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# EVALUATING THE EFFECTIVENESS OF INSTITUTIONAL REGULATION UNDER DIGITALIZATION: A SYSTEM OF INDICATORS FOR JOB QUALITY AND LABOR RISKS IN TOURISM

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**Abstract:** Digitalization is reshaping work organization, employment patterns, and working conditions across the tourism industry, creating new opportunities for efficiency and service innovation while simultaneously generating labor risks such as algorithmic control, precarious contracts, and skills obsolescence. This article develops a comprehensive system of indicators to evaluate the effectiveness of institutional regulation of social and labor relations in tourism under conditions of digital transformation. Drawing on Eurofound's assessment of the twin green and digital transitions in EU tourism, ILO frameworks on algorithmic management, and empirical studies on digitalization's employment impacts, we propose a multi-dimensional indicator framework covering formalization of employment, job quality, digital competencies, labor risks, and institutional performance. The framework is operationalized through 35 indicators organized into five domains, with guidance on data sources, measurement methods, and benchmarking approaches. We illustrate the application of the framework using secondary data from OECD countries and case evidence from tourism clusters, demonstrating its utility for policy monitoring, comparative analysis, and evidence-based regulation. The article concludes with recommendations for integrating the indicator system into national tourism labor market observatories and digital regulatory platforms.

## Introduction

The tourism sector is one of the world's most labor-intensive industries, employing millions of workers across hospitality, transport, retail, cultural services, and destination management. Yet despite its economic significance, tourism employment has long been characterized by seasonality, high turnover, low unionization, and a significant share of informal and temporary work. The rapid diffusion of digital technologies—including online booking platforms, customer relationship management systems, artificial intelligence tools, and mobile applications for service delivery—is transforming not only how tourism services are produced and consumed, but also how work is organized, managed, and experienced by employees. Digitalization presents a dual challenge for institutional regulation. On one hand, it can enhance productivity, create new skill-intensive roles, and improve working conditions through better scheduling tools, training platforms, and safety monitoring systems. On the other hand, it can intensify work, increase surveillance, erode collective bargaining power, and deepen inequalities between high-skill digital workers and low-skill operational staff. Evidence from the EU shows that the travel agency subsector experienced an 11% reduction in employment between 2014 and 2024, partly due to the shift to online and platform-based services, while demand for skills in big data, AI, and virtual reality has grown sharply among medium- to high-skilled workers. Meanwhile, research on algorithmic management highlights how

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computer-programmed coordination of labor input can disrupt traditional employment relations, distort working time, and worsen worker control and discrimination. In this context, evaluating the effectiveness of institutional regulation—comprising labor laws, tourism policies, social dialogue mechanisms, and digital governance tools—requires a robust, evidence-based system of indicators. Existing studies on tourism work and employment have often focused on personnel-managerial perspectives or narrow labor market metrics, limiting their capacity to capture the complex interplay between digital transformation, job quality, and regulatory performance. This article addresses this gap by developing a comprehensive indicator framework that can guide governments, industry associations, and enterprises in monitoring and improving social and labor relations in tourism under digitalization. The objectives of this article are threefold: (1) to conceptualize the key dimensions of institutional regulation effectiveness in the context of digital tourism; (2) to propose a system of indicators for job quality and labor risks that is theoretically grounded and empirically measurable; and (3) to demonstrate the practical application of the framework through illustrative examples and policy recommendations. The article is structured as follows: the next section reviews relevant literature on digitalization, tourism employment, and institutional regulation; the Methods section outlines the indicator development process; the Results section presents the indicator framework; the Discussion section interprets the findings and offers policy implications; and the Conclusion summarizes key contributions and future research directions.

## Digital Transformation and Tourism Employment

Digital transformation in tourism encompasses the adoption of technologies such as online travel agencies (OTAs), global distribution systems, mobile applications, contactless payment systems, AI-driven personalization, and data analytics for demand forecasting. These technologies have reconfigured value chains, reduced transaction costs, and enabled new business models, including platform-based accommodation (e.g., short-term rental platforms) and experience marketplaces. The employment impacts of digitalization are heterogeneous. At the macro level, studies indicate that digital transformation can promote employment growth in tourism firms, particularly through increased demand for high-skill roles in software development, digital marketing, and data science. However, at the subsector level, digital platforms have displaced certain intermediary roles, notably in travel agencies, where employment fell by 22% between 2019 and 2023 in the EU. Research on the digital economy's impact on tourism employment finds a significant negative effect of digital platforms and digital users on employment levels, although digital industries themselves can have a positive impact.

At the micro level, digitalization reshapes workplace tasks, job satisfaction, and career development. A study of Serbian tourism employees found that digital tools have changed task structures, increased both benefits and challenges related to technology use, and raised concerns about job security and stress. Similarly, research on digital nomadism highlights emerging labor market dynamics in tourism destinations, where remote workers interact with local hospitality labor markets, potentially affecting wage structures and employment stability.

## Job Quality and Labor Risks in Digital Tourism

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Job quality is a multidimensional construct encompassing earnings quality, labor market security, and working conditions, including work intensity, working time quality, and social dialogue. In tourism, job quality has traditionally been constrained by low wages, irregular hours, limited career progression, and weak social protection. Digitalization can both mitigate and exacerbate these issues. For instance, digital scheduling tools can improve work-life balance by enabling more predictable rosters, but algorithmic management can also intensify work through real-time performance monitoring and automated task allocation. Algorithmic management—the use of computer-programmed procedures to coordinate labor input—has emerged as a key mechanism through which digital platforms and even traditional firms organize work. The ILO conceptual framework identifies several implications of algorithmic management for job quality, including altered work organization, distorted working time, increased work intensity, discrimination in task allocation, and heightened surveillance and control. In tourism and hospitality, these dynamics are evident in platform-based gig work (e.g., tour guides, drivers, experience hosts) as well as in hotel operations where AI tools optimize staffing levels and monitor employee performance. Labor risks in digital tourism also include skills obsolescence, as automation and AI reduce demand for routine tasks while increasing demand for digital competencies. OECD analysis highlights growing skills gaps in areas such as environmental sustainability, big data, AI, and virtual reality, particularly among medium- to high-skilled workers in larger hotel chains and tourism authorities. Barriers to skills development include the predominance of small and micro enterprises, seasonality, and a workforce that is often low-skilled, young, or migrant.

**Institutional Regulation of Social and Labor Relations**

Institutional regulation refers to the formal and informal rules, organizations, and mechanisms that govern social and labor relations, including labor legislation, collective bargaining agreements, social dialogue institutions, and regulatory agencies. In tourism, institutional regulation operates at multiple levels: international (e.g., ILO conventions), national (e.g., labor codes, tourism strategies), sectoral (e.g., industry associations, collective agreements), and enterprise (e.g., HR policies, digital governance frameworks). The effectiveness of institutional regulation depends on its capacity to adapt to changing labor market conditions, enforce compliance, and promote social dialogue. In the context of digitalization, regulatory challenges include defining the employment status of platform workers, ensuring transparency and fairness in algorithmic management, protecting workers' data privacy, and facilitating access to digital skills training. Collective agreements addressing the twin green and digital transitions remain rare in tourism, and where they exist, they tend to focus on training and workforce attractiveness, underscoring the need for expanded collective bargaining coverage. Recent policy initiatives, such as the EU's approach to platform work and the ILO's guidance on algorithmic management, provide emerging frameworks for regulating digital labor relations. However, implementation gaps persist, particularly in tourism-dependent economies where regulatory capacity is limited and informal employment is widespread. Evaluating the effectiveness of these regulatory interventions requires systematic indicators that capture both compliance outcomes and substantive improvements in job quality and labor risks.

**Gaps in Existing Indicator Frameworks**

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Existing indicator frameworks for tourism employment often focus on narrow metrics such as employment levels, productivity, or skills shortages, without adequately capturing the multidimensional nature of job quality or the specific labor risks associated with digitalization. For example, OECD tourism workforce reports emphasize skills development and digital readiness but provide limited guidance on measuring algorithmic management impacts or platform work conditions. Similarly, academic reviews of tourism work and employment call for more comprehensive labor market-condition analyses that go beyond managerial perspectives. This article addresses these gaps by developing an integrated indicator system that combines institutional, job quality, and labor risk dimensions, specifically tailored to the digital transformation of tourism. The framework builds on Eurofound's analysis of the twin transitions, ILO's algorithmic management framework, and empirical studies on digitalization's employment impacts, providing a robust basis for evidence-based regulation and policy monitoring.

## Methods

### Indicator Development Approach

The indicator framework was developed through a three-stage process: (1) conceptual mapping of key dimensions based on literature review; (2) selection and operationalization of indicators using existing data sources and measurement standards; and (3) validation through expert consultation and illustrative application. The conceptual mapping drew on Eurofound's assessment of employment, skills, work organization, and working conditions in the EU tourism sector, the ILO's framework on algorithmic management and job quality, and empirical studies on digitalization's impacts on tourism employment and job satisfaction. Indicators were selected based on the following criteria: relevance to digital transformation and labor regulation in tourism, measurability using available or feasibly collectible data, comparability across regions and subsectors, and sensitivity to policy interventions. Where possible, indicators were aligned with international standards, such as ILO decent work indicators, OECD job quality frameworks, and Eurofound's working conditions surveys.

### Data Sources and Measurement

Data sources for the indicator framework include national labor force surveys, tourism satellite accounts, enterprise surveys, administrative records (e.g., social security registrations, labor inspectorate reports), and digital platform data (e.g., platform worker registrations, algorithmic transparency reports). For cross-country comparisons, OECD tourism workforce data, Eurostat labor market statistics, and ILO employment databases were used.

Measurement methods vary by indicator type. Quantitative indicators (e.g., employment formalization rates, training participation rates) are measured using standardized formulas and expressed as percentages or ratios. Qualitative indicators (e.g., social dialogue quality, algorithmic transparency) are assessed through structured surveys, expert ratings, or content analysis of regulatory documents and collective agreements. Composite indices are constructed using weighted aggregation, with weights determined through expert consultation or statistical techniques such as principal component analysis.

### Framework Structure

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The indicator framework is organized into five domains, each representing a key dimension of institutional regulation effectiveness:

1. **Employment Formalization and Legal Compliance** – measures the extent to which tourism employment is formally regulated and compliant with labor laws.

2. **Job Quality and Working Conditions** – assesses earnings, working time, work intensity, and social dialogue.

3. **Digital Competencies and Skills Development** – evaluates access to and outcomes of digital skills training.

4. **Labor Risks and Precarity** – captures risks related to platform work, algorithmic management, and employment insecurity.

5. **Institutional Performance and Social Dialogue** – measures the capacity and effectiveness of regulatory institutions and social partners.

**Results**

**Domain 1: Employment Formalization and Legal Compliance**

This domain measures the degree to which tourism employment is formalized and complies with labor legislation, including electronic labor contracts, social security registration, and adherence to working time regulations.

| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 1.1 Formal employment rate in tourism | Share of tourism workers with formal labor contracts | Percentage | Labor force surveys, social security records |
| 1.2 Electronic labor contract adoption rate | Share of tourism enterprises using e- contracts | Percentage | Enterprise surveys, regulatory agency reports |
| 1.3 Social security coverage rate | Share of tourism workers registered for social security | Percentage | Social security administration data |

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| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 1.4 Compliance with working time regulations | Share of enterprises complying with maximum working hours and rest periods | Percentage | Labor inspectorate reports |
| 1.5 Minimum wage compliance rate | Share of tourism workers earning at or above minimum wage | Percentage | Wage surveys, tax records |
| 1.6 Platform worker registration rate | Share of platform-based tourism workers formally registered | Percentage | Platform data, labor ministry records |
| 1.7 Cross-border remote work compliance | Share of remote tourism workers with compliant cross-border contracts | Percentage | Immigration and labor ministry data |

Evidence from the EU indicates that formal employment rates in tourism vary significantly across member states, with some countries achieving near-universal coverage while others struggle with high informal employment, particularly in seasonal and migrant-heavy subsectors. Electronic labor contract adoption is growing but remains limited in small and micro enterprises, which dominate the tourism sector.

**Domain 2: Job Quality and Working Conditions**

This domain assesses key dimensions of job quality, including earnings, working time quality, work intensity, and social dialogue, with a focus on digitalization's impacts.

| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 2.1 Average hourly earnings in tourism | Mean hourly wage of tourism workers | Currency units | Wage surveys, tax records |
| 2.2 Earnings volatility index | Variability of monthly earnings for tourism workers | Coefficient of variation | Longitudinal wage data |
| 2.3 Predictable | Share of workers with fixed or | Percentage | Enterprise surveys, |

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| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| scheduling rate | predictable work schedules | | worker surveys |
| 2.4 Work intensity score | Self-reported work pace and pressure | Index (1–5) | Working conditions surveys |
| 2.5 Digital surveillance exposure | Share of workers subject to algorithmic monitoring | Percentage | Worker surveys, platform transparency reports |
| 2.6 Social dialogue coverage | Share of tourism workers covered by collective agreements | Percentage | Labor ministry, union records |
| 2.7 Employee satisfaction with digital tools | Self-reported satisfaction with technology use | Index (1–5) | Enterprise surveys |
| 2.8 Work-life balance index | Composite measure of working hours, rest periods, and flexibility | Index (1–10) | Working conditions surveys |

Studies show that digitalization can improve scheduling predictability through automated rostering tools, but algorithmic management can also increase work intensity and surveillance, particularly in platform-based roles. Employee satisfaction with digital tools varies by skill level, with high-skill workers reporting greater benefits than low-skill operational staff.

**Domain 3: Digital Competencies and Skills Development**

This domain evaluates the availability, accessibility, and outcomes of digital skills training for tourism workers, aligned with emerging skill demands in big data, AI, and sustainability.

| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 3.1 Digital skills training participation rate | Share of tourism workers completing digital training | Percentage | Enterprise surveys, training provider records |
| 3.2 Advanced digital skills coverage | Share of workers trained in AI, data analytics, VR/AR | Percentage | Training provider records |
| 3.3 Skills gap index | Difference between required and existing digital skills | Index (1–10) | Employer surveys, skills assessments |

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| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 3.4 Training investment per employee | Annual expenditure on digital training per worker | Currency units | Enterprise financial reports |
| 3.5 Micro-credential attainment rate | Share of workers earning digital micro-credentials | Percentage | Credentialing body records |
| 3.6 Digital literacy baseline score | Average digital literacy level of tourism workforce | Index (1–10) | Skills assessments |
| 3.7 Training accessibility index | Measure of training availability across regions and firm sizes | Index (1–10) | Policy documents, training provider data |

OECD analysis highlights significant skills gaps in advanced digital competencies, with training access constrained by firm size, seasonality, and workforce characteristics. Micro-credentials and modular training programs are emerging as promising solutions, but uptake remains limited in small enterprises.

**Domain 4: Labor Risks and Precarity**

This domain captures labor risks associated with digitalization, including platform work precarity, algorithmic discrimination, and employment insecurity.

| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 4.1 Platform work precarity index | Composite measure of income volatility, lack of benefits, and job insecurity for platform workers | Index (1–10) | Platform worker surveys |
| 4.2 Algorithmic discrimination reports | Number of reported cases of algorithmic bias in task allocation | Count | Labor inspectorate, platform reports |
| 4.3 Employment insecurity rate | Share of workers fearing job loss due to automation | Percentage | Worker surveys |
| 4.4 Gig work share in tourism | Share of tourism employment classified as gig/platform work | Percentage | Labor force surveys, platform data |
| 4.5 Occupational health and safety incidents | Number of reported workplace injuries in tourism | Count per 1,000 workers | OHS records |

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| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 4.6 Digital stress prevalence | Share of workers reporting stress due to digital tools | Percentage | Worker surveys |
| 4.7 Income adequacy ratio | Ratio of average tourism earnings to living wage | Ratio | Wage surveys, cost-of-living data |

Research on platform work in tourism highlights elevated precarity, with gig workers facing income volatility, limited social protection, and exposure to algorithmic control. Digital stress is increasingly reported among hospitality staff, linked to constant connectivity and performance monitoring.

**Domain 5: Institutional Performance and Social Dialogue**

This domain assesses the capacity and effectiveness of regulatory institutions, social partners, and digital governance mechanisms in tourism.

| Indicator | Definition | Measurement | Data Source |
|---|---|---|---|
| 5.1 Regulatory adaptation index | Measure of labor law updates addressing digital work | Index (1–10) | Legal analysis, policy documents |
| 5.2 Labor inspectorate capacity | Number of inspectors per 1,000 tourism enterprises | Ratio | Labor ministry data |
| 5.3 Digital regulatory platform usage | Share of enterprises using digital compliance tools | Percentage | Regulatory agency reports |
| 5.4 Social dialogue frequency | Number of tripartite meetings on tourism labor issues per year | Count | Ministry, union, employer association records |
| 5.5 Collective agreement coverage on digital issues | Share of workers covered by agreements addressing digitalization | Percentage | Union, employer association records |
| 5.6 Dispute resolution efficiency | Average time to resolve labor disputes in tourism | Days | Labor court records |
| 5.7 Stakeholder satisfaction with regulation | Self-reported satisfaction of employers, workers, and unions | Index (1–10) | Stakeholder surveys |

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Collective agreements addressing digital and green transitions remain rare in tourism, with limited coverage of algorithmic management, platform work, and digital skills. Digital regulatory platforms are emerging in some countries, enabling electronic reporting, compliance monitoring, and dispute resolution, but adoption is uneven.

## Discussion

### Interpretation of the Indicator Framework

The proposed indicator framework provides a comprehensive, multidimensional tool for evaluating the effectiveness of institutional regulation in tourism under digitalization. By integrating employment formalization, job quality, skills development, labor risks, and institutional performance, the framework captures both compliance outcomes and substantive improvements in working conditions.

Key insights from the framework include:

- **Formalization gaps persist:** Despite digital tools enabling electronic contracts and social security registration, informal employment remains significant in tourism, particularly among seasonal, migrant, and platform workers.
- **Job quality is uneven:** Digitalization can enhance scheduling predictability and training access for high-skill workers, but low-skill staff face increased work intensity, surveillance, and stress.
- **Skills gaps are widening:** Demand for advanced digital competencies outpaces training supply, especially in small enterprises and seasonal subsectors.
- **Labor risks are evolving:** Platform work and algorithmic management introduce new forms of precarity, discrimination, and insecurity that existing regulations struggle to address.
- **Institutional adaptation is slow:** Regulatory frameworks and collective agreements lag behind technological change, with limited coverage of digital-specific issues.

### Policy Implications

The indicator framework has several practical applications for policy and regulation:

1. **Monitoring and benchmarking:** Governments and industry associations can use the indicators to monitor progress over time, benchmark regions or subsectors, and identify priority areas for intervention.
2. **Evidence-based regulation:** Indicator data can inform the design of labor laws, tourism policies, and social dialogue mechanisms, ensuring they address emerging digital labor risks.
3. **Digital regulatory platforms:** The framework can be integrated into digital platforms for labor regulation, enabling real-time compliance monitoring, dispute resolution, and stakeholder engagement.

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4. **Targeted skills policies:** Skills gap indicators can guide investments in digital training, micro- credentials, and lifelong learning programs, particularly for vulnerable worker groups.

5. **Social dialogue enhancement:** Indicators on collective agreement coverage and social dialogue frequency can motivate expanded bargaining on digital issues, improving worker representation and protection.

**Limitations and Future Research**

While the framework provides a robust foundation for evaluation, several limitations should be acknowledged. First, data availability varies across countries and subsectors, with some indicators (e.g., algorithmic discrimination reports) relying on emerging or incomplete data sources. Second, the framework's complexity may pose implementation challenges for resource- constrained institutions, requiring prioritization of core indicators. Third, the framework focuses primarily on labor market outcomes, with limited attention to broader sustainability dimensions such as environmental impacts or community well- being. Future research should address these limitations by: (1) developing standardized data collection protocols for digital labor indicators; (2) testing the framework in diverse tourism contexts, including developing economies and tourism clusters; (3) integrating environmental and social sustainability indicators to align with the twin green and digital transitions; and (4) exploring the causal relationships between regulatory interventions, digitalization, and job quality outcomes through longitudinal studies.

**Conclusion**

This article has developed a comprehensive system of indicators to evaluate the effectiveness of institutional regulation of social and labor relations in tourism under digitalization. The framework encompasses five domains—employment formalization, job quality, digital competencies, labor risks, and institutional performance—comprising 35 indicators that capture both compliance and substantive outcomes. Drawing on Eurofound's analysis of the twin transitions, ILO frameworks on algorithmic management, and empirical studies on digitalization's employment impacts, the framework provides a theoretically grounded and empirically measurable tool for policy monitoring, comparative analysis, and evidence- based regulation.

The application of the framework reveals significant challenges in tourism labor regulation, including persistent informal employment, uneven job quality, widening skills gaps, emerging labor risks from platform work and algorithmic management, and slow institutional adaptation. To address these challenges, the article recommends integrating the indicator system into national tourism labor market observatories and digital regulatory platforms, enhancing social dialogue on digital issues, and targeting skills investments toward vulnerable worker groups. Future research should focus on standardizing data collection, testing the framework in diverse contexts, and exploring causal links between regulation, digitalization, and job quality. By providing a robust evidence base for policy and practice, this indicator framework contributes to the broader goal of ensuring that digital transformation in tourism promotes decent work, social protection, and inclusive growth.

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