.

This conclusion is in good agreement with the approach of Aydogan et al. (2024), who showed that crisis-resistant organizations in the hospitality sector are distinguished not only by the ability to respond to shock, but also by the presence of high-quality service, a loyal customer base, a strong brand, sufficient capital, orientation to the domestic market, a positive sanitary and safety image, the use of information and communication technologies, product and market diversification, and debt restructuring. This is of fundamental importance for our model, since it shows that external threats do not act mechanically.

The second important result concerns macroeconomic uncertainty as a separate source of threats. In our study, inflationary price pressures and constraints on access to finance occupy a central place in the external hierarchy, which directly echoes the findings of Ozdemir et al. (2022) and Menicucci and Paolucci (2025). The former showed, using hotel data from California, Florida, and New York, that economic and political uncertainty has a negative and lagged effect on occupancy, average room rate, and revenue per available room, with consumer sentiment acting as a significant mediator of this

relationship. The latter, studying 661 Italian luxury hotels over 2018–2022, also found a negative relationship between economic and political uncertainty and profitability, price, and occupancy, while drawing attention to the role of brand affiliation, conference infrastructure, and wellness services as factors mitigating the impact.

Financial security requires a separate discussion. Our modeling showed that cash flow instability and dependence on external financing are not initial, but derivative internal threats, which are formed under the pressure of a weak analytical basis of management, a shortage of own working capital, and personnel instability. This conclusion is consistent with the work of Crespi-Cladera et al. (2021), where, based on stress testing and a logit model for Spanish hospitality companies, it was found that with a 60% drop in revenue, financial distress can affect about 25% of firms, and with an 80% drop, it can affect 32%, with small companies becoming the most vulnerable, and the main problems are not only liquidity, but also solvency.

At the same time, our approach goes further than stating the risk of distress, as it allows us to identify its internal prerequisites even before the transition to an open crisis phase. This is one of the key differences between our article and works that assess the financial consequences of COVID-19 mainly through changes in revenue, liquidity, or bankruptcy.

Another important area of discussion concerns innovation security. Our results demonstrate that AI readiness and low digital maturity are not autonomous internal threats, but rather result from a combination of financial, human, and analytical constraints. This interpretation is consistent with Chandran et al. (2024), who showed that hotels' innovative capacity is directly enhanced by customer orientation, and the impact of customer collaboration on innovation is stronger in the presence of transformational leadership.

A similar logic is supported by Tajeddini et al. (2024), who showed that resource orchestration and strategic information sharing enhance supply chain innovation and thereby improve performance, although digital orientation alone did not have the expected moderating effect.

In turn, El-Said et al. (2024) showed that in international hotel chains, the COVID-19 crisis was a stimulus for innovation, and innovation activity during the shock was biased towards stakeholders and recovery. At the same time, Lopes and Basso (2023) found that eco-innovation is positively associated with operational improvements and competitiveness, but the direct relationship with performance is not always statistically significant. This is particularly important for our paper, as it confirms this view.

Poretti et al. (2025) showed that ownership concentration and the presence of institutional investors are associated with lower innovation, while family investors, on the contrary, are associated with higher levels of innovation, especially in an environment where innovation activity is generally supported.

In the context of our topic, this finding is important, as it reinforces the thesis of heterogeneity of internal vulnerabilities of enterprises. Even with the same external threats, enterprises may have different levels of innovation security depending on the decision-making horizon, control structure, and the willingness of owners to invest in long-term renewal.

However, the research results have certain limitations that should be taken into account when interpreting and applying them in practice. First, the proposed hierarchical model relies heavily on expert establishment of direct relationships between threats, and therefore partly depends on the composition of the expert group and the level of consistency of its assessments. Second, the constructed matrices primarily reflect the structural logic of cause-and-effect relationships, but do not themselves measure the strength of the impact of each threat without additional quantitative content.

CONCLUSIONS

As a result of the study, scientific approaches to the interpretation of the financial and innovative security of enterprises in the hotel and restaurant sector have been generalized. It has been established that financial security is not limited only to liquidity, solvency, or profitability, and innovative security is not limited only to the introduction of innovations. They are formed as interrelated components of the overall stability of the enterprise and reflect its ability to maintain controllability of development, adapt to the external crisis environment, maintain competitiveness, and ensure the renewal of the business model on the basis of modern solutions based on applied digital technologies and technologies based on artificial intelligence.

External threats at the macro level and internal threats at the micro level have been identified, which most significantly affect the financial and innovative security of enterprises in the hotel and restaurant sector. External threats include military and security instability, inflationary and price pressures, reduced consumer demand and mobility, energy and infrastructure failures, limited access to credit and investment resources, personnel and migration pressure, as well as technological lag

and unequal access to artificial intelligence-based technologies. The internal threat vector includes insufficient working capital, unstable cash flows, high dependence on external financing, personnel instability, weak accounting and analytical support for management, low level of digital maturity, and insufficient readiness to implement artificial intelligence-based technologies.

The criteria for selecting the most significant threats are substantiated, and their coding is carried out for further modeling. It is proven that the allocation of exactly 7 external and 7 internal threats ensures sufficient representativeness of the model, since it covers the security, macroeconomic, market, infrastructure, financial, resource, personnel, and technological areas of destabilization. The use of the T1–T14 symbols made it possible to move from a substantive description of threats to their formalized representation and to ensure the further construction of dependency and reachability matrices.

Binary dependency matrices and reachability matrices for external and internal threats were formed. Their use made it possible to identify not only direct, but also indirect relationships between individual destabilizers. It was established that a significant part of threats does not appear in isolation, but is a consequence of the action of deeper causes that trigger chains of secondary and derivative negative effects in the system of financial and innovative security of enterprises in the hotel and restaurant sector.

Based on the formalized procedure of successive iterations, the levels of the threat hierarchy were determined. It has been established that at the macro level, the basic destabilizers are military and security instability and inflationary and price pressures, which form the basis for infrastructure failures, narrowing access to financial resources, personnel losses, reduced demand, and technological lag. At the micro level, the most serious internal threat is the weakness of accounting and analytical support for management, on which the deficit of own resources, increased personnel instability, increased dependence on external financing, low digital maturity, and insufficient readiness for the implementation of technologies based on artificial intelligence depend to a large extent.

The practical significance of the results obtained lies in the possibility of using the constructed threat hierarchy to form priority management decisions. For threats of a higher macro level, adaptation measures aimed at increasing energy independence, diversifying sales channels, adjusting the business model, and reducing sensitivity to external shocks are appropriate. For threats at the higher micro level, strengthening accounting and analytical support, stabilizing working capital, developing human resources, increasing digital maturity, and gradually introducing technologies based on artificial intelligence are of paramount importance.

Prospects for further research are associated with empirically filling the model based on expert data and expanding the assessment by integrating quantitative indicators of financial and innovative security.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ОЦІНЮВАННЯ ЗАГРОЗ ФІНАНСОВІЙ ТА ІННОВАЦІЙНІЙ БЕЗПЕЦІ ПІДПРИЄМСТВ ГОТЕЛЬНО-РЕСТОРАННОЇ ГАЛУЗІ НА МІКРО- ТА МАКРОРІВНЯХ

У дослідженні вивчено загрози фінансовій та інноваційній безпеці підприємств готельно-ресторанної галузі на мікро- та макrorівнях. Актуальність теми зумовлена тим, що функціонування підприємств цієї галузі відбувається в умовах тривалого посткризового тиску, який сформувався під впливом наслідків пандемії COVID-19, повномасштабного вторгнення, інфляційно-цінової нестабільності, інфраструктурних обмежень, кадрових втрат і прискореного поширення технологій на базі штучного інтелекту. Метою дослідження є оцінка загроз фінансовій та інноваційній безпеці підприємств готельно-ресторанної галузі та формування ієрархічної моделі їхніх взаємозв'язків для визначення пріоритетності управлінського реагування. Методологія дослідження поєднує системний підхід, аналіз і синтез, класифікацію, індукцію й дедукцію, формалізацію, експертне оцінювання, графічні й табличні методи, а також ієрархічне моделювання на основі теорії графів, бінарних матриць залежності й матриць досяжності. У межах дослідження виокремлено такі зовнішні загрози макrorівня: воєнно-безпекову нестабільність, інфляційно-ціновий тиск, скорочення платоспроможного попиту й мобільності споживачів, енергетичні й інфраструктурні збої, обмеження доступу до кредитних та інвестиційних ресурсів, кадрово-міграційний тиск, технологічне відставання та нерівний доступ до технологій на базі штучного інтелекту. До внутрішніх загроз мікрорівня віднесено недостатність власного оборотного капіталу, нестабільність грошових потоків, високу залежність від зовнішнього фінансування, кадрову нестабільність, слабкість обліково-аналітичного забезпечення управління, низький рівень цифрової зрілості й недостатню готовність до впровадження технологій на базі штучного інтелекту. Ієрархія загроз установлена так, що базовий рівень формують первинні дестабілізатори, саме вони запускають ланцюги вторинних і похідних загроз. У результаті встановлено, що для підприємств готельно-ресторанної галузі критичне значення має поєднання зовнішнього кризового тиску із внутрішньою фінансовою, кадровою, аналітичною та цифровою вразливістю. Запропонований підхід надає можливість підвищити обґрунтованість управлінських рішень щодо зміцнення фінансової та інноваційної безпеки підприємств, а також формує підґрунтя для подальшого емпіричного наповнення моделі й практичного використання її результатів у системі антикризового управління.

Ключові слова: фінансова безпека, інноваційна безпека, готельно-ресторанна галузь, загрози, ієрархічне моделювання, макrorівень, мікрорівень, підприємства

JEL Класифікація: L83, G32, O31, D81, C63