

INNOVATION SCIENCE AND TECHNOLOGY

ISSUE 7, PART 1 / JULY 2026

 **Acceptance of papers**



**Acceptance of
papers**

Published monthly



Topics

economics,
technology, social
sciences



EDITOR-IN-CHIEF:

Mirzaliyev Sanjar Makhmatjon ugli

DEPUTY EDITOR-IN-CHIEF:

Makhmudov Nosir Makhmudovich
DSc., Prof., Academician

DEPUTY EDITOR-IN-CHIEF:

Ochilov Bobur Bakhtiyor ugli – Senior
lecturer at TSUI

THE SCIENTIFIC-POPULAR ELECTRONIC
JOURNAL **"INNOVATION SCIENCE AND
TECHNOLOGY"** HAS BEEN REGISTERED
UNDER THE NUMBER **C-5669633** BY THE
AGENCY FOR INFORMATION AND MASS
COMMUNICATIONS (AOKA) OF THE
REPUBLIC OF UZBEKISTAN, EFFECTIVE
FROM OCTOBER 9, 2024.

CONTACTS

Phone: **+998 50 737 87 88**

Website: <https://ist-journal.uz>

Email: innovationist2025@gmail.com

The scientific electronic journal "Innovation Science and Technology" has been included in the list of scientific publications recommended for the publication of main scientific results of dissertations for the award of PhD and DSc degrees in economics and technical sciences, in accordance with the Resolution No. 370 of the Presidium of the Higher Attestation Commission of the Republic of Uzbekistan, dated May 8, 2025.

Editorial board:



Sharipov Kongiratbay Avezimbetovich,
Doctor of Technical Sciences (DSc), Professor



Abdurakhmanova Gulnora Kalandarovna, Doctor of
Economic Sciences (DSc), Professor



Cham Tat Huei,
Doctor of Philosophy (PhD), Professor (Malaysia)



Muhammad Imran Sadiq
Doctor of Philosophy in Economics (PhD), Professor,
Malaysia



Ahmed Aziz Ismail
Doctor of Technical Sciences (DSc),
Professor (Egypt)



Lee Chin
Doctor of Philosophy in Economics (PhD), (Malaysia)



Asongu Simplice
Doctor of Philosophy in Economics (PhD), Cameroon



Rui Dang
Doctor of Chemistry (DSc), Professor, China



Zahoor Ahmed
Doctor of Philosophy in Economics (PhD), Turkey



Shujaat Abbas
Doctor of Philosophy in Economics (PhD), Russia



Tina A Coffelt
Doctor of Philosophy in Educational Sciences (PhD),
USA



Abdikarimova Dinara Rustamxanovna
Doctor of Economic Sciences (DSc), Professor

Kurbonbekova Mohichehra Turobjonovna
Doctor of Economic Sciences (DSc), Professor

Alimardonov Ilkhom Muzrabshokovich
Doctor of Economic Sciences (DSc), Professor



Razakova Barno Sayfieva
Doctor of Philosophy in Economics (PhD)



Khasanov Sarvar Ulugbek ugli
Doctor of Philosophy in Economics (PhD)



Kholikova Rukhsora Sanjarovna
Associate Professor (PhD)

CONTENTS

PLATFORM MIDDLEWARE-MANAGEMENT: FROM RESOURCE CONTROL TO INTERACTION COORDINATION IN DIGITAL SERVICE ECOSYSTEMS.....	8
Ilgor Abdullayev	
APPROACHES TO IMPROVING KNOWLEDGE EXCHANGE PROCESSES IN INDUSTRIAL CLUSTERS.....	16
Mamadaliyev Anaxxon Ziyodillayevich	
IMPROVING EXPENDITURE ACCOUNTING IN HIGHER EDUCATION INSTITUTIONS	21
Islom Ergash ugli Khonimqulov	
MANAGEMENT OF FOREIGN EXCHANGE AND CONCENTRATION RISKS IN THE OPERATIONS OF COMMERCIAL BANKS	26
Qurbonov Ilhom Jumaqulovich	
WAYS TO IMPROVE THE USE OF NATURAL RESOURCES IN THE DEVELOPMENT OF HEALTH SERVICES.	29
Sobirov Kayum Xamraevich	
REGIONAL BANKING MARKET TRENDS FOR RETAIL DEVELOPMENT	33
Salamov Islom Tashqazaqovich	
REFORMS UNDERTAKEN IN THE REPUBLIC TO INCREASE PRODUCTION CAPACITY AT FOOD INDUSTRY ENTERPRISES	37
Gulmatov Sunnatillo Nurillayevich	
PROSPECTS FOR USING ISLAMIC FINTECH TECHNOLOGIES IN SMALL BUSINESS FINANCING IN UZBEKISTAN	44
Toshxo'jayev Abduqodirxon Abdulmansurxon ugli	
ADAPTIVE CONCEPT OF HUMAN CAPITAL MANAGEMENT: A NEW PARADIGM FOR SUSTAINABLE ECONOMIC GROWTH	51
Dinora Qudrat qizi Yusubboyeva	
MECHANISMS FOR ENHANCING EDUCATION SERVICE QUALITY IN DEVELOPING YOUTH ENTREPRENEURSHIP IN THE ARAL SEA REGION.....	58
Raxmanov Raxmanbergan Abdullayevich	
CONCEPTUAL FOUNDATIONS OF IMPLEMENTING AGILE MANAGEMENT IN PUBLIC ADMINISTRATION	62
Sayfiyev Jasur Ravshanovich	
SCIENTIFIC PERSPECTIVES OF WORLD, EUROPEAN, AND CIS SCHOLARS ON ENTREPRENEURSHIP DEVELOPMENT AND FINANCIAL SUPPORT: A COMPARATIVE ANALYSIS	70
Inobatov Abror Boshlarovich	
SUSTAINABILITY REPORTING AND ESG AUDITING: EMERGING TRENDS IN CORPORATE ACCOUNTABILITY.....	84
Turabekov Bekali, Eshpulatova Zaynab	
ИНДИКАТОРЫ ОЦЕНКИ И МОНИТОРИНГА РАЗВИТИЯ ЖЕНСКОГО ПРЕДПРИНИМАТЕЛЬСТВА В УЗБЕКИСТАНЕ	91
Хусанова Зулфия Рахматуллаевна	
A METHODOLOGICAL APPROACH TO DIGITALIZING INTERNAL AUDIT IN COMMERCIAL BANKS BASED ON THE CONTINUOUS AUDITING CONCEPT	95
Narziyev Xayotjon Azamatovich	
AN AUTHOR'S APPROACH TO THE CLASSIFICATION OF FINANCIAL INVESTMENTS BY MEASUREMENT BASIS FOR ACCOUNTING AND AUDITING PURPOSES	102
Jumamurodov To'libay Yeldashbayevich	
ENHANCING THE CONTINUOUS MONITORING PROCEDURE FOR IDENTIFYING IMPAIRMENT INDICATORS OF NON-CURRENT ASSETS IN JOINT-STOCK COMPANIES.....	107
Fayzullayev Begzod Baxtiyor o'g'li	

THE INTERRELATIONSHIP BETWEEN MATERIALITY AND AUDIT RISK IN PUBLIC-SECTOR INTERNAL AUDITING AND THEIR APPLICATION WITHIN A UNIFIED METHODOLOGICAL FRAMEWORK.....	114
Ismatillayev Baypo'lat Xushvaqtovich	
THE NATURE, DEFINITION AND CLASSIFICATION OF INTERNAL AUDIT OF PUBLIC PROCUREMENT	122
Rajabov Shukhrat Ismayilovich	
A METHODOLOGY FOR THE COMPOSITE ASSESSMENT OF THE MATURITY OF INTERNAL AUDIT FUNCTIONS IN COMMERCIAL BANKS.....	128
Ismailov Azizbek Madaminovich	
THE ECONOMIC SUBSTANCE OF THE CONCEPT OF "RISK-BASED INTERNAL AUDITING" AND THE THEORETICAL FOUNDATIONS OF ITS APPLICATION IN LIGHT INDUSTRY ENTERPRISES	136
Shahlo Mahmatmurodovna Tojiyeva	
THE INSTITUTIONAL MECHANISM FOR THE INNOVATIVE DEVELOPMENT OF THE RAILWAY NETWORK.....	143
Muradov Bakhrom Akramjanovich	
ТЕОРЕТИЧЕСКОЕ ОПРЕДЕЛЕНИЕ ОСНОВНЫХ СТАТИЧЕСКИХ ХАРАКТЕРИСТИК ОПТОЭЛЕКТРОННЫХ ДИСКРЕТНЫХ ПРЕОБРАЗОВАТЕЛЕЙ ПЕРЕМЕЩЕНИЙ С ПОЛЫМИ И ВОЛОКОННЫМИ СВЕТОВОДАМИ.....	148
Умид Садирдинович Холматов	
ИНСТИТУЦИОНАЛЬНЫЙ РАЗРЫВ В ЗАЩИТЕ ЗАЁМЩИКОВ: ЭМПИРИЧЕСКИЙ АНАЛИЗ НАЧИСЛЕНИЯ ПРОЦЕНТОВ И НЕУСТОЙКИ ПОСЛЕ СУДЕБНОГО ВЗЫСКАНИЯ В УЗБЕКИСТАНЕ..	155
Жаксымуратов Бахрам Раджович	
PROSPECTS FOR SMALL BUSINESS DEVELOPMENT IN THE CONTEXT OF THE GREEN ECONOMY.....	164
Abdurakhimov Iskandar Nodirjon o'g'li	
DIGITAL PAYMENT ADOPTION IN TOURISM: FACTORS INFLUENCING ACCEPTANCE IN SAMARKAND, UZBEKISTAN	169
Nazarova Kamola Sultonmurod qizi	
CHANGE MANAGEMENT IN THE ADOPTION OF BIM TECHNOLOGY IN UZBEKISTAN'S CONSTRUCTION PROJECTS: A CONCEPTUAL APPROACH BASED ON THE ADKAR MODEL.....	176
Shaxlo Baxtiyor qizi G'ulomova	
SMART DESTINATIONS, SMARTER JOURNEYS: SCIENCE, INNOVATION, AND THE DIGITAL TRANSFORMATION OF GLOBAL TOURISM.....	182
Sirojiddinova Shahrizoda, Nasimov Dilmurod Abdulloyevich	
SELECTION OF INPUT MAGNITUDE FOR INVESTIGATING KINEMATIC AND STRUCTURAL PARAMETERS OF VSH PTM ELLIPTICAL DRUM COTTON PICKING APPARATUS	186
Abdazimov Anvar, Ravutov Shavkat, Rajapbayev Umidjon	
BIOGAS GENERATION AND PRACTICAL IMPLEMENTATION IN UZBEKISTAN: TECHNOLOGICAL ASPECTS AND STATISTICAL ASSESSMENT	191
Eshbekov Mukhriddin, Khudoyqulov Zokir	
THE ROLE OF YOUTH ENTREPRENEURSHIP ENTITIES IN INDUSTRIAL DEVELOPMENT: AN EMPIRICAL ANALYSIS.....	198
Mirzatov Baxtiyor Toxirovich	
MODERN FORMWORK SYSTEMS FOR MONOLITHIC CONSTRUCTION: CHALLENGES AND APPLICATION POTENTIAL OF BASALT FIBER REINFORCED POLYMER COMPOSITES	202
Ali Narbabayevich Soatov, Husniddin Tolibovich Hasanov	
CREATING A PATIENT ELECTRONIC MEDICAL RECORD FROM MEDICAL CONVERSATIONS USING NATURAL LANGUAGE PROCESSING.....	209
Ibragimov Sanjarbek Salijanovich	
РАЗРАБОТКА МЕТОДОВ И АЛГОРИТМОВ ПАРАМЕТРИЧЕСКОГО 3D-МОДЕЛИРОВАНИЯ ОДЕЖДЫ С УЧЁТОМ АНТРОПОМЕТРИЧЕСКИХ ХАРАКТЕРИСТИК ФИГУРЫ ЧЕЛОВЕКА	217
Каримбердиева Мохинур Шерзод кизи	
O'ZBEKISTONDA SUG'URTA BOZORINING O'SISHI VA PASAYISHI: 1991-2026 YILLAR DINAMIKASINING TAHLILI	225
Ismailov Shaxobiddin	

DEVELOPMENT OF AN INTEGRATED SYSTEM FOR THREE-DIMENSIONAL GARMENT DESIGN AND AUTOMATED TECHNOLOGICAL PREPARATION OF APPAREL PRODUCTION.....	231
Karimberdiyeva Mokhinur Sherzod qizi	
ИНДЕКС ИНСТИТУЦИОНАЛЬНОЙ СРЕДЫ ФОРМИРОВАНИЯ И ЭФФЕКТИВНОГО ФУНКЦИОНИРОВАНИЯ ЧЕЛОВЕЧЕСКОГО КАПИТАЛА.....	238
Холбаева Сабина Рустамовна	
IMPROVING METHODS FOR DETECTING AND PREVENTING CYBERATTACKS IN COMPUTER NETWORKS.....	246
Babakulov Bekzod Mamatkulov	
ANALYTICAL ASSESSMENT OF THE BUSINESS ACTIVITIES OF BUILDING MATERIALS MANUFACTURING ENTERPRISES	256
Fayzullayev Jonibek Mambetsaliy ugli	
ECONOMIC DIPLOMACY AS A TOOL FOR ATTRACTING FOREIGN DIRECT INVESTMENT: EXPERIENCE OF UZBEKISTAN (2017–2025)	261
Po'latov Odil, Abdullayev E. E.	
ANALYSIS OF THE PRACTICE OF INNOVATIVE BANKING SERVICES IN THE DIGITAL ECONOMY	268
D. M. Kallibekov	
EXPORT ACTIVITIES OF SMALL BUSINESS ENTITIES IMPROVING OF THE FINANCING SYSTEM.....	271
Karamatdinova Aysawle Paraxatovna	
PROBLEMS ASSOCIATED WITH THE FINANCING OF INVESTMENT PROJECTS IN JOINT-STOCK COMPANIES AND THE WAYS OF OVERCOMING THEM.....	278
Jumaniyazova Feruza Rajabovna	
IMPROVING THE PRODUCTION MECHANISM OF BEEKEEPING FARMS IN THE KASHKADARYA REGION BASED ON DIGITAL TECHNOLOGIES	284
Farmanov Jonibek Ziyadullaevich	
THE IMPACT OF STRATEGIC ADAPTABILITY DEVELOPMENT ON ENTERPRISE COMPETITIVENESS	290
Baymuradov Shoxrux, Dilmurodov Komiljon	
FOREIGN EXPERIENCE AND METHODOLOGICAL APPROACHES TO ASSESSING THE EFFICIENCY OF HOTEL ENTERPRISES.....	295
RAKHIMOV HASAN ABDUSAITOVICH	
USE OF SOFTWARE PRODUCTS IN THE CONTEXT OF DIGITAL TRANSFORMATION	299
Abdulaxatov Muzaffarjon Mashrabjon o'g'li	
IMPROVING THE METHODOLOGY OF AUDITING INTANGIBLE ASSETS IN THE ICT SECTOR	305
Ishankulov Izzatilla Nurillaevich	
IMPROVING THE ITEM-BASED ACCOUNTING OF PRODUCTION COSTS AND THE FORMATION OF PRODUCT COST IN GRAIN CLUSTERS.....	310
Yuldashev Sherali Khaitovich	
THE IMPACT OF DEPOSITS ON THE DEVELOPMENT OF KASHKADARYA REGION	318
Shodiev Odiljon Salim ugli	
IMPROVING METHODS FOR ENHANCING MANAGEMENT EFFICIENCY IN THE SERVICES SECTOR THROUGH DIGITAL TECHNOLOGIES	322
Tursunova Shahlo Sayfillayevna	

UDC: 338.48:640.4(575.1)

FOREIGN EXPERIENCE AND METHODOLOGICAL APPROACHES TO ASSESSING THE EFFICIENCY OF HOTEL ENTERPRISES

Rakhimov Hasan AbdusaitovichSamarkand Institute of Economics and Service,
Doctor of Philosophy (PhD) in Economics

Abstract. The article examines foreign experience and methodological approaches to evaluating hotel business efficiency. It analyses the methodologies of international organisations (UN Tourism — TSA, WTTC — economic impact research, OECD, WEF — TTDI), international standards for evaluating and classifying hotels (USALI, Hotelstars Union, revenue management, STR benchmarking), and the experience of leading countries and regions (the United States, China, Europe, Türkiye, and the UAE). **A comparative analysis of modern evaluation models — Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA), and the Balanced Scorecard (BSC) — is conducted, and ways of adapting them to the conditions of Uzbekistan's hotel industry are substantiated. Uzbekistan's 78th place among 119 countries in the TTDI 2024 ranking indicates the need to enhance the competitiveness of the sector.**

Keywords: foreign experience, international standards, DEA, SFA, BSC, benchmarking, RevPAR, hotel efficiency.

Annotatsiya. Maqolada mehmonxona xo'jaliklari samaradorligini baholashning xorijiy tajribasi va metodologik yondashuvlari tadqiq etilgan. Xalqaro tashkilotlarning metodologiyalari (UN Tourism — TSA, WTTC — iqtisodiy ta'sir tadqiqoti, OECD, WEF — TTDI), mehmonxona faoliyatini baholash va toifalashning xalqaro standartlari (USALI, Hotelstars Union, daromadlarni boshqarish, STR benchmarking) hamda yetakchi davlatlar (AQSh, Xitoy, Yevropa, Turkiya va BAA) tajribasi tahlil qilingan. Zamonaviy baholash modellari — ma'lumotlarni qamrab olish tahlili (DEA), stoxastik chegaraviy tahlil (SFA) va muvozanatli ko'rsatkichlar tizimi (BSC) qiyosiy tahlil qilinib, ularni O'zbekiston mehmonxona xo'jaligi sharoitiga moslashtirish yo'llari asoslangan. TTDI-2024 reytingida O'zbekistonning 119 mamlakat orasida 78-o'rinni egallagani soha raqobatbardoshligini oshirish zaruratini ko'rsatadi.

Kalit so'zlar: xorijiy tajriba, xalqaro standartlar, DEA, SFA, BSC, benchmarking, RevPAR, mehmonxona samaradorligi.

Аннотация. В статье исследуются зарубежный опыт и методологические подходы к оценке эффективности гостиничного хозяйства. Проанализированы методологии международных организаций (UN Tourism — TSA, WTTC — исследование экономического воздействия, OECD, WEF — TTDI), международные стандарты оценки и классификации гостиниц (USALI, Hotelstars Union, управление доходами, бенчмаркинг STR), а также опыт ведущих стран (США, Китай, страны Европы, Турция и ОАЭ). Проведён сравнительный анализ современных моделей оценки — анализа среды функционирования (DEA), стохастического граничного анализа (SFA) и системы сбалансированных показателей (BSC), **а также обоснованы** пути их адаптации к условиям гостиничного хозяйства Узбекистана. **78-е место Узбекистана среди 119 стран в рейтинге TTDI-2024 свидетельствует о необходимости повышения конкурентоспособности отрасли.**

Ключевые слова: зарубежный опыт, международные стандарты, DEA, SFA, BSC, бенчмаркинг, RevPAR, эффективность гостиниц.

INTRODUCTION

Improving the mechanisms for evaluating and analysing the efficiency of hotel enterprises requires careful study of foreign experience and international standards. In the world's leading countries, the hotel industry is highly developed, and scientifically grounded methodological approaches, international standards, and benchmarking systems for efficiency assessment have been established. Studying this experience is important for two reasons: it makes it possible to adopt modern and proven methods of efficiency evaluation, while the application of international standards creates opportunities to enhance the competitiveness of Uzbek hotels in the global market and to compare their performance internationally through benchmarking.

In Uzbekistan, the development of the tourism sector has been designated as a priority at the level of state policy [1]. At the same time, it is important not to copy foreign approaches mechanically, but to adapt them to

national conditions and specific characteristics. The purpose of this study is to examine foreign methodological approaches, international standards, and modern models for evaluating the efficiency of hotel enterprises and to substantiate ways of adapting them to the conditions of Uzbekistan.

LITERATURE REVIEW

The methodologies developed by international organisations play a central role in assessing the efficiency of the hotel and tourism sectors. The United Nations World Tourism Organization (UN Tourism) developed the Tourism Satellite Account (TSA) methodology [2] to assess the contribution of tourism to national economies; the World Travel & Tourism Council (WTTC) developed its Economic Impact Research methodology [3]; and the World Economic Forum developed the Travel & Tourism Development Index (TTDI) [7]. For the financial benchmarking of hotel operations, the Uniform System of Accounts for the Lodging Industry (USALI) and STR (CoStar Group) benchmarking indicators, including RevPAR, ADR, and occupancy [4], are widely used, while Cornell University research [5] plays an important role in the development of revenue management methodology. International classification systems such as Hotelstars Union are also applied in hotel categorisation [6].

In the field of modern efficiency assessment models, A. Charnes, W. Cooper, and E. Rhodes developed Data Envelopment Analysis (DEA) [8]; R. Banker, A. Charnes, and W. Cooper introduced its variable returns to scale model (BCC) [9]; D. Aigner, C. Lovell, and P. Schmidt developed Stochastic Frontier Analysis (SFA) [10]; and R. Kaplan and D. Norton developed the Balanced Scorecard (BSC) [11]. Researchers such as C.P. Barros, A.G. Assaf, and M. Sigala have applied these models to the hotel industry [12]. Within the framework of organisational and economic mechanisms, M. Porter's cluster theory [13] also occupies an important place. Uzbek scholar H.A. Rakhimov has studied issues related to the organisation of hotel services [14]. These approaches require critical analysis and appropriate adaptation to national conditions.

RESEARCH METHODOLOGY

The study employed comparative analysis, a systems approach, and scientific generalisation methods. Models for assessing hotel efficiency were classified into three groups according to their methodological foundations: non-parametric methods (DEA and its variants), parametric methods (SFA), and multi-criteria and integral methods (BSC and integral indices). The selection and application of a particular model depend on the purpose of the assessment, the volume and quality of available data, and the number of input and output indicators. In an emerging tourism market such as Uzbekistan, the application of these models requires consideration of national characteristics, including the state of the statistical database, the seasonality of the sector, and hotel categories. **In preparing the text of this article, artificial intelligence tools were used to an extent of up to 10%.** Therefore, particular attention was paid to the practical adaptation of the models to the specific conditions of Uzbekistan.

ANALYSIS AND RESULTS

The international system for assessing hotel industry efficiency consists of three interrelated components: methodologies developed by international organisations, international standards, and efficiency indicators, which are applied in practice through benchmarking. The methodologies of international organisations are systematised in Table 1.

Table 1

Methodologies of International Organisations for Assessing Efficiency in the Tourism and Hotel Sector

International organisation	Methodology and indicators
UN Tourism (World Tourism Organization)	Tourism Satellite Account (TSA) — assessment of tourism's contribution to GDP, employment, and exports within the system of national accounts
WTTC (World Travel & Tourism Council)	Economic Impact Research (EIR) — assessment of direct, indirect, and induced impacts
OECD (Organisation for Economic Co-operation and Development)	A system of indicators for assessing tourism productivity, competitiveness, and sustainability
WEF (World Economic Forum)	Travel & Tourism Development Index (TTDI) — comprehensive ranking of countries' tourism environments

Source: compiled by the author based on data from international organisations.

Revenue management methodology is widely used to optimise hotel profitability. Developed by researchers at Cornell University, this approach is aimed at maximising hotel revenue and occupancy by flexibly adjusting

prices on the basis of demand and supply analysis. Under modern conditions, revenue management is increasingly being automated through artificial intelligence and big data technologies. Dynamic pricing systems analyse demand, competitors' prices, seasonality, and events in real time, automatically adjust room rates, and thereby optimise both hotel occupancy and revenue. The introduction of such digital approaches in hotels in Uzbekistan has significant potential.

The experience of leading countries in assessing and improving hotel efficiency is comparatively analysed in Table 2.

Table 2

Experience of Selected Countries in Assessing and Improving Hotel Efficiency

Country / Region	Key Features of the Approach to Assessing and Improving Efficiency
United States	Revenue management, RevPAR/GOPPAR benchmarking, STR and Cornell University methodologies
European countries	Hotelstars unified classification system, sustainable development, energy efficiency, and service quality standards
People's Republic of China	Rapid growth of the hotel industry, assessment based on digital technologies and Big Data

Source: compiled by the author based on the analysis of foreign sources.

A number of mathematical and statistical models are used in modern economic research to assess hotel efficiency. Data Envelopment Analysis (DEA) is a non-parametric method that constructs an efficiency frontier based on the best-performing hotels and evaluates the remaining hotels relative to this frontier. Its main variants include the CCR model (constant returns to scale), the BCC model (variable returns to scale), as well as the Malmquist Index, Network DEA, Super-Efficiency DEA, and Bootstrap DEA.

Stochastic Frontier Analysis (SFA) is a parametric method that decomposes the overall deviation into random error and inefficiency and makes it possible to assess the factors affecting inefficiency, including within the Battese and Coelli framework. The Balanced Scorecard (BSC), in turn, provides a comprehensive assessment of efficiency from four perspectives: financial performance, customers, internal business processes, and learning and growth. A comparative analysis of these three models is presented in Table 3.

Table 3

Comparative Analysis of the Main Models for Assessing Hotel Efficiency

Criterion	DEA	SFA	BSC
Type	Non-parametric	Parametric	Multi-criteria
Functional form	Not required in advance	Specified in advance	—
Random error	Not taken into account	Taken into account	—
Multiple outputs	Easily accommodated	More complex	Accommodated
Qualitative indicators	Partially included	Partially included	Comprehensively covered
Data requirements	Relatively low	High (large sample required)	Moderate

Source: compiled by the author.

When adapting the models to the conditions of Uzbekistan, the two-stage DEA approach is particularly effective. In the first stage, hotel efficiency is assessed, while in the second stage the resulting efficiency scores are linked to external (contextual) factors — such as location, category, and seasonality — through regression analysis. By integrating the above-mentioned models, an integral assessment approach (the MSII index) can be developed. In addition, as an organisational and economic mechanism for improving efficiency, the “Hospitality Cluster”, based on M. Porter’s cluster theory, makes it possible to achieve synergistic effects through the vertical integration of services under a unified ownership and management structure. Uzbekistan’s 78th position in the TTDI 2024 ranking (Kazakhstan — 52nd, Tajikistan — 99th, Kyrgyzstan — 102nd) demonstrates the need to adapt foreign experience and modern assessment models to national conditions.

One of the important capabilities of the DEA method is the decomposition of technical efficiency into pure technical efficiency and scale efficiency. By comparing the results of the CCR and BCC models, it is possible to determine whether a hotel’s inefficiency arises from managerial shortcomings (pure technical inefficiency) or from a non-optimal scale of operations (scale inefficiency). In the SFA method, it is necessary to select the functional form of the production function — most commonly the Cobb–Douglas or flexible translog specification — and estimate its parameters using the maximum likelihood method. As a result, an efficiency score for each hotel (ranging from 0 to 1) and coefficients reflecting the factors influencing inefficiency are obtained. Since these methods make it possible not only to measure hotel efficiency but also to identify the sources of inefficiency, it is advisable to apply them in national practice as complementary analytical tools.

CONCLUSION AND SUGGESTIONS

The study led to the following conclusions. First, scientifically grounded methodological approaches, international standards (USALI, Hotelstars, TSA), and benchmarking systems (STR, RevPAR/GOPPAR) for assessing hotel efficiency have been developed in the world's leading countries. Second, each of the modern assessment models (DEA, SFA, BSC) has its own advantages and limitations; therefore, they should be selected and applied in accordance with specific objectives and national conditions. Third, Uzbekistan's position in the TTDI ranking indicates the need to further enhance the competitiveness of the tourism and hotel sector.

Based on the research findings, the following practical recommendations are proposed: to introduce international standards (USALI and standardised performance indicators) and benchmarking systems into Uzbekistan's hotel industry; to apply modern assessment models, particularly two-stage DEA and SFA, taking into account the national statistical database and seasonality; to adapt creatively the experience of leading countries, including the United States in revenue management, China in digitalisation, and Türkiye and the UAE in cluster development; and to establish hospitality clusters based on the vertical integration of services. These measures are expected to contribute to improving the efficiency of the hotel industry and strengthening its international competitiveness.

REFERENCES

- UN Tourism; United Nations Statistics Division; Eurostat; OECD. *Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008)*. – Luxembourg; Madrid; New York; Paris, 2010. – URL: <https://www.unwto.org/tourism-statistics/on-economic-contribution-of-tourism-tsa-2008>.
- World Travel & Tourism Council (WTTC). *Economic Impact Research (EIR): Methodology 2025* [Electronic resource]. – London: WTTC, 2025. – URL: <https://researchhub.wttc.org/product/economic-impact-research-eir-methodology-2025> (accessed: 30.06.2026).
- STR (CoStar Group). *Hotel Performance Benchmarking: Occupancy, ADR and RevPAR* [Electronic resource]. – URL: <https://str.com/> (accessed: 30.06.2026).
- *Uniform System of Accounts for the Lodging Industry (USALI)*. – 11th Revised ed. – American Hotel & Lodging Educational Institute, 2014.
- Cornell University, eCornell. *Hotel Revenue Management* [Electronic resource]. – URL: <https://ecornell.cornell.edu/certificates/hospitality-and-foodservice-management/hotel-revenue-management/> (accessed: 30.06.2026).
- Hotelstars Union. *Catalogue of Criteria 2025–2030: European Hotel Classification* [Electronic resource]. – URL: <https://www.hotelstars.eu/for-hotels/downloads> (accessed: 30.06.2026).
- World Economic Forum. *Travel & Tourism Development Index 2024*. – Geneva: World Economic Forum, 2024. – URL: <https://www.weforum.org/publications/travel-tourism-development-index-2024/> (accessed: 30.06.2026).
- Charnes A., Cooper W.W., Rhodes E. Measuring the Efficiency of Decision Making Units // *European Journal of Operational Research*. – 1978. – Vol. 2, No. 6. – P. 429–444.
- Banker R.D., Charnes A., Cooper W.W. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis // *Management Science*. – 1984. – Vol. 30, No. 9. – P. 1078–1092.
- Aigner D., Lovell C.A.K., Schmidt P. Formulation and Estimation of Stochastic Frontier Production Function Models // *Journal of Econometrics*. – 1977. – Vol. 6, No. 1. – P. 21–37.
- Kaplan R.S., Norton D.P. *The Balanced Scorecard: Translating Strategy into Action*. – Boston: Harvard Business School Press, 1996.
- Barros C.P. Measuring Efficiency in the Hotel Sector // *Annals of Tourism Research*. – 2005. – Vol. 32, No. 2. – P. 456–477. – DOI: 10.1016/j.annals.2004.07.011.
- Assaf A.G., Magnini V. Accounting for Customer Satisfaction in Measuring Hotel Efficiency: Evidence from the US Hotel Industry // *International Journal of Hospitality Management*. – 2012. – Vol. 31, No. 3. – P. 642–647. – DOI: 10.1016/j.ijhm.2011.08.008.
- Sigala M. Using Data Envelopment Analysis for Measuring and Benchmarking Productivity in the Hotel Sector // *Journal of Travel & Tourism Marketing*. – 2004. – Vol. 16, No. 2/3. – P. 39–60. – DOI: 10.1300/J073v16n02_04.
- Porter M.E. *The Competitive Advantage of Nations*. – New York: Free Press, 1990.
- Rakhimov H.A. *Improving the Assessment and Analysis of Efficiency in Hotel Enterprises*: Dissertation for the Degree of Doctor of Philosophy (PhD) in Economics, specialty 08.00.05 – Economics of Service Industries. – Samarkand: Samarkand Institute of Economics and Service, 2018.

Proofreader: Zokir ALIBEKOV

Layout and Designer: Oloviddin Sobir ugli

2026. № 7

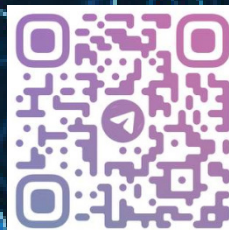
© When materials are reproduced, the INNOVATION SCIENCE AND TECHNOLOGY journal must be cited as the source. Authors are responsible for the accuracy of the information in materials and advertisements published in the journal. Editorial opinions may not always align with those of the authors. Submitted materials will not be returned to the editorial office.

To publish articles in this journal, you may submit articles, advertisements, stories, and other creative materials through the following links. Materials and advertisements are published on a paid basis.

You may subscribe to the journal at any time using the following details. Once subscribed, please send a screenshot or photo of your payment confirmation to our Telegram page @iqtisodiyot_77. Based on this, we will send the latest issue of the journal to your address each month.

“The journal “INNOVATION SCIENCE AND TECHNOLOGY” has been registered by the Agency for Information and Mass Communications under the Administration of the President of the Republic of Uzbekistan from 09.10.2024 under the registration number №390637. License number: C-5669633. PNFL: 30407832680027

Our address: Tashkent city, Yunusobod district, 19th block,
House 17.



Acceptance of articles

Published every
monthly



Directions

Social, economic, political,
technological, scientific



Scopus || Scientific electronic journal specializing in Scopus

CERTIFICATE NUMBER: №390637

**ORDER NUMBER ACCORDING TO
THE LICENSE REGISTER: C-5669633**

CONTACT:



Contact us
+998 50 737 87 88



Telegram channel
t.me/scopus_IST2100



Journal official website
<https://ist-journal.uz/index.php/IST>