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The Deskilling-Yet-Oversight Paradox: AI Automation, Role Identity Erosion, and Technostress among Data Centre Operators in Malaysia

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Abstract

Malaysia's rapidly growing data centre sector has led to significant advances in the application of artificial intelligence (AI) in small-to-medium data centres (SMDCs), however there is dearth of research examining the workforce implications of this transformation. Grounded in conservation of resources (COR) theory and social identity theory (SIT), this paper provides a conceptual framework by utilising these theoretical foundations to understudied context of Malaysian SMDCs. The framework centres on a structural condition, *deskilling-yet-oversight paradox*, wherein AI-induced systems concurrently displace operators' expertise while elevating their accountability as supervisors of automated systems. This condition documented in analogous industries has not been examined in the data centre context. This paper proposes *role identity erosion* as mediator linking automation exposure to AI-induced technostress. Moreover, a moderating distinction between *substantive human-in-the-loop (S-HITL)* and *nominal human-in-the-loop (N-HITL)* arrangements is applied to study how oversight quality affects operator's identity and technostress in this context. This paper derives five propositions for future empirical testing. An institutional argument is advanced to explain why nominal oversight is the likely structural default in Malaysian SMDCs. Three HRM intervention pathways are proposed to convert the default N-HITL into S-HITL. The paper contributes to literature by providing theoretically integrated framework for understudied Malaysian SMDCs.

Keywords: Technostress, Role Identity Erosion, Human-in-the-Loop, Data Centre Operations, Malaysia

Introduction

AI has evolved from a strategic priority in the digital economy to an essential component of infrastructure of data centres worldwide, including Southeast Asia (Cheng et al., 2023; Raisch & Krakowski, 2021). Malaysia emerges as one of the regions where data centres are experiencing the rapid development, drawing investments from hyperscalers and multinational technology companies (Kanapathipillai et al., 2024). However, behind the impressive expansion of infrastructures, there is dearth of research exploring the impact of AI based infrastructural development on workforce dynamics including the experiences of operators and technicians within the operational environment of data centres.

Occupational situation of operators in data centres is paradoxical in its nature. AI-induced technologies such as predictive maintenance platforms, automated anomalies' detection mechanisms, AI-based cooling management tools, and AIOps applications progressively erode operators' technical competencies which used to form the core of their occupational identity (Jain & Srinivasan, 2022; Tang et al., 2022). Those competencies played a crucial role in the process of establishing operators' professional identity, demonstrating occupational skills, and gaining recognition among peers. At the same time, the emergence of AI transforms operators into overseers of increasingly independent processes in charge of overseeing AI operations, validating automatic decisions, and being held accountable for the errors occurring at the level of the system in question. As a result, operators become deskilled but receive the responsibility for monitoring AI without having the organizational power, competence frameworks, and recognition associated with this supervisory role (Crootof et al., 2023; Parent-Rocheleau & Parker, 2022). The result is a structural condition this paper terms as *deskilling-yet-oversight paradox*: which implies operators' loss of occupational identity driven by AI-induced automation process and simultaneous increase in supervisory responsibilities with ambiguous organisational parameters. This condition is documented in analogous high-stakes industries but has not been yet theorised in the data centre context.

Understanding data centre operators' experience of this paradox is urgent because its consequences are already manifesting as a documented sectoral problem. AI adoption in data centre environments is generating a worsening human capital crisis that threatens both workforce wellbeing and operational reliability. The Uptime Institute (2023) reports that 58% of the operators struggle to attract and retain qualified staff, and that four in five respondents identified their most recent serious outage as preventable with better human management, processes, and system configuration implicating workforce psychological conditions, not merely technical failure, as the primary source of operational risk. The evidence linking AI-induced technological change to deteriorating worker wellbeing is also mounting. The American Psychological Association (2023) found that 64% of workers worried about AI making their job duties obsolete reported feeling chronically tense or stressed during the workday, compared with 38% of those without such worries. Moreover, AI-exposed workers also reported significantly lower motivation, a diminished sense of professional mattering, and higher turnover intention. AI adoption generates distinct stressors including career disruption, loss of autonomy, and social erosion that established technostress frameworks do not fully capture (Sapkota et al., 2025). Research shows that 83% of Malaysia's workforce lack sufficient time or energy to complete their work and one in four employees plan to leave their employer within the next year, a retention crisis driven in part by the psychological strain of poorly governed technological transition (Microsoft, 2025). These pressures are

structurally amplified for data centre operators who are simultaneously exposed to AI-driven deskilling, expanded oversight accountability, and the institutional vulnerabilities in the SMDC context of Malaysia. Yet data centre operators' specific psychological experience of AI-mediated work restructuring has not been studied.

The overlapping theoretical gaps in the literature justify the proposed topic and the need for research in question. The first one refers to *contextual limitation* of the current literature base, with studies of AI and organizational behavior primarily examining the functioning of large Western corporations (Kim et al., 2025; Pan & Froese, 2023). Simultaneously, Malaysian SMEs operating data centres remain underrepresented in academic papers (Sawang & Sornlertlamvanich, 2025; Wang et al., 2025). Scholarship on AI-induced technostress has recognized an extended taxonomy of AI-specific stressors (Sapkota et al., 2025), and research on algorithmic management has identified the need for research examining how automation reshapes professional identities and worker psychology (Bankins et al., 2024; Zhang et al., 2025). While identity erosion and technostress have been studied in other analogous contexts, neither body of work has been integrated and applied to the specific conditions of technically constituted operational staff in monitoring-intensive SMDC settings. This paper draws on *role identity erosion*, a variable grounded in the broader identity and stress literatures, as the organising mechanism for this integration in the context of SMDCs. The second gap is of *institutional nature*. Existing models predict generalized negative impact of AI integration on small-and-medium enterprise (SME) workers; however, there is lack of theoretical account explaining the role of unique institutional characteristics of Malaysian SMDCs, such as owner-managed informality in HRM systems, decoupled technology governance, and labour market compression, in predisposing SMDCs to N-HITL as the default outcome, and dual identity displacement which is the psychologically deteriorating form of human-AI interaction.

This study seeks to close the identified gaps by proposing a *conceptual framework* that theorises how AI-driven automation contributes to role identity erosion and technostress in Malaysian SMDC operators. In addition, the proposed model includes classification of oversight formats, Substantive Human-in-the-Loop (S-HITL) and Nominal Human-in-the-Loop (N-HITL) arrangements, as a key moderating variable. Relying on conservation of resources (COR) theory (Hobfoll et al., 2018) and social identity theory (Tajfel & Turner, 1979), the proposed model posits that the results of the deskilling-yet-oversight paradox depend on the form of human presence in AI work-systems. If the involvement is substantive giving genuine decision-making authority and organisational recognition, the paradox is likely to generate resource gain and *identity reconstruction*. However, if the involvement is nominal, i.e., attributing accountability without judgement authority, the paradox can generate *dual identity displacement*, the severely damaging consequence of AI-integrated work restructuring (Kellogg et al., 2020; Raisch & Krakowski, 2021).

This paper makes four contributions to the literature. Firstly, it proposes the theoretically integrated conceptual framework concerning AI-induced automation effects on operator identity and wellbeing outcomes in SMDC operations, which represents a population and sector that, to our knowledge, has been under-represented in management research. Secondly, it synthesises conservation of resources theory, social identity theory, and the technostress literature into a coherent mediated moderation model, applying the

role identity erosion as a mediator that connects theoretical frameworks to the specific structural conditions of operational staff of Malaysian SMDCs. Thirdly, the research provides an institutional argument based on resource poverty theory, decoupling of technology and governance, and Malaysia-specific labour market explaining N-HITL as the predicted default structure in Malaysian SMDCs., giving a theoretically backed contextualisation that goes beyond general claims about weak human resource (HR) structures. Fourthly, this paper produces five empirically testable propositions, providing a structured agenda for future empirical investigation in this understudied but practically significant sector. Fifthly, the study identifies three organizational intervention pathways that may affect the discourses producing N-HITL, and provide HRM recommendations based on the logic of the theory developed.

The findings of this paper are directly relevant to multiple audiences: data centre managers who need to understand why AI-mediated role restructuring generates psychological harm rather than mere operational adjustment; HR practitioners designing reskilling, role redesign, and wellbeing governance frameworks for AI-integrated workplaces; and Malaysian policymakers seeking to ensure that the nation's digital infrastructure investment is matched by commensurate attention to workforce sustainability. The paper proceeds as follows: Section 2 establishes the contextual background; Section 3 develops the theoretical foundations; Section 4 presents the conceptual framework and propositions; Section 5 articulates organisational intervention pathways; and Section 6 concludes with implications and a future research agenda.

Contextual Background

Malaysia's Data Centre Landscape and the Role of SME Operators

Since 2020, Malaysia's data centre sector has witnessed an explosive structural growth, resulting from Singapore's decision to put a moratorium on new facilities, growing demand for cloud services in the region, and investments by global technology multinationals into the country's economy. In turn, this trend places Malaysia in a broader context of digital infrastructure transformation in Southeast Asia, a process which academic studies have highlighted as transformative for labour markets, required skills, and organizational forms in the region (Bankins et al., 2024; Cheng et al., 2023). The focus of new capacities along the Johor and Cyberjaya corridors marks Malaysia as one of the fastest growing data centres' markets in Asia-Pacific, an emerging trend with major repercussions for its labour markets due to the rapid integration of AI in data centres and insufficient development of relevant people-management processes (Kanapathipillai et al., 2024; Pan & Froese, 2023).

However, despite the common emphasis on hyperscale investment, the contribution made by small-and-medium data centres (SMDCs) to Malaysia's data centre sector cannot be overlooked. Tier II and Tier III facilities provide their services to local businesses, governmental entities, financial companies, and regional colocations with needs for data sovereignty and low latency incompatible with hyperscale cloud infrastructure. Unlike larger data centres which have established HR functions and training programs in place, SMDCs have small-scale operations and lack formal systems for people management as well as proper employee training. As a result, operators of these facilities face severe human challenges posed by the introduction of AI technologies at the workplace, yet the experience of such actors has not been properly examined by existing research due to its bias towards

HR-mature facilities of large scale found in Western countries (Kim et al., 2025;Pan & Froese, 2023).

The SMDC workforce in Malaysia faces a dual challenge that has only been partially addressed by management research. Firstly, there is a structural disparity between the abilities that operational employees have in their current jobs, which must adapt to AI-based function requirements brought on by the introduction of AI-supported technology (Cheng et al., 2023; Wang et al., 2025). Second, when a dominant regional hub, such as Singapore, offers better wages skilled local employees feel tempted to leave, further constraining the SMDC talent pool (Kanapathipillai et al., 2024). As a result, the negative effects of AI-induced job transformations on well-being and worker identity will primarily affect local employees working in institutions that have limited human resource (HR) management capabilities to intentionally manage these effects (Kim et al., 2025; Sawang & Sornlertlamvanich, 2025).

AI in Data Centre Operations: What Has Changed for Operators

To appreciate the work performance paradox faced by data centre operators, it is essential to identify what these operators used to do historically and what AI solutions now do in their place. Literature on automation and technical work indicates that operationally skilled personnel performed duties requiring continuous pattern recognition, adaptive fault location, and hands-on physical intervention. All these tasks were cognitively demanding, and identity building (Acemoglu & Restrepo, 2022; Nazareno & Schiff, 2021). Data centre operators were responsible for managing the building management systems, performing rounds on physical infrastructure, responding to alarms, and troubleshooting cases of power, cooling, and connectivity. These tasks instituted what COR theory recognizes as valuable personal resources that defined occupational competence and made up an operator's work identity (Hobfoll et al., 2018).

In the field of operational technology, AI has been widely implemented in practice to automate or significantly diminish the traditional competency domains of employees. For example, in a monitoring-intensive environment, AI is used for predictive maintenance to identify potential failures due to anomalies in the equipment (e.g., abnormal power usage) before they occur and for monitoring resource consumption and the dynamics of how resources are consumed in a way that could previously only be accomplished with the use of human judgement (Acemoglu and Restrepo, 2022; Raisch and Krakowski, 2021). In addition, algorithmic management systems increasingly generate the operational recommendations that workers are then asked to approve, a structural inversion of the traditional operator-machine relationship in which the machine now leads and the human confirms (Kellogg et al., 2020; Parent-Rocheleau and Parker, 2022). Research on similar settings including healthcare, aviation, and manufacturing process control shows that this design of automation-then-oversight restructures job roles and operational intelligence is transferred from the human expertise to the algorithmic systems. In addition, the workers that continue to operate under the new paradigm of automation followed by oversight do not have well-defined competencies, responsibilities, and performance measures (Bankins et al., 2024). For operators, the net effect is significant. The technical duties that were part of the operators' expertise have been taken over by automation.

Their previous role as an operator has now been changed to a supervisory (oversight) role i.e. monitoring dashboards, reviewing AI-driven alerts, validating automated recommendations, and bearing accountability for system-level outcomes. This change in the operators' roles corresponds with changes seen in other AI-driven industries where automation decreases the use of skills while also increasing the level of supervisory accountability. This results in a situation of role strain that cannot be completely resolved by existing frameworks (Bankins et al., 2024; Parker & Grote, 2022). It is this structural condition i.e. the coexistence of deskilling and elevated oversight that the framework advanced in Section 4 seeks to theorise.

Empirical Precedents from Analogous High-Stakes Settings

Empirical studies of data centre operators specifically remain scarce, a gap this paper addresses, theoretical grounding for the deskilling-yet-oversight paradox draws on a body of empirical evidence from structurally similar industries. Aviation and healthcare provide useful examples as AI and advanced automation have displaced experienced tech-based competencies while increasing human supervisory accountability in these industries. Controlled flight simulator study has empirically documented the effects of flight deck automation on pilots' professional expertise and their vigilance. Causse et al. (2024) investigated the effects of varying levels of cockpit automation on 20 professional airline pilots during landing. Overall, they found that increasing levels of cockpit automation reduced mental workload and positively impacted immediate flight performance metrics. Nevertheless, pilots' vigilance i.e. the ability to monitor primary flight instruments particularly flight path indicators and thrust parameters significantly declined. The study confirmed adverse effects of automation on visual monitoring and situational awareness, the competencies that define a pilot's ability to intervene meaningfully when automation fails or generates erroneous outputs. In other words, the findings of this study mirrored the core concepts of the theoretical paradox outlined here, that is, increased automation yields superior operational performance at the system level while simultaneously eroding the active competency of the human operator; thus, leaving the pilot with official responsibility for flight safety outcomes that their now-diminished monitoring skills may be insufficient to secure. Furthermore, the aviation literature documents that this deskilling effect results in role ambiguity as the pilots repositioned primarily as monitors of automated systems report reduced professional self-concept and difficulty articulating the nature of their contribution to safe flight outcomes, the identity dimension of the paradox (Causse et al., 2024; Parker & Grote, 2022).

In the healthcare sector, the integration of AI-assisted diagnostic systems has generated a similar paradox. Now, radiographers and radiologists frequently supervise the outputs generated by AI diagnostic tools that identify abnormalities, and validate the algorithms recommended by the programs. In doing so, their own diagnostic abilities are being underutilised (Hardy et al., 2025). In one mixed-method review, research revealed that AI-induced deskilling in medical settings manifests across different areas of competence, such as, diagnostic reasoning, procedural judgment, and clinical decision-making, as practitioners transition from performing a consulting role to approving algorithmic recommendations (Combalia et al., 2025). In another empirical survey study on UK, radiographers identified over-reliance on AI and the resultant loss of autonomous decision-making to be the most significant professional concerns. The respondents explicitly shared that the formal accountability for AI-assisted outputs had not been accompanied by appropriately structured

oversight roles or AI literacy training, producing precisely the nominal oversight dynamic this paper theorises (Hardy et al., 2025). The healthcare evidence is particularly relevant because it documents the identity dimension: clinicians whose expertise-based professional identity had been constituted through diagnostic mastery reported strong concerns about AI-induced role erosion and occupational self-concept threat.

Taken together, these empirical studies show that the theorised deskilling-yet-oversight paradox is an established structural condition across operationally critical industries. Furthermore, data centres, possessing the monitoring-intensive, high-accountability, and AI-automated characteristics of both aviation and healthcare, represent a natural extension of this established structure into a largely underexplored context of research. This paper presents the argument that it is specifically role identity erosion, not automation exposure by itself, that transmits the paradox into technostress outcomes. Moreover, the quality of human oversight determines whether this transmission is weakened or augmented.

Theoretical Foundations

Conservation of Resources Theory

The Conservation of Resources Theory (also known as COR), as proposed by Hobfoll (1989) and further developed by Hobfoll (2018) serves as the primary theoretical basis for understanding stress within the context of this model. According to COR, individuals are motivated to acquire, protect, and accumulate resources that they value which may include people, places, things, and energy. Stress occurs when those resources are threatened, lost or do not appear after substantial investments of resources. The main tenets of COR are particularly valuable to our understanding of these correlations between resources and stress. Hobfoll (1989) stated that the resource loss is disproportionately more salient than equivalent resource gain; this concept is referred to as the *loss primacy principle* (Hobfoll, 1989). Second, a loss will more likely make subsequent losses, thereby creating a loss spiral through which stress levels increase over time (Jiang et al , 2023; Sonnentag & Meier, 2024).

COR theory identifies professional expertise and occupational identity as valued resources in the context of data centre operator. When AI automation is utilized to replace the traditional technical tasks that data centre operators used to perform, then operators experience a direct and ongoing loss of resources. The operators' knowledge capital that they built through performing their job functions, such as fault diagnosis or equipment management, is rendered less functional in comparison to the speed and reliability of AI systems performing the same tasks. Furthermore, AI automation concurrently raises operators' accountability as HITL supervisors presenting new resource demands, like cognitive vigilance and interpretive judgment, without proportionately replenishing the resources. The combination of reduced resources and additional responsibility represents the condition that COR theory identifies as most likely to generate *loss spirals*. (Bon & Shire, 2022; Hobfoll et al., 2018).

The Conservation of Resources (COR) theory provides a resource-gain path; when people acquire new resources that compensate for lost resources, stress is buffered (Hobfoll, 1989; Sonnentag & Meier, 2024). This is the theoretical basis for the moderating proposition concerning the quality of the Human-In-the-Loop (HITL) developed in Section 4.3. When

operators exercise substantive decision-making authority, receive recognition, and develop AI-literacy capabilities, the HITL role establishes a *resource gain* that partially recompenses for technical expertise loss. However, when supervision is nominal, and no compensating resource gain occurs, then the loss spiral deepens (Bankins et al., 2024; Jiang et al., 2023). This dynamic of resource gain/loss, operationalised through the S-HITL/N-HITL classification, forms the moderating logic of this framework.

COR theory articulates the stress-process underpinning for this framework explaining how resource loss results in stress outcomes, and how loss spirals progressively intensify distress. However, assumes that all resources are generally exchangeable, thus indicating that any new resource, such as increased pay, social support, or recognition, may potentially act as a buffer for any past loss of resources. Therefore, it does not explain why the displacement of expertise that constitutes worker identity creates qualitatively distinct distress that cannot be addressed by generic compensation (Hogg et al., 2017; Johnson et al., 20204). Therefore, to entirely understand why the loss of occupational expertise is specifically detrimental in this context, social identity theory must be taken into account as well. In congregation, these two theories give a better account of the deskilling-yet-oversight paradox than either provides in isolation: COR theory gives explanation for the stress trajectory while SIT gives account of why loss of expertise specifically threatens professional identity in a manner that general substitution of resource cannot capture.

Social Identity Theory

Social identity theory (Tajfel & Turner, 1979; Turner et al., 1987) complements conservation of resource theory by explaining how AI-induced role changes threaten an operator's sense of identity. Self identity theory (SIT) posits that a significant portion of individual's self-concept comes from membership of social groups including occupational groups. Moreover, these social identities are maintained by making social comparisons that confirm the group is positively distinguished from others. Professional identity, the degree to which one's self-identity is attached to one's professional role as well as one's level of expertise within that role, characterises a salient kind of social identity for people working in highly skilled technical jobs (Bankins et al., 2024; Hogg et al., 2017). The professional identity of data centre operators is originally borne out of technical expertise that includes the diagnostic ability to timely intervene and resolve complicated issues that required specialized skills. This tech-based identity is both personally meaningful for each operator and is recognised socially by the occupational community (Bankins et al., 2024; Haslam et al., 2020; Hogg et al., 2017). Operators experience, what SIT identifies as, identity threat when AI automation substitutes their core competencies. Identity threat is defined as a condition in which the attributes that previously defined positive occupational distinctiveness are no longer functionally valued or socially recognised. Research on AI has shown that adoption of automated systems is viewed by workers as a negative indicator concerning their task capability, reducing self-perception of performance, thereby undermining an individual's occupational self-efficacy (Kilduff & Galinsky, 2013; Pan & Froese, 2023; Yam et al., 2023).

The relevance of SIT to the distinction of quality in HITL appears rather explicit. In the case of S-HITL, operators now have an alternative identity as expert overseers of AI which provides them with an identity resource to compensate for this new position of organisationally valued and consequential judgement. This results in *identity reconstruction*,

where the operators redefine their occupational distinction into a new, socially legitimate role and retain their positive self-concept even though their technical identity is displaced (Bankins et al., 2024; Turner et al., 1987). However, for N-HITL, there is no such opportunity for identity reconstruction as an operator is neither a technical expert since that role has become automated nor does the operator participate in meaningful decision-making as the supervision role is merely perfunctory. This *dual displacement* i.e. stripping the worker of the previous professional identity and denying the resources required to develop a new one denotes the most psychologically consequential arrangement of AI-induced work restructuring. This condition is most likely to produce continued stress outcomes. (Kellogg et al., 2020; Raisch & Krakowski, 2021; Sapkota et al., 2025).

SIT addresses the concept of identity threat; however, it does not explain the generation of progressive stress from the state of psychological identity threat. Moreover, it also does not provide the explanation of why some operators are successful in reconstruction of new identity while others fail to so do and get trapped in stress spiral. Furthermore, SIT does not take into account the compounding accountability demands that HITL oversight forces on the operators pushing them away from recovery even when they acknowledge their identity threat. The escalatory dimension is addressed by the logic of loss-spiral propagated by COR theory (Hobfoll et al., 2018; Jiang et al., 2023). Thus, the combined of both the theories, COR theory and SIT, is required to explain the framework proposed by this paper.

The Evolving Technostress Landscape

Brod (1984) originally conceptualised the term *technostress* and Tarafdar et al. (2007) operationalised it by conducting research on technology in organisations, identifying five dimensions of technostress: techno-overload, techno-invasion, techno-complexity, techno-insecurity and techno-unreliability. These five dimensions defined the primary underpinning of a proposed framework for technology-induced stress. Recent literature indicates that these original dimensions were developed within the general context of ICTs and are inadequate for identifying distinct sources of stress introduced by emerging AI systems (Caporusso, 2023; Sapkota et al., 2025). Further research conducted through a systematic literature review indicates that there are five specific sources of stress related to AI systems that were not included in the traditional technostress dimensions; techno-unpredictability, loss of autonomy, ethical or moral conflict, social erosion and career disruption. The literature concludes that existing frameworks for studying stress need to be revised and expanded to incorporate the newly identified sources of stress imposed on individuals by recent developments in AI technology. (Sapkota et al., 2025). The literature on technostress presents the outcome-level construct for this framework. While current research including Sapkota et al. (2025) systematic review of AI-specific stressors comprehensively provides the categories of AI-induced technostress, they have been developed mainly in the context of Western, large-organisation, and general knowledge-worker. This paper uses the technostress construct precisely in the perspective of technical staff in monitoring-intensive SMDCs, where the specific blend of operator deskilling and oversight liability creates technostress outcomes that existing frameworks have not studied in this form. The role identity erosion variable is used here as the organising mechanism that connects the COR-SIT framework to the stress outcomes identified in the broader literature (Bankins et al., 2024; Sapkota et al., 2025).

Each one of these AI-related stressors has a specific contextual relevance for data centre operators. Techno-unpredictability, a stressor empirically linked to increased distress in AI-intensive roles, is concentrated within the opacity of the AI recommendations as operators cannot readily question or validate the underlying algorithmic reasoning (Dang & Liu, 2025; Sapkota et al., 2025). Loss of autonomy, through AI-generated recommendations and alerts that shrink the decision-making space of operators, ultimately reduces the human judgement to ratification resulting in psychological strain and reduced self-efficacy (Parker & Grote, 2022; Tang et al., 2022). Literature on algorithmic accountability puts forth a concept of responsibility-without-agency burden, whereby operators bear liability for AI-initiated actions that they neither authorised nor fully understood (Crootof et al., 2023; EDPS, 2025). For SMDC operators, career disruption is perhaps the most significant stressor as their typical technical skills are rendered irrelevant, and they face uncertainty regarding competency with potential of long-term employability in an increasingly automated industry (Bankins et al., 2025; Jain & Srinivasan, 2022). These stressors, when combined, create the phenomenon called *AI-induced technostress*, which is a qualitatively distinct stress condition that traditional technostress frameworks only partly capture in the context of data centre operations. This framework expands on Sapkota et al.'s (2025) typology of AI-specific technological stressors (TTS) by explaining that the experience of TTSs do not stem from being exposed to automation per se, but rather from the way that TTSs disrupt role identity through eroding the resources of identity that previously provided meaning and competence to the operator's professional self-concept. Thus, the logical path of the mediation and erosion of role identity between AI and TTS in the Malaysian SMDC context is the central theoretical contribution this framework makes to the management literature.

The Conceptual Framework and Propositions

Based on Figure 1, the theoretical foundations introduced in Section 3, presents the conceptual framework of this study. This type of conceptual framework serves as an established method of synthesising theoretical mechanisms, developing new constructs, and generating research propositions in non-empirical studies of organisational behaviour and management (Whetten, 1989; Gilson & Goldberg, 2015). The framework consists of four elements, which include (1) the antecedents: AI operational automation in SMDCs, (2) the mediating process: operator erosion of role identity, (3) the moderating variable: quality of human oversight: S-HITL versus N-HITL and (4) the outcomes: technostress induced by AI and its dimensions. The framework also describes the pathways to organisational interventions (to be detailed in Section 5) that act as second order mechanisms impacting the quality of the oversight itself.

FIGURE 1: 1conceptual Framework – AI Automation, Role Identity Erosion, Oversight Quality, and Technostress

ANTECEDENT		MEDIATOR		OUTCOME
AI-Driven Automation in SME Data Centres • Predictive maintenance AI • Automated anomaly detection • AIOps task automation • AI-governed cooling management	→	**Role Identity Erosion** • Expertise devaluation • Role ambiguity escalation • Professional self-concept threat • Status incongruence	→	**AI-Inducted Technostress** • Techno-insecurity • Techno-unpredictability • Loss of autonomy stress • Career disruption anxiety

MODERATOR: Quality of Human Oversight – Substantive HITL (S-HITL: genuine judgement, override authority, role recognition) vs. Nominal HITL (N-HITL: perfunctory ratification, accountability without agency)

↑ S-HTL buffers identity erosion → technostress pathway | ↑ N-HITL amplifies identity erosion → technostress pathway

ORGANISATIONAL INTERVENTIONS (convert N-HITL → S-HITL): (1) Formal Role Redesign | (2) Contextualised AI Literacy Development | (3) Psychologically Safe Accountability Structures

Note: Arrows indicate proposed directional relationships consistent with the theoretical logic developed in Section 3 and 4. The dashed boarder denotes the moderating role of oversight quality. Organisational interventions act as second-order mechanism influencing the nature of the oversight.

AI-Driven Automation as Antecedent: The Deskilling-Yet-Oversight Paradox

The AI-driven automation in SMDC operations, the antecedent condition of the framework, is operationalised through four key technological domains collectively responsible for restructuring operator work: (1) predictive maintenance AI, that autonomously predicts and manages equipment failure; (2) automated anomaly detection, that detects infrastructural irregularities and generates response in real time; (3) AIOps platforms, that automate provisioning, configuration, and resource allocation decisions; and (4) AI-governed cooling management, that dynamically optimises thermal and energy systems without human intervention. Together, these technologies displace the technically trained, manually intensive tasks that established the core of data centre operator's role (Parker & Grote, 2022; Raisch & Krakowski, 2021).

The COR theory views this as double-bind as SMDC operators face resource loss while simultaneously experiencing increased resource demands in the shape of vigilant supervision of opaque AI systems and accountability for AI-generated results (Bon & Shire, 2022; Hobfoll et al., 2018). The SIT perspective states that SMDC operators are deprived of the identity-affirming technical expertise while being given an additional supervisory role with undefined and ambiguous competency requirements. Absence of processes of role redesign further intensify this ambiguity that is generated subsequent to AI adoption in resource-constrained SME settings (Budhwar et al., 2022; Kanapathipillai et al., 2024).

Role Identity Erosion as Mediator

Role identity erosion is proposed as the key mediator through which AI automation translates into stress outcomes. In this framework, role identity erosion is defined as the progressive decline in the psychological values associated with one's occupational role, which

occurs when technological advances displace or devalue the tasks and competencies that were mainly constituent of that role. The concepts of SIT's identity threat (Tajfel & Turner, 1979) and COR theory's resource loss (Hobfoll, 1989) are integrated to explain the mediating variable i.e. role identity erosion. The combination of these two theories produces a theoretically richer variable than either of the theories alone could. There exists a precedent for integration of these theories in the broader literature on identity reconstruction under technological changes. (Hogg et al., 2017; Haslam et al., 2020).

In the SMDC setting, three analytically distinct dimensions manifest role identity erosion. In the first dimension, expertise devaluation, the operator's technical expertise is rendered less relevant by AI-induced technologies that perform the diagnostic and interventional functions previously handled manually. This displacement by AI mirrors the deskilling aspect observed in other AI-intensive sectors (Tang et al., 2022; Jain & Srinivasan, 2022). Role ambiguity escalation, the second dimension, manifests role identity erosion: the traditional role of the operator is around AI oversight. However, the competencies, and performance criteria, required for the new role are not clearly defined. This ambiguity regarding the new role forms the ground for technostress outcomes (Kumar et al., 2024; Nazareno & Schiff, 2021; Tarafdar et al., 2007). In the third dimension, operators experience status incongruence where the peer recognition they previously received for being a technical expert has now been replaced by their ability to oversee, monitor, and use AI tools. These operators may perceive that the work they do with AI tools is less skilled and consequential, and can be easily replaced. This dynamic, status incongruence, is consistent with the SIT framework as the group is at risk of losing its unique identity (Tajfel and Turner, 1979; Yam et al., 2023). Collectively, these three dimensions of the erosion of operators' role identity provide a basis for operators' experiences of the AI-induced techno-stressors, as described by Sapkota et al. (2025).

Proposition 1: The greater the degree of AI-driven automation of core operational tasks in SMDC, the higher the level of role identity erosion experienced by operators.

Proposition 2: Role identity erosion mediates the relationship between AI-driven automation and AI-induced technostress among data centre operators, such that the effect of automation on technostress is transmitted through the progressive erosion of operators' expertise-based professional identity.

The Moderating Role of Oversight Quality: S-HITL vs. N-HITLr

The theoretical centrepiece of the conceptual framework outlined is the distinction between *S-HITL* and *N-HITL oversight arrangements*, which is viewed as a critical moderator for the relationship between identity erosion and technostress. This distinction is based upon the understanding that there is a broad disparity in functional quality of human participation in AI-mediated workflows. The mere presence of individuals in supervisory role does not guarantee them meaningful agency, decision-making authority, or identity-affirming contribution. (Crootof et al., 2023; EDPS, 2025). Hybrid human-AI systems that are poorly designed may compound the flaws of both the human and AI components by bringing about accountability without providing the benefits of true human judgment, while eroding the

worker's capabilities to render that accountability substantive (Crootof et al., 2023; Kellogg et al., 2020; Parent-Rocheleau & Parker, 2022).

In contrast to S-HITL, N-HITL is an environment in which operators are formally responsible to monitor the output of AI, but they do not possess the authority to dispute or challenge the output without incurring significant organizational cost. The time constraints and operational norms exacerbate the pressure on operators to ratify the AI-generated recommendations amount of pressure put on operators to ratify AI-based recommendations regardless of their own judgement. The oversight role entails no formal recognition as a distinct capability within organisational performance management system. Moreover, operators lack the necessary AI-literacy to critically evaluate the recommendations made by AI. Under N-HITL, operators experience *accountability without agency* as they bear the consequences of oversight without enjoying the resource-replenishing and identity-affirming benefits associated with real decision authority (Crootof et al., 2023; Dang & Liu, 2025; Sapkota et al., 2025).

The process through which the moderating effects of agency occur in both the S-HITL and N-HITL environments is informed by COR and SIT theoretical frameworks. In an S-HITL environment, operators that are exposed to AI develop a new identity as expert supervisors; thus, their identity erosion is buffered. Moreover, in consistency with COR, operators get resource gains such as AI-based competencies, formal recognition, and autonomous decision-making authority; these resources diminish the stress outcomes generated by loss of technical expertise (Hobfoll et al., 2018; Sonnentag & Meier, 2024). On the other hand, in N-HITL environments, identity erosion is amplified as it deprives operators of both the identities, the old one of being a technical expert and the new one of being a resourceful supervisor. This deprivation results in dual identity displacement which literature shows as the most damaging psychological consequence of AI-induced work restructuring (Kellogg et al., 2020; Raisch & Krakowski, 2021; Sapkota et al., 2025).

A theoretically significant corollary follows. COR theory predicts that N-HITL may yield poorer wellbeing implications than complete removal of automation, especially so for operators with high identity centrality (Johnson et al., 2024; Hogg et al., 2017). Under full automation, accountability is fully transferred to the system. Under N-HITL, operators retain accountability but have no authority, no meaningful competency or recognition, incur resource costs without resource gains, thereby experiencing the steepest loss spirals (Hobfoll et al., 2018; Jiang et al., 2023). Therefore, the most damaging recipe is not automation as such but presence of humans in name: operators who are left responsible but without any authority or means to render such responsibility meaningful (Crootof et al., 2023; Sapkota et al., 2025).

The Malaysian SMDC Institutional Context: Why N-HITL is the Structural Default

The claim that N-HITL is disproportionally produced in Malaysian SMDCs is not merely a contextual observation; it is necessary to develop a theoretical argument concerning the institutional mechanisms that produce this organisational outcome. There are three interlocking institutional logics that provide an explanation for the fact that N-HITL is the structurally expected configuration in this context as opposed to being a contingent or potentially correctable deviation. The first of these institutional logics is informal HRM driven

by *resource poverty*. SME organisations exist in environments characterised by structural resource constraints, which means that they cannot invest in formal people management infrastructure. SME scholarship identifies resource poverty as a defining characteristic of this institutional context, and encompasses the lack of financial resources in addition to a lack of slack i.e., time and managerial attention for strategic HRM decisions (Harney et al., 2022). Empirical studies of Malaysian SMEs specifically confirm that unlike large firms with formal HR departments and formal competency frameworks, Malaysian SME owner/managers rely on informal, relational, and ad-hoc mechanisms for managing people. These are mechanisms that are structurally unable to support the formalised role redesign, structured investments in AI literacy, and alignment of performance systems that S-HITL requires (Au & Stephens, 2023; Harney et al., 2022). The resource poverty argument is therefore not simply that Malaysian SMDCs cannot afford S-HITL; it is that the owner-managed institutional architecture of these organisations systematically directs managerial attention away from the human governance of technology adoption entirely.

The second institutional logic *is technology-governance decoupling*. In times of resource constraints in the organisation, AI is typically implemented only to gain the operational efficiency; therefore, any concerns related to impacts on the workforce are generally addressed reactively or inadequately or not at all from an operational perspective. Evidence from research across sectors related to SME adoption of AI further emphasises how the strategic advantages of AI only emerge when deployment of the technology is paired with appropriate investments in workforce reskilling, data governance and role integration. When no investments are made in these arenas, the deployed technology yields only isolated productivity improvements within defined operations but cannot be expected to produce enduring capacity for the organisation (Schwaeke et al., 2024). Within the SMDC context, while predictive maintenance and anomaly detection are examples of technologies used to reduce operational costs and to increase reliability of systems, the organisation utilizing these AI systems is not designed to allow operators to be effectively repositioned within the respective system. As a result, operators are assigned to oversight roles, but processes such as authority codification, training investment, or performance system alignment are not developed to support those assignments. Technology-governance decoupling is the mechanism that converts resource poverty from a general HR weakness into the specific configuration of N-HITL. Thus, creation of new oversight responsibilities by AI adoption outpaces the governance infrastructure needed to support these roles (Sawang & Sornlertlamvanich, 2025; Schwaeke et al., 2024).

The third institutional logic is the *labour market compression* in Malaysia. Specifically, Malaysian SMDCs are positioned in a labour market structurally compressed by the gravitational wage effects of Singapore. The workforce in Malaysia has strong incentives to migrate to Singapore for better wages (an estimated 1.13 million Malaysians work in Singapore). Most of those roles are represented by skilled or semi-skilled roles and these workers are attracted by significant wage increases (Kanapathipillai et al., 2024). The result of mobility is the retention paradox whereby organizations that need to invest on training and development of operators to equip them with AI-relevant competencies tend to become reluctant as they find the return on operator investment to be uncertain. Thus, the high attrition risk discourages the organizations to make such investments on workforce. Furthermore, there exists a persistent issue of skills mismatch between the competencies

produced by education and training and those that are required by the AI-intensive industries. The skill-gap has only widened with time because rate of technology adoption is higher than that of human capital development (Tee et al., 2024). Malaysia's data centre boom has been accelerated by foreign direct investment (FDI) rather than organic institutional building. While FDI managed to deploy technologically sophisticated AI systems in these data centres, the governance structures of these data centres did not keep pace with the advancement of technology (Kanapathipillai et al., 2024; Sawang & Sornlertlamvanich, 2025). These factors result in the condition specific to Malaysian context whereby technology advancements outpace the development of governance structures needed to manage the human implications of technology adoption.

In aggregate, these institutional aspects result in a logical rather than empirical conclusion that N-HITL represents the expected structural consequence with respect to Malaysian SMDCs. S-HITL is not precluded from occurring in this context; rather, the intervention pathways developed in Section 5 outline how organisations can disrupt these institutional arrangements. There is a heavy burden on organisations to undertake a deliberate, counter-institutional approach to action to avoid their trajectory towards N-HITL. However, if the organisations fail to do so, it is reasonable to conclude that the trajectory towards N-HITL is both theoretically anticipated and empirically aligned with HRM practices of Malaysian SMDCs and the institutional conditions of the sector.

Proposition 3: The quality of human oversight moderates the relationship between role identity erosion and AI-induced technostress, such that Substantive HITL (S-HITL) weakens the positive relationship between identity erosion and technostress, while Nominal HITL (N-HITL) strengthens it.

Proposition 4: SME data centres in Malaysia are disproportionately likely to generate N-HITL rather than S-HITL oversight arrangements thereby intensifying the identity erosion-to-technostress pathway for local operational staff as the predictable structural outcome of the Malaysian SMDC-specific context which precludes the organisational conditions necessary for substantive human oversight.

Organisational Intervention Pathways: Converting N-HITL to S-HITL

If the crux of this framework is the N-HITL configuration and if, without intentional organisational action, people management in Malaysian SMDCs is likely to remain at N-HITL level, then the fundamental practical question becomes: what kind of organisational practices can transform a nominal level of oversight into a substantial one, in effect buffering the identity erosion to technostress pathway? Three distinct intervention paths, derived from existing theories, are presented below:

Formal Role Redesign: Institutionalising the Oversight Identity

The most rudimentary intervention to manage the transition is to formally redesign operators' roles. The explicit, documented redefinition of the job architecture for a data centre operator must formally recognise the supervision of AI as a unique skill-set and as a part of its professional domain. Both research on AI adoption in organisational settings and

existing literature show that integration of new technologies without corresponding redesigns of the related organizational positions lead to structural identity gaps where the existing job descriptions no longer match actual duties (Budhwar et al., 2022; Parker & Grote, 2022). When operators' job descriptions continue to specify functions of technical maintenance that AI now performs while their actual work involves AI supervision, role ambiguity intensifies and the conditions for N-HITL are structurally entrenched.

Formal role redesign for S-HITL requires three dimensions: Firstly, *competency redefinition*: formal statement of AI oversight competencies such as critical appraisal of AI output, exception handling, system governance and validation of output as critical skill requirements replacing some technical competency areas (Budhwar et al., 2022; Pan & Froese, 2023). Secondly, *authority codification*: clear statement of the conditions where operators are authorised to override the recommendations of the AI systems and thus structurally removed from the tendency to simply affirm (Crootof et al., 2023; EDPS, 2025); and thirdly, *performance system alignment*: changes to performance appraisal mechanisms to evaluate and acknowledge AI supervisory skills, error detection, evidence-based overrides of the AI recommendations ensuring that supervisory judgement receives formal appreciation that sustains identity (Hobfoll et al., 2018; Haslam et al., 2020). From a COR perspective, redesigning of roles acts as an organisational resource forming the conditions whereby operators can gain new capabilities to replace old ones. From a SIT perspective, it allows identity reconstruction by giving a new and valued occupational position to operators. This position reinforces their identity as a specialist in human-AI interaction systems (Tajfel & Turner, 1979; Turner et al., 1987).

Contextualised AI Literacy Development

The second intervention path is about overcoming a specific competency gap, which directly causes N-HITL: the operator's insufficient knowledge of the AI system being supervised. General digital literacy programmes will not suffice here. Operators working in Malaysian SMDCs need to be provided with domain-specific competence development programs in AI literacy to equip them to critically evaluate the performance of AI system and make over-ride decisions (Ekuma, 2024; Pan & Froese, 2023). The contextually relevant AI literacy development needs three components. Firstly, system-specific comprehension training: hands-on learning about the AI systems applied in each specific facility, such as, predictive maintenance, anomaly detection, AIOps platforms including their performance criteria, error types and explainable outputs. Secondly, exception and override simulation: training the operators to correctly identify situations which necessitate override actions and document the process (Bankins et al., 2024; Ekuma, 2024); and thirdly, AI governance *literacy*: building a comprehensive knowledge of the ethical, accountability, and safety of AI-guided decision-making in high stakes operational environments (Crootof et al., 2023; EDPS, 2025).

From COR perspective, this intervention provides an individual resource at the operator level and mitigates stress related to perceived incompetence (Hobfoll, 1989; Sonnentag & Meier, 2024). Evidence of technical retraining under technological changes proves that such investment results in additional resource gains and enhanced job stability. This aspect of continuous learning is particularly important for data centre operations, where AI systems are being rapidly developed and improved (Bankins et al., 2024; Ekuma, 2024).

Psychologically Safe Accountability Structures

The third and final intervention path is designed to remedy the negative condition associated with N-HITL, the state of being accountable for something one has insufficient authority to manage, namely the AI-supervised operational output. Research in algorithmic management reveals that operators who report AI output discrepancies, refuse to rubber-stamp the AI recommendations or raise concerns about suspected mistakes, often end up paying for this vigilance. In a high-stakes, fast-paced setting like a data centre, this behavior is often suppressed due to concerns about career risk, strained relationships with the management and a general hesitation due to perceived procedural hurdles (Dang & Liu, 2025; Kellogg et al., 2020). Psychologically safe accountability structures establish conditions under which questioning of the AI's suggestions will be met not with subtle punitive measures, but with encouragement and support. It necessitates three interventions: Firstly, the establishment of formal pathways for escalation of questionable AI output-clear procedures allowing operators to formally report perceived anomalies and have human operators verify decisions, without substantial procedural obstacles (Crootof et al., 2023; EDPS, 2025). Secondly, promotion of a blameless error-review system to establish how all errors at the human-AI interface will be used for learning and improvement instead of direct individual blame, mitigating the moral and psychological burden of operational accountability (Parker & Grote, 2022; Sapkota et al., 2025); and thirdly, ensuring that managers have sufficient AI-training and knowledge to endorse operators' override recommendations when there is a disagreement with the AI output (Bankins et al., 2024; Pan & Froese, 2023). From COR perspective, psychologically safe accountability structures act as organizational resources that mitigate ethical and moral conflict-induced stressors associated with AI technologies (Sapkota et al., 2025; Hobfoll et al., 2018). From SIT perspective, this supports operators' identity by valuing and supporting their professional judgement (Haslam et al., 2020; Tajfel & Turner, 1979).

Proposition 5: Effective organisational interventions convert N-HITL toward S-HITL arrangements, thereby moderating the identity erosion-to-technostress relationship and attenuating AI-induced technostress among Malaysian SMDC operators.

Discussion, Implications, and Conclusion

Theoretical Contributions

This paper makes several contributions to the literatures on AI and management. First, it provides an integrated theoretical framework applying the deskilling-yet-oversight paradox, a structural phenomenon demonstrated in aviation, healthcare, and industrial process control, to the context of Malaysian SMDCs. This paper integrates the said paradox into a cohesive COR−SIT mediated moderation model for the operational staff of Malaysian SMDCs making a contextual and theoretical contribution to the body of knowledge of this understudied sector.

Second, this paper expands the contemporary HITL scholarship from the regulatory and engineering domains (Crootof et al., 2023; Kellogg et al., 2020) into the perspectives of human resource management and organisational behaviour. Using the theoretical grounding of COR and SIT, it is reasoned that the quality of human involvement leads to either identity

reconstruction or identity displacement. The utilisation of this distinction to the unique institutional context of Malaysian SMDCs represents the paper's key contextual contribution.

Thirdly, by contextualizing the framework within Malaysian SME data centres, this study adds to the small but growing literature on AI and work research that considers non-Western, SME organizational contexts. Most existing research on AI and work is from Western, large organizations (Kim et al., 2025; Pan & Froese, 2023;). The particular institutional conditions of Malaysian SMDCs such as informal people management systems, pressure from talent mobility, shortages of skilled local talent, and accelerated AI implementation without commensurate investment in the organization, create distinct pressures on operators with AI that are theoretically informative for future empirical investigation.

Practical Implications

The research offers some guidelines for operations managers in Malaysian SMDCs, with or without dedicated HR departments, the framework offers a set of practical recommendations organized around the need to shift toward S-HITL work. The most immediate practical recommendation is to articulate and document operator authority over AI i.e. in what situations can operators choose not to adhere to or must escalate AI suggestions and through what procedures. These recommendations can be implemented by revising operating procedures, which require minimal resource expenditure but significant management intent and commitment. For policymakers, industrial and regulatory bodies, the framework points to the limitations of training programs that focus solely on upskilling workers' technical capabilities while neglecting the governance and accountability structures within which new AI competencies must be deployed. AI literacy programs that fail to facilitate substantial oversight create workers with nominally enhanced skills who remain subject to the constraints of N-HITL, wasting training investments and perpetuating role identity and well-being harms as identified in this framework.

Limitations and Future Research Agenda

As a conceptual paper, this research suffers from the lack of empirical validation for the propositions set forth. The propositions are logically derived from theory but need empirical testing. Following directions are proposed for future research. First, further theoretical work on the distinction between S-HITL and N-HITL may be done to conceptualize it into testable scales in the fields of automation, human factors, and algorithmic management. Second, quantitative survey research with operators of Malaysian SMDCs to test mediated moderation relationships identified in Propositions 1 through 5 using structural equation modeling may be done to generate empirical data for this particular population. Third, qualitative work through interviews and observations with both managers and operators in Malaysian SMDCs may demonstrate how the S-HITL/N-HITL condition is experienced, communicated, and contested within organizations with weak HR structures. Fourth, comparisons between Malaysian and other Southeast Asian SMDC contexts, specifically Thailand and Vietnam, which are also experiencing rapid data centre sector growth, may enable the examination of the cultural and institutional boundary conditions of this framework. Fifth, the effectiveness of HRM interventions may be explored through longitudinal, experience-sampling studies that observe operators over months following AI implementation.

Conclusion

This study shows that deployment of AI systems into Malaysian SMDCs gives rise to a challenging occupational condition for operators: the technical expertise that constitute the core of their occupational identity is progressively displaced by AI-induced technologies, while their formal accountability as supervisors of such systems simultaneously intensifies. An integrated conceptual framework has been developed by utilising the theoretical foundations of conservation of resources theory and social identity theory. This framework seeks to theorise how deskilling-yet-oversight paradox produces role identity erosion that mediates the pathway to AI-induced technostress in the underexplored context of Malaysian SMDCs.

This study critically argues that the consequences generated by the deskilling-yet-oversight paradox are not always negative, rather they depend on the quality of human involvement in the AI-mediated workflows. The paradox generates operator's identity reconstruction and resource gain in S-HITL context where operators are able to exercise genuine decision-making authority, develop AI-relevant skills, and receive formal recognition for their supervisory role. On the other hand, the paradox generates dual identity displacement and stress spiral whereby N-HITL arrangements reduces oversight to accountability without agency. In Malaysian SMDCs, with their informal people management structures and constrained AI literacy investment, N-HITL is the likely default outcome making the organisational intervention agenda advanced here not merely beneficial but necessary.

Malaysia's data centre sector's exponential growth with deepening AI deployment across operational functions calls for scholarly attention to explore the human psychological aspect of these AI-induced technological advancements. The SMDC operators who sustain these lived experiences under the the oversight of systems neither designed nor fully understood by them deserve frameworks, organisational policies and practices that take into account their identity, wellbeing, and professional agency. This paper offers a theoretical starting point for that necessary and timely agenda.

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