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REVIEW SCIENTIFIC PAPER

Multilevel Public Administration and Occupational Health and Safety (OHS) Governance in Sustainable and Mobile Urban Environments

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Abstract: This paper examines the transformation of Occupational Health and Safety (OHS) governance driven by digitalization, labor mobility, and the expansion of non-standard employment. It argues that OHS has evolved from a narrow regulatory function into a core pillar of sustainable development and public health resilience. While the European Union has embedded OHS as a fundamental social right, many developing economies remain trapped in a "cycle of neglect," marked by weak regulatory capacity and high rates of workplace accidents. The study underscores the limitations of traditional command-and-control enforcement in fragmented labor markets shaped by platform work, subcontracting, and informal or bogus self-employment. These arrangements diffuse accountability and disproportionately expose vulnerable groups, particularly migrants and women, to occupational risks. The Pressures–Disorganization–Regulatory Failure (PDR) model is used to explain how such structural conditions contribute to adverse physical and mental health outcomes. The COVID-19 pandemic is identified as a catalyst for closer integration between OHS and public health surveillance, especially in dense urban settings. In response, emerging paradigms such as OSH 5.0 promote a human-centered, digitally enabled governance approach aligned with the UN Sustainable Development Goals and based on quadruple-helix collaboration among the state, industry, academia, and civil society. The paper concludes by proposing a strategic roadmap for Turkey, addressing the coexistence of advanced digital OHS systems and a large informal economy. Key recommendations include legal protections for migrant reporting, guidance-oriented inspections for SMEs, and the integration of health security indicators into Sustainable Urban Mobility Plans.

Keywords: OHS Governance, Multilevel Administration, OSH 5.0, Sustainable Urban Mobility, Public Health Resilience

INTRODUCTION

Occupational health and safety (OHS) remains a major global challenge, posing significant human, social, and economic costs. These burdens are most acute in developing economies, where weak regulatory capacity, low productivity, and poor working conditions amplify occupational risks (Chen et al., 2020). In contrast, the European Union has progressively institutionalized OHS as a core element of social policy since the 1950s, evolving from early debates on the "humanisation of work" to binding frameworks such as Directive 89/391/EEC. Today, EU OHS policy emphasizes mental health, sustainability, and decent work in response to green, digital, and demographic transitions, underpinned by tripartite governance involving governments, employers, and trade unions and framed as a social right within the Eu-

ropean Pillar of Social Rights (Dörflinger & Tisch, 2023).

Safe and healthy work is increasingly recognized as a cornerstone of sustainable development and effective public governance in a rapidly changing world of work. OHS, and wellbeing underpin not only worker protection but also organizational performance, economic resilience, and social cohesion, requiring governance approaches that extend beyond compliance-based regulation toward integrated, multi-actor collaboration (Jain et al., 2024). Comparative evidence from developed countries including the United States, Japan, the United Kingdom, Germany, and Australia demonstrates that mature OHS systems combining strong enforcement with stakeholder participation have substantially reduced workplace accident mortality. These experiences highlight a persistent governance gap with developing

economies and have informed proposals for government-led, multi-subject collaborative governance models tailored to national institutional contexts, such as China, to improve regulatory effectiveness and OHS outcomes (Chen et al., 2020).

At the same time, labour market transformations associated with globalization, outsourcing, privatization, and non-standard employment have fragmented employment relationships and shifted health and safety risks from employers and states onto workers. Temporary, subcontracted, platform-based, informal, and migrant work arrangements are consistently linked to higher injury rates, poorer physical and mental health outcomes, and limited access to social protection, particularly in mobile and urban labour markets (Quinlan, 2025; Lippel et al., 2017). These dynamics weaken regulatory oversight and complicate enforcement across multilevel governance structures, where responsibilities are dispersed across public and private actors and along global supply chains (Dörflinger & Tisch, 2023).

The COVID-19 pandemic starkly exposed these vulnerabilities, demonstrating how weak OHS enforcement especially in essential, informal, and mobile sectors can accelerate disease transmission and overwhelm public health systems. In response, the literature increasingly conceptualizes OHS governance as an integral component of public health and environmental protection rather than a stand-alone regulatory function (Atima & Anioke, 2020). Integrated, risk-based, and outcome-oriented enforcement models that align labour regulation with public health surveillance are seen as critical for early detection of hazards, prevention of community-level spillovers, and reduction of health inequalities, consistent with the “healthy workplaces–healthy communities” perspective.

Informal, migrant, and other high-risk worker populations remain central challenges for urban OHS governance, as traditional enforcement mechanisms often fail in decentralized, mobile, and low-trust contexts. Scholars therefore emphasize adaptive strategies such as community-based monitoring, mobile inspections, trust-building measures, simplified reporting, and integrated data systems to extend protection to excluded workers (Atima & Anioke, 2020). The “cycle of neglect” identified by Jilcha and Kitaw (2016) illustrates how weak regulation, poor enforcement, low compliance, and underreporting mutually reinforce unsafe conditions, particularly in developing countries, underscoring the need for accountable and adaptive enforcement systems.

Recent evidence from the public sector further confirms these governance gaps. Studies from highly urbanized contexts, such as the Philippines, show that even where formal OHS legislation exists, implementation remains uneven due to limited institutional capacity, insufficient training, and weak accountability across governance levels (Abad, 2025). More broadly, the literature

highlights that effective OHS governance depends not only on regulation but also on complementary strategies, including voluntary standards, corporate social responsibility and environmental, social, and governance initiatives, and rights-based approaches, while maintaining a strong role for the state in enforcement and coordination (Jain et al., 2024). Overall, the literature converges on the need for coordinated, multilevel OHS governance that integrates labour, public health, environmental, and urban policy objectives. Strengthening institutional capacity, aligning enforcement across governance levels, and addressing the needs of mobile and vulnerable workers are essential for ensuring safe and healthy work as a foundation of sustainable, inclusive, and resilient urban development.

EVIDENCE ON THE HEALTH EFFECTS OF NON-STANDARD / INFORMAL WORK

The literature indicates that non-standard and insecure work substantially heightens OHS risks by concentrating vulnerable groups, particularly migrants, women, young and older workers in low-paid, weakly regulated jobs marked by insecurity, irregular hours, and fragmented work organization. These risks are intensified by declining union representation, regulatory exclusions, and complex subcontracting and global supply chains that diffuse responsibility and strain enforcement. Employment insecurity increasingly affects both non-standard and permanent jobs, with overlapping work arrangements and demographic changes further amplifying risks and extending harm beyond workers to clients and the public. Despite extensive evidence, policy responses remain uneven, highlighting the need for stronger, better-resourced, and more inclusive multilevel OHS governance that integrates supply-chain accountability, social protection, and worker representation in mobile urban labour markets (Quinlan, 2025).

Informal work accounts for a large share of global employment around 61% of the workforce and is marked by the absence of formal contracts, OSH protections, and social security, particularly in developing and emerging economies. Informal workers face heightened exposure to physical, chemical, biological, and psychosocial hazards, compounded by unsafe workplaces, long hours, limited training, and restricted access to healthcare. Informal outsourcing by formal industries further shifts risks into unregulated settings, often extending harm to families and communities. The COVID-19 pandemic intensified these vulnerabilities, expanding informality and exposing its public health implications. Overall, the literature underscores the need for integrated occupational, public health, and social policies, alongside improved data and targeted interventions, to reduce risks and support safer, more sustainable informal work (Schulte et al., 2022).

Triangular/temporary agency work

Temporary and agency work consistently lead to elevated OHS risks, characterized by higher injury rates, greater exposure to physical and psychosocial hazards, and poorer mental health outcomes compared to permanent employment. According to Quinlan (2025), these risks are manifested through increased experiences of bullying, depression, and delayed return to work. These vulnerabilities are particularly acute for migrant, female, and inexperienced workers, who often face language barriers and economic pressures that make hazardous tasks seem like “risks worth taking” despite the inherent dangers (Hopkins, 2017; Cajander et al., 2023).

The Pressures–Disorganization–Regulatory failure (PDR) model explains how these risks are structurally embedded in triangular employment relationships. Economic instability creates pressures that discourage the reporting of hazards, while disorganization arises from mismatched placements, unfamiliarity with host worksites, and fragmented communication regarding training and supervision (Spillett et al., 2005; Underhill & Quinlan, 2011). This fragmentation is common in sectors like construction and hospitality, where the blurred lines of authority between staffing agencies and host firms often result in inadequate safety cultures and limited access to protective equipment (Gogulescu et al., 2021; Strauss-Raats & Adăscăliței, 2025).

Regulatory and governance gaps further exacerbate these dangers, as traditional OHS frameworks are often ill-equipped to handle multi-employer arrangements. Shared legal responsibility is frequently poorly defined or weakly enforced, leading to a “regulatory gap” where agencies and host employers shift blame rather than coordinating prevention (Strauss-Raats, 2019; Howard, 2016). For example, comparative studies of Ontario and Quebec reveal that while some systems offer better income replacement or shared liability, both struggle with underreporting and fragmented accountability (Lippel et al., 2011). Ultimately, addressing these vulnerabilities in modern urban labor markets requires stronger multilevel governance and clearer allocation of responsibility across all parties in the employment chain (Quinlan, 2025; Xu et al., 2025).

Home-based work

Home-based work (HBW) is a diverse and expanding component of urban labour markets, encompassing informal home production, formal telework, homecare, and platform-based gig work, each with distinct OHS and governance challenges. In low-income and informal settings, HBW is often invisible and unregulated, exposing workers and households to physical, chemical, and ergonomic hazards. In higher-income contexts, formal telework raises ergonomic and psychosocial risks, while platform-mediated home-based gig work is characterized by low pay, surveillance, weak dispute resolution,

and limited OHS protection (Dong et al., 2025; Nilsson et al., 2021; Wagemann et al., 2024).

Access to HBW is highly unequal. The capacity to work from home is concentrated among higher-paid, better-educated urban workers in wealthier countries, while limited internet access, housing conditions, and job task requirements exclude many workers in low-income contexts. During crises such as COVID-19, these disparities amplified labour market and health inequalities, disproportionately harming young, poorly educated, temporary, and informal workers in countries with weaker social protection systems (Hall et al., 2023; Sánchez et al., 2020). HBW is frequently organized through subcontracting and temporary arrangements that fragment responsibility for OHS and shift risks into private homes. Cost-driven outsourcing, dispersed worksites, and weak enforcement contribute to poorer OHS outcomes across both high- and low-income settings, making HBW a critical governance challenge in sustainable and mobile urban economies (Quinlan, 2025).

Overall, the literature highlights the need for multilevel OHS and urban governance that recognizes the scale and diversity of HBW, extends labour and health protections into homes and digital platforms, addresses gendered care burdens, and better integrates housing, labour, and digital policies to ensure that home-based work supports both livelihoods and health.

Part-time work

Part-time work is often promoted as a means of improving work–life balance and supporting labour market participation, particularly for women. Evidence shows that voluntarily chosen part-time work can enhance work–life balance and job satisfaction, especially in gender-egalitarian contexts and when hours are substantially reduced, without necessarily increasing sickness absence at the organizational level (Beham et al., 2019; Jacobsen et al., 2023). In such settings, part-time employment can provide a stable and acceptable arrangement for combining paid work with care or study. However, the benefits of part-time work are unevenly distributed. Low-paid, marginal, or involuntary part-time jobs are associated with lower income, weaker job security, limited career progression, and long-term risks such as unemployment and disability retirement. Part-time work is strongly feminized and often reinforces gender inequalities by concentrating women in lower-status roles with reduced access to training, promotion, and pensions, while also sustaining traditional divisions of unpaid care (Booth & van Ours, 2010; Lyonette, 2015; Jacobsen et al., 2023).

From an OHS perspective, part-time work presents mixed outcomes. While reduced hours may lower some physical risks, part-time workers particularly in low-quality jobs are more exposed to unpredictable schedules, psychosocial stress, harassment, and economic insecurity. These patterns mirror broader challenges associated

with non-standard employment and point to the need for context-sensitive OHS and labour governance (Quinlan, 2025). Part-time work can be a sustainable and equitable employment form only when it is voluntary, adequately protected, and embedded in supportive welfare, gender, and employment regimes. Strengthening rights, job quality, and career opportunities for part-time workers is essential to prevent the reproduction of inequality and to realize the promised benefits of flexibility.

Dependent self-employment and subcontracting

Dependent self-employment occupies a regulatory “grey zone” between standard employment and genuine entrepreneurship and has become increasingly prevalent through outsourcing, subcontracting, and platform-based work. Workers are formally classified as self-employed but remain economically and organizationally dependent on one or a small number of clients, with limited autonomy over pricing, workload, or strategic decisions. This status raises significant concerns for job quality, social protection, and OHS governance, particularly in complex and mobile urban labor markets. Across the EU28, dependent self-employment is closely linked to worker misclassification, especially in the gig economy, where individuals lack multiple clients, hiring authority, or decision-making power. Williams and Lapeyre (2017) argue that addressing this gap requires reclassification mechanisms or hybrid protections, strengthened collective bargaining, and expanded social protection to ensure decent work. Evidence from the Netherlands shows that while dependency alone does not necessarily predict poor outcomes, involuntary entry into self-employment is associated with higher risks of dissatisfaction, low income, and financial insecurity (Kösters & Smits, 2021).

Firms increasingly rely on dependent self-employment to gain labor flexibility, shift risks, and evade employment protections, social contributions, and training obligations (Kautonen et al., 2021). Stricter employment protection legislation has been shown to increase transitions into dependent, rather than genuinely independent, self-employment (Román et al., 2011). High-risk sectors such as construction, logistics, care, finance, and platform delivery illustrate how subcontracting chains intensify precarity and unpaid work (Böheim & Muehlberger, 2006; Moore & Newsome, 2018). This fragmentation weakens regulatory oversight and elevates injury risks, making dependent self-employment a central challenge for multilevel OHS governance and accountability (Quinlan, 2025).

Bogus/undeclared work and the informal sector

Bogus self-employment, undeclared work, and informality represent a critical challenge for global OHS. These work forms frequently exist in a “gray zone” between formal and informal sectors, making them difficult to regulate in mobile urban environments. Research

indicates that while these arrangements can serve as survival strategies for vulnerable populations, they are systematically associated with poorer physical and mental health, long hours, and low pay (Davidescu et al., 2024; Van Den Berg & Baum, 2024). The risks of informality are particularly concentrated in dispersed or home-based sectors such as construction, hospitality, retail, and platform courier work. In these areas, the formal/informal dichotomy often obscures deeper exploitation; for instance, digital platform couriers may face “super-exploitation” regardless of whether they are labeled as independent contractors or employees (Novianto, 2025). This precariousness is exacerbated by the lack of workers’ compensation, tax evasion such as envelope wages, and a total absence of regulatory oversight, which is a widespread issue in both developing economies and high-income countries (Tairova, 2023; Quinlan, 2025).

Addressing these OHS vulnerabilities requires a move away from purely repressive or punitive measures toward “high-road” strategies. Effective governance must focus on formalization incentives, such as simplifying business registration and building trust in public institutions, rather than relying solely on labor inspections (Stasyuk et al., 2023). Furthermore, because dependent self-employment is often used to externalize costs along subcontracting chains, urban governance must look beyond traditional employer-employee contracts to address the blurred legal categories that leave workers unprotected. Ultimately, achieving sustainable development and decent work requires a nuanced policy approach. This involves balancing risk-based enforcement with enabling measures that make formal work accessible and attractive, ensuring that the most hazardous forms of non-standard employment do not continue to undermine unions, collective bargaining, and universal OHS standards (Quinlan, 2025).

MULTILEVEL PUBLIC ADMINISTRATION AND OHS GOVERNANCE IN MOBILE, SUSTAINABLE CITIES

Urban environments are becoming more digital, mobile, and sustainability-driven, which complicates how OHS is governed and enforced. Research links effective OHS to multi-level public administration, sustainable mobility planning, and smart-city agendas, but also shows persistent coordination and implementation gaps.

Multilevel Governance and OHS

Modern urban OHS governance is undergoing a transformative shift toward multilevel and polycentric arrangements. In dense, digitalized cities, OHS is no longer a standalone workplace issue but a core component of sustainable development and public health. Research indicates that while local governments are the primary

implementation hubs, they often face a under-cooperating on safety when acting independently. Centralized regulation and health-footprint models are essential to resolve this coordination failure and ensure stable inter-governmental cooperation (Li et al., 2020; Cevheribucak, 2024).

The current gold standard in advanced economies is a “multiple and differentiated” governance model. This approach features strong state leadership balanced by active collaboration between employers, unions, and social partners (Chen et al., 2020). Governance is effectively distributed across three distinct tiers:

- **National Level:** Establishing legal frameworks, standards, and alignment with Sustainable Development Goals (SDGs).
- **Regional/City Level:** Integrating safety into Sustainable Urban Mobility Plans (SUMP) and coordinating context-specific enforcement (Mapar et al., 2017).
- **Organizational Level:** Managing internal safety systems, digital risk tools, and worker participation (Baghdadi, 2024).

A critical frontier in urban safety is the integration of OHS into broader infrastructure and mobility planning. Achieving Vision Zero requires cities to move beyond basic accident prevention to include “health security”, addressing risk perception and contagion risks within mobility systems (Spadaro & Pirlone, 2021). By using systems-based frameworks like the Hierarchy of Hazard Controls (See Figure 1), urban planners can align transport safety with environmental and public health goals (McLeod & Curtis, 2020).

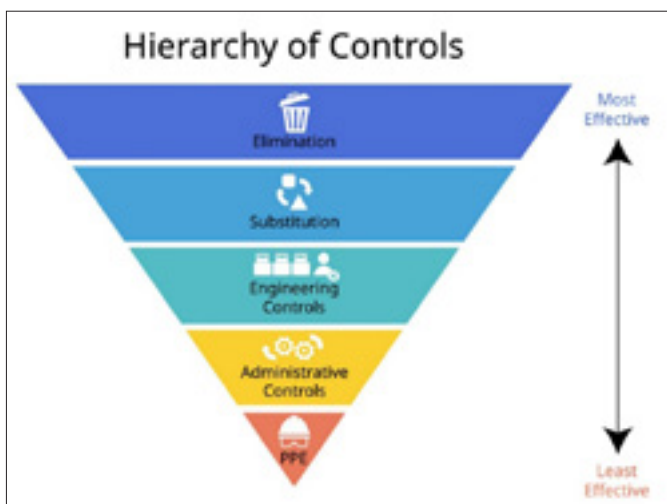


Figure 1. From OSH 4.0 to OSH 5.0: Bridging the Implementation Gap in Digital and Smart City Governance

OSH governance in the digital era is increasingly shaped by the interaction between traditional regulatory systems and rapid technological transformation. Effective OSH governance operates across international,

regional, and national levels and depends on a complementary mix of hard law such as legislation, treaties, and ILO conventions and soft law, including voluntary standards, guidelines, and stakeholder agreements. While hard law provides legitimacy and enforceability, it often struggles to keep pace with digitalization and emerging psychosocial risks. Soft law, by contrast, enables flexibility and faster adaptation but lacks binding authority (Schulte et al., 2022).

The transition to Industry 4.0 has accelerated the emergence of OSH 4.0, where digital tools and data-driven systems can substantially improve safety performance and reduce accidents. However, digitalization also generates new risks, notably around data privacy and cybersecurity, blurred roles and accountability, and psychosocial hazards associated with intensified, platform-based, and algorithmically managed work (Akyıldız, 2023; Schulte et al., 2022). Despite these advances, a persistent implementation gap remains within Smart City and Industry 4.0 frameworks, where worker safety is often subordinated to efficiency, innovation, and productivity goals.

To address this gap, OSH 5.0- a human-centered, digitally enabled approach embedded in socio-technical systems and aligned with sustainable development is advocated. OSH 5.0 emphasizes quadruple-helix governance, bringing together public authorities, businesses, researchers, and citizens to ensure that technological innovation enhances, rather than undermines, worker health and safety. Within this framework, OSH innovation is positioned as a driver of all six pillars of sustainable development: economic, social, environmental, cultural, political, and technological rather than a narrow compliance function (Jilcha & Kitaw, 2017; Ávila-Gutiérrez et al., 2022).

Overall, the convergence of digital tools with cooperative, multilevel governance is critical for protecting an increasingly mobile, diverse, and digitally managed workforce. Adaptive OSH governance. Combining robust regulation, flexible voluntary instruments, and participatory governance models is essential for ensuring that smart cities and digital economies remain not only efficient, but also safe, inclusive, and sustainable.

OHS Governance: Standards, Participation, and Digital Transformation

A large-scale review of studies in the construction sector shows that research has focused primarily on occupational health and safety management systems (OHSMSs) implementation and management, while evidence on measurable benefits, performance, awareness, and barriers remains limited. Persistent challenges such as poor communication, inadequate training, weak safety culture, low PPE use, psychosocial strain, and insufficient legal compliance are compounded by a lack of reliable incident and organizational data, constraining

robust evaluation of OHSMS effectiveness. Nevertheless, international standards and management systems provide an important governance framework linking workplace risk control with sustainability, particularly in construction and infrastructure contexts (Kineber et al., 2023).

Public sector evidence underscores the importance of multilevel governance and localized implementation. Studies of urban government offices show generally high levels of OSH standards implementation, but with significant variation across governance levels and functional domains. City governments often translate standards into practice more effectively than national bodies, particularly in emergency preparedness and workplace safety, while gaps persist in OSH programs and support facilities at higher and intermediate levels. These findings emphasize the value of intergovernmental coordination and context-sensitive enforcement (Cagbaleño & Palic, 2025).

Digital transformation further reshapes OSH governance in public administration. Research from Swedish local governments demonstrates that digitalization can either strengthen or marginalize occupational health and safety, depending on managerial approach. Where Plan-Do-Check-Act (PDCA) cycles, risk assessment, and employee participation are embedded in digital change processes, OHS is reinforced; where technological determinism prevails, safety considerations are sidelined. This highlights leadership and adaptive management as critical determinants of safe digitalization (Asp et al., 2026).

Across governance levels, participatory approaches emerge as a key enabling factor. Multilevel, participatory interventions in municipalities improve psychosocial safety climate, leadership empowerment, and risk awareness, although effects on individual stress are limited and implementation is complex (Dalggaard et al., 2025). Broader public administration research similarly shows that stakeholder participation promotes preventive safety cultures and shifts governance from reactive to proactive risk management (Afiah, 2023).

Finally, strong OSH governance in the public sector has clear economic and public health implications. Evidence from local administrations links weak OSH implementation to inefficient public spending, while improved safety culture reduces accidents, losses, and resource waste (Mohamed et al., 2022). In public health services, crises such as COVID-19 have exposed the consequences of inadequate OSH management, reinforcing the need to integrate occupational safety into public health policy and organizational resilience strategies (Adamopoulos et al., 2022). Collectively, there is a need of more holistic, data-informed, participatory, and digitally aware OSH governance models that align workplace safety with public health objectives and sustainable public administration (Akyıldız, 2023; Schulte, 2020).

A ROADMAP FOR MULTILEVEL OHS GOVERNANCE IN TURKEY'S RESILIENT CITIES

The governance of OHS in Turkey is at a transformative crossroads, driven by the pressures of rapid urbanization, post-pandemic recovery, and the digital shift toward Industry 4.0/5.0. While Turkey possesses a sophisticated legal framework (Law No. 6331) and advanced digital monitoring tools like İSG-KATİP, a significant implementation gap remains due to administrative fragmentation and a large informal economy

The Current Landscape: A Structural Paradox

Turkey's OHS environment is characterized by world-class digital architecture contrasted against chronic enforcement challenges in highly mobile urban settings.

- **Legal Strength:** As of January 1, 2026, OHS mandates cover all formal workplaces, regardless of size or risk level. Platforms like e-Nabız and İSG-KATİP offer potential for real-time tracking of occupational diseases (Çalış & Buyukakinci, 2019; Çabuk, 2025).
- **The "Invisible" Workforce:** including millions of refugees and migrants operates informally, remaining outside the reach of safety standards. Current enforcement relies heavily on punitive fines, which often drive these businesses further into the shadows (Yıldırım et al., 2022).
- **Sectoral Failures:** The construction industry, in particular, remains plagued by high accident rates and an immature inspection system that lacks the coordination necessary for meaningful reform (Yıldırım et al., 2022).

Integrated Urban Resilience & Mobility

Post-pandemic research in Istanbul highlights that sustainable city planning and public health are mutually reinforcing.

- **Healthy Urbanism:** Future resilience depends on "de-densifying" indoor spaces and integrating green infrastructure to mitigate contagion risks (Agboola, 2025). Successful responses require a balance of centralized decision-making and active local implementation (Ahsan, 2020).
- **Sustainable Urban Mobility Plans (SUMPs):** Transitioning from chronic congestion to sustainable mobility requires embedding health security indicators such as risk perception, crowding, and infection risk into transport planning (Spadaro & Pirlone, 2021).
- **Policy Translation:** Benchmarking successful models (like London's Mayor's Transport Strategy) requires "translating" international standards into Turkey's specific local institutional structure to overcome fragmented governance (Canitez, 2020).

Strategic Roadmap for Turkey (2026–2033)

The proposed roadmap (See Table 1) advocates for a transition from a punitive culture to a protective, preventive one through a phased approach.

Table 1. The proposed roadmap for Turkey

Phase	Focus	Key Actions
Short Term (1–3 Yrs)	Alignment	Update regulations to integrate OHS 5.0 and SDGs; mandate health security indicators in all SUMPs.
Medium Term (3–7 Yrs)	Scaling	Establish a National–Metropolitan Coordination Platform; standardize OHS KPIs in all Public-Private Partnership (PPP) contracts (Canitez, 2020).
Long Term (7+ Yrs)	Consolidation	Fully operationalize a digital OHS information system; use “health footprint” metrics to evaluate municipal performance.

Key Recommendations for Reform

- **The “Legal Firewall”:** Establish a barrier preventing OHS data from being shared with migration authorities, ensuring that informal and migrant workers can report hazards without fear (Yıldırım et al., 2022).
- **Incentivized Compliance:** Shift to a “Guidance First” model for SMEs, offering financial incentives such as Social Security (SGK) premium discounts for workplaces with verified safety records.
- **Quadruple-Helix Collaboration:** Build alliances between public authorities, researchers, businesses, and citizens to increase the legitimacy of OHS measures (Agboola, 2025; Yıldırım et al., 2022).
- **Educational Mainstreaming:** Embed OHS and health security modules into university curricula (SDG 4) to support a preventive culture and future workforce skills (Kavouras et al., 2022).

DISCUSSION

The literature emphasizes that integrating OHS governance with public health is critical for sustainable, mobile urban environments, especially where informal, precarious, and non-standard work is prevalent. Fear of sanctions and job loss often suppresses reporting of unsafe conditions, allowing occupational hazards to spill over into wider public health risks such as disease outbreaks, environmental contamination, and gaps in surveillance. Shifting from purely punitive enforcement toward graduated, incentive-based compliance, supported by tools like amnesties, mobile training, and community safety champions can improve trust, extend regulatory reach, and enable incremental safety improvements without undermining livelihoods.

Contemporary OHS governance is increasingly multilevel and network-based, moving beyond com-

mand-and-control regulation toward orchestrated governance that combines legal rules with social dialogue, coordinated inspections, incentives, and information-based instruments. Evidence from Europe shows that strong vertical and horizontal coordination across EU, national, sectoral, and workplace levels is essential. Binding regulation provides the most durable impact, but its effectiveness depends on institutional capacity, while softer tools often struggle to translate into sustained workplace practice.

Broader transformations: digitalization, globalization, climate change, and the expansion of informal and platform work have fragmented labor markets and created new physical, psychosocial, and environmental risks, disproportionately affecting urban and climate-exposed workers. In response, scholars call for adaptive OHS frameworks aligned with the Decent Work agenda that integrate top-down regulation with bottom-up participation, link OHS data with public health surveillance, protect vulnerable and informal workers, and incorporate environmental and community health impacts into enforcement.

The provided text outlines a fundamental shift in OHS governance, moving from isolated “command-and-control” enforcement toward an orchestrated, multilevel model that integrates workplace safety with broader public health and urban sustainability. In modern, mobile urban environments, OHS is no longer just about preventing site-specific accidents; it is a critical component of community resilience. The literature highlights that when OHS is disconnected from public health, occupational hazards such as disease outbreaks or chemical leaks, remaining hidden due to workers’ fear of reporting, thereby undermining national health surveillance (Schulte et al., 2022). To address this, a “four-pillar” strategy is proposed, emphasizing Institutional Capacity, Integrated Data, Enforcement Toolkits, and Inclusive Adaptability (Weber et al., 2023; Hasle et al., 2017).

A major barrier to effective OHS in urban contexts is the scale of the informal economy, where platform-based and migrant workers often avoid engaging with OHS systems out of fear that inspections may trigger immigration enforcement, rendering occupational risks largely invisible. To overcome this, the literature emphasizes the need for legal firewalls that explicitly separate OHS enforcement from immigration authorities, ensuring that all workers can report hazards and access protections without fear of retaliation or deportation (NIOH, 2022). In parallel, a shift from purely punitive regulation toward graduated compliance is recommended, whereby “guidance-first” approaches, temporary amnesty periods, and supportive inspections enable informal and small businesses to improve safety practices incrementally while preserving livelihoods, trust, and regulatory legitimacy.

The transition from traditional regulation to orchestrated governance represents a move toward “network-

based" regulation. Success depends on horizontal and vertical coordination from international frameworks (EU/ILO) to local municipal enforcement (Weber et al., 2023). In Turkey's context, this is reflected in the transition toward "OSH 5.0," which aligns safety standards with the UN Sustainable Development Goals (SDGs) and human-centered Industry 5.0 principles. The integration of OHS data with public health databases (such as Turkey's e-Nabız or İSG-KATİP) allows for the early detection of emerging threats. By sharing real-time metrics on workplace illness clusters, cities can trigger public health investigations before a localized hazard becomes a community-wide crisis.

While digitalization in Industry 4.0/5.0 reduces some physical risks, it introduces new psychosocial hazards, such as increased surveillance stress and cognitive workload. Furthermore, climate change acts as a "risk multiplier," where extreme heat and pollution disproportionately affect outdoor urban workers. A resilient governance framework must therefore be adaptive, integrating environmental health standards into OHS licensing and emergency preparedness. OHS in sustainable, mobile cities is most effective when it functions as a preventive public health strategy. By moving from "punishment to protection," and fostering "quadruple-helix" collaborations (government, business, researchers, and citizens), cities can build a safety culture that promotes social equity and long-term economic productivity (Hasle et al., 2017; Agboola, 2025; Schulte et al., 2022).

Overall, sustainable OHS outcomes in urban settings depend on strong institutional capacity, integrated data systems, inclusive enforcement strategies, and coordinated multilevel governance. When aligned with public health, OHS functions as a preventive policy tool that reduces community health risks, promotes social equity, and strengthens urban resilience.

CONCLUSION

The evolution of OHS from a narrow regulatory function to a pillar of sustainable urban governance is essential for protecting the modern, mobile workforce. As digitalization and informality fragment labor markets, traditional "command-and-control" models must be replaced by multilevel, orchestrated approaches that integrate workplace safety with public health, environmental standards, and urban mobility planning. The risks identified in the platform economy and "triangular" employment underscore the need for inclusive, adaptive strategies. In Turkey, bridging the "implementation gap" requires transitioning from punishment to protection by establishing legal firewalls for vulnerable workers and adopting "OSH 5.0" frameworks. Strengthening institutional capacity ensures that safety remains a driver of community wellbeing rather than a bureaucratic burden. Ultimately, the convergence of digital innovation and

participatory governance is vital to ensuring that urban sustainability is never achieved at the expense of human dignity.

Taken together, the literature demonstrates that OHS in sustainable, mobile urban environments can no longer be treated as a discrete workplace issue. Effective protection depends on integrated, multilevel governance in which national frameworks aligned with the Sustainable Development Goals set clear standards, city and regional authorities are empowered to coordinate and implement them, and organizations embed robust OHS management systems into everyday practice. When inspections, data sharing, and corrective actions are coordinated across governance levels, OHS functions as a core element of preventive public health, ensuring that protecting workers simultaneously protects communities.

At the same time, significant implementation gaps persist. Smart city, digitalization, and mobility policies increasingly acknowledge safety, health, and epidemic risk as design criteria, yet worker-focused "smart OHS" and coherent intergovernmental coordination remain underdeveloped. These gaps are most visible in mobile, multi-employer urban labor markets, where temporary and agency workers face systematically higher risks due to economic pressures, fragmented responsibilities, and regulatory misfit between public rules and workplace realities. Addressing these challenges requires governance frameworks that explicitly account for labor mobility and non-standard employment. Clear allocation of duties between agencies, host employers, and regulators; stronger coordination across administrative levels; and meaningful participation and voice for temporary workers are essential. Combined with education, digital innovation, and inclusive enforcement strategies, such approaches enable OHS to support not only safer work but also broader goals of urban sustainability, equity, and resilience.

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