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EXPLORING WORK-LIFE BALANCE AMONG TECHNICIANS IN KULIM HIGH-TECH MANUFACTURING SECTOR – A PRELIMINARY STUDY

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ABSTRACT

This study explores the lived experiences of technicians working rotational shifts in multinational manufacturing firms within Malaysia's Kulim Hi-Tech Park. As Malaysia positions itself as a global hub for high-tech industrialization, technicians remain the backbone of continuous production processes. However, the work-life balance (WLB) of these shift-based employees often receives limited scholarly and policy attention. Guided by Spillover Theory, this qualitative case study aims to understand how long working hours, night shifts, and workplace dynamics affect technicians' well-being, family life, and overall satisfaction. Purposive sampling was used to select six participants: four technicians, two human resource (HR) representatives, and one labour department officer. Data were collected through semi-structured interviews conducted both online and face-to-face. Thematic analysis based on Braun and Clarke (2006) six-step framework revealed three key themes: (1) workplace culture and lack of collaboration, (2) family life impacts due to misaligned shifts, and (3) physical and mental exhaustion caused by prolonged work hours. Despite HR efforts to provide health benefits and counselling services, technicians continue to experience spillover effects from work to home, especially among women and caregivers. Findings highlight critical gaps in manpower planning, institutional support, and policy implementation, particularly concerning after-hours expectations and overtime dependency. The study calls for improved coordination between HR, production teams, and government agencies to develop more inclusive and shift-sensitive WLB policies. This preliminary research contributes to addressing the silent challenges faced by Malaysia's technical workforce and emphasizes the need for human-centric approaches in industrial policy planning.

Keywords: *Manufacturing technicians, shift work challenges, work-life balance*

INTRODUCTION

The concept of work-life balance (WLB) has gained significant attention in both academic and professional discourses due to its implications on employee well-being, productivity, and organizational sustainability. As the boundary between work and personal life becomes increasingly blurred, particularly with technological advancement and performance-driven cultures, maintaining a balance is now viewed as a critical component of workforce resilience (Bella, 2023). In Malaysia, this trend mirrors global observations. Randstad (2025) reported that 83% of Malaysian employees ranked work-life balance as a top career priority, surpassing salary (82%), highlighting a paradigm shift in employee values and expectations. The increasing pressure to manage career demands while maintaining family and personal commitments presents an urgent need for organizations to rethink traditional work models, especially in high-pressure environments.

One of the most pressing challenges to achieving WLB stems from shift-based work, which remains prevalent in industries that operate continuously, such as manufacturing and the healthcare sector. Technicians are the key personnel in maintaining the smooth functioning of industrial operations often face unique stressors due to long working hours, night shifts, physical strain, and a lack of schedule flexibility (Costa, 2003b; Harrington, 2001). Likewise, technicians in Malaysia's

multinational manufacturing firms are often tasked with maintaining the reliability of production lines while coping with inflexible schedules and demanding managerial expectations. Studies by Das and Palo (2025) and Lee et al. (2021) supported that these shift patterns not only disrupt circadian rhythms but also adversely impact sleep quality, mental health, and family relationships, thereby worsening work-life imbalance.

Meanwhile, it is well understood that the working nature of technicians in these environments is shift-based, often involving extended hours, night rotations, and minimal flexibility to accommodate personal or family life (Costa, 2003b; Das & Palo, 2025; Harrington, 2001; U.S Bureau of Labor Statistics, 2024). These demanding schedules are necessary to ensure uninterrupted operations, but come at a cost to technicians' personal well-being and social participation. Despite their critical role, the lived experiences of technicians working in such high-performance and shift-intensive environments remain underexplored. While existing research on work-life balance in Malaysia tends to focus on white-collar employees or adopt a quantitative approach, it often overlooks the nuanced and complex challenges faced by technical workers in the manufacturing sector (Noor & Mohd Mahudin, 2015; Rahman & Sing, 2024).

Emerged as one of Malaysia's premier hubs for high-technology manufacturing, Kulim Hi-Tech Park plays a strategic role in advancing the nation's industrial ambitions. The technology park, situated in the northern region of Malaysia, is home to numerous multinational corporations involved in the semiconductor, electronics, and precision engineering industries. As of 2023, the park has attracted over RM70 billion in investments, positioning itself as a major contributor to Malaysia's high-tech manufacturing output and employment growth (MIDA, 2023). As Malaysia strives to become a competitive global player in the high-tech supply chain, the role of human capital—particularly skilled technicians—becomes increasingly central to sustaining industrial expansion and technological leadership (Rasiah & Yap, 2015).

Hence, this study responds to that gap by giving voice to technicians in the northern manufacturing corridor, acknowledging their critical role in supporting Malaysia's economic aspirations. Given the significance of the technology park's contribution to national development, we believe that managing the well-being of the human capital behind this rapid industrial growth is both timely and well justified. Hence, this study aims to explore the personal experiences and challenges of work-life balance among technicians working in shift-based roles in multinational manufacturing firms in Kulim Hi-Tech Park, Malaysia.

LITERATURE REVIEW

Work-Life Balance: Definition and Dimensions

Work-life balance (WLB) refers to an individual's ability to manage both their work and personal responsibilities effectively, ensuring that one domain does not significantly interfere with the other. It involves achieving harmony between professional commitments and individual aspirations in a manner that promotes psychological, physical, and emotional well-being (Majini Jes Bella, 2023). The concept is highly individualistic and dynamic, varying according to life stages, job roles, and personal expectations.

A central feature of WLB is time management, which entails the effective allocation of time to both work-related duties and personal activities. This skill allows individuals to maintain control over their schedules and prevent one domain from dominating the other. Another critical dimension is boundary setting, where individuals clearly distinguish between work and personal time, thereby reducing spillover and psychological strain (Wolters & Brady, 2021).

Fulfilment and flexibility are also vital components of work-life balance. Fulfilment refers to an individual's sense of satisfaction and achievement in managing both work and life roles (Abdirahman et al., 2020). Flexibility, on the other hand, reflects the ability to adjust work or personal schedules to accommodate the demands of both work and personal life (Ray & Pana-Cryan, 2021). These dimensions collectively contribute to a balanced lifestyle where individuals experience reduced stress, increased motivation, and improved performance in both personal and professional spheres.

A Spillover Theory Perspective on Work-Life Balance

The Spillover Theory provides a foundational perspective on understanding the interconnection between work

and personal life. It suggests that experiences, emotions, attitudes, and behaviors in one life domain can spill over into another, thereby creating either positive or negative outcomes. Conceptualized initially to explain how job-related stress or satisfaction may influence home life, the theory helps clarify the fluid boundary between work and non-work domains (Clark, 2000; Staines, 1980). The theory posits that high job demands, irregular schedules, and emotional strain experienced at work can carry over into an employee's personal life, affecting health, relationships, and overall life satisfaction. This is particularly evident in shift-based technical roles, where physical fatigue or workplace pressure frequently undermines time spent with family or engagement in personal interests. Positive spillover can also occur, though it is less common in demanding work environments. This theory provides a valuable framework for analyzing how technicians in multinational manufacturing firms experience work-life imbalance. The theory supports the examination of how long shifts, role overload, and management expectations not only affect workplace outcomes but also extend into technicians' personal lives, contributing to stress, fatigue, and disengagement from social and family roles.

According to Figure 1, there are six central components and indicators of the happiness index, which are: (1) physical; (2) social; (3) emotional; (4) living environment; (5) economic, and (6) education. These components and indicators are used to assess a community's level of happiness and to ensure its general well-being increases alongside the development conducted by the government. Goal 11 in the Sustainable Development Goals (SDGs) outlines a global framework for creating sustainable cities and communities, fostering happier cities. The promotion of secure, resilient, and sustainable development is the key to improving quality of life, rather than just economic indices (Arslan et al., 2016; Muin et al, 2024; Modu et al., 2024). Aside from Malaysia, many cities worldwide have adopted this approach. Therefore, by learning from their experiences, the Malaysian local governments can better improve their future growth strategy.

Overview of Technicians' Working Conditions in the Manufacturing Sector

Technicians serve as the operational backbone of manufacturing industries, particularly within multinational corporations where uninterrupted production is essential. Their responsibilities include operating, maintaining, and repairing complex machinery, ensuring that production lines run efficiently and safely (Freeman & Aspray, 1999; Lewis, 2019). Due to their technical expertise and hands-on role, technicians are indispensable in supporting the high output demands of industrial environments. The nature of their work, however, places them at the frontline of operational pressures, where the expectation for availability, accuracy, and resilience is exceptionally high (U.S Bureau of Labor Statistics, 2024).

Technicians in manufacturing firms often work in rotational 12-hour shifts, including night and weekend cycles, to support 24/7 production schedules (Das & Palo, 2025). These rotating schedules are designed to minimize tool downtime and maximize productivity. However, the rigid nature of these work patterns disrupts technicians' daily biological rhythms and lifestyle routines. Some technicians are required to work alternating days and night shifts each month, and often use their days off to cover overtime due to production demands. These arrangements leave little time for rest or personal commitments (Costa, 2003a; Harrington, 2001).

Shift work poses significant challenges to technicians' ability to manage personal responsibilities. Disrupted circadian rhythms contribute to poor sleep quality and prolonged fatigue, while irregular schedules hinder participation in family events and social life (Lee et al., 2021). Female technicians, especially those in later stages of pregnancy or with caregiving duties, experience greater difficulties in aligning their work with family needs. Interviews from the current study highlighted that these technicians often resorted to leaving their children with relatives due to mismatched shifts with their spouses, causing emotional strain and exhaustion.

The physical demands of technical roles, including prolonged standing, repetitive movements, and manual handling of machinery, contribute to musculoskeletal disorders and chronic fatigue (Hoogendoorn et al., 2002). Mentally, the stress from shift rotations and workplace pressures often leads to anxiety, mood disturbances, and low motivation (Dall'Ora et al., 2016). Technicians in the study also reported experiencing migraines, sleep disruptions, and feelings of being overwhelmed—especially when organizational support was lacking.

Over time, these conditions contribute to job dissatisfaction and absenteeism (Costa, 2003a; Das & Palo, 2025).

Unlike white-collar roles, technicians typically lack access to flexible work arrangements due to the need for physical presence on the shop floor. Practices such as flexi-hours, job sharing, or hybrid work are not feasible for hands-on technical tasks (Noor & Mohd Mahudin, 2015). This rigidity limits their autonomy and intensifies work-life conflicts. The lack of structural flexibility and supportive workplace policies exacerbates stress, leading to reduced concentration and increased error rates (Khoshakhlagh et al., 2023). Overworked and fatigued technicians are more prone to workplace accidents and disengagement, ultimately impacting operational efficiency and organizational performance (Alias et al., 2022a; Xu et al., 2023). In summary, technicians in multinational manufacturing environments face multifaceted challenges to achieving a work-life balance, stemming from inflexible shift structures, heavy physical demands, limited workplace flexibility, and inadequate support mechanisms. Table 1 summarises the overview of technicians' work conditions in the manufacturing sector.

MATERIALS AND METHODS

This study aimed to explore the WLB experiences of shift-based technicians in multinational manufacturing firms located in the Kulim Hi-Tech Park, a key industrial zone in Northern Malaysia. The research was grounded in Spillover Theory, which conceptualizes how work-related stressors can affect personal and family life. A qualitative case study design was employed to gather in-depth, context-rich insights from frontline technicians.

Study Design and Participant Selection

A single-case exploration design was adopted to understand the WLB challenges among technicians within a shift-intensive manufacturing environment. Participants were selected using purposive sampling, a non-probability technique commonly used in qualitative research to select information-rich cases that are most relevant to the study's objectives (Patton, 2002). This method enabled the selection of technicians with direct experience in 12-hour rotational shifts. The inclusion criteria focused on those who had worked in production or maintenance roles for at least one year and could provide insight into daily challenges related to work-life balance. Four participants (T1–T4) were selected to represent a cross-section of the population in terms of gender, parental status, and shift type. Additionally, two human resource representatives and one representative from the Department of Labor were interviewed to provide institutional and policy-level perspectives that informed the way forward.

Table 1 Overview of technicians' work conditions in the manufacturing sector

Theme	Details	References
Role of Technicians	Operate, maintain, and repair complex machinery; crucial to 24/7 production efficiency	(Freeman & Aspray, 1999; Lewis, 2019)
Work Nature	12-hour shifts (including nights/weekends); limited rest and personal time	(Costa, 2003b; Das & Palo, 2025; Harrington, 2001)
Impact of Shift Work	Disrupted circadian rhythms, fatigue, limited family/social time	(Lee et al., 2021)
Physical and Mental Strain	Musculoskeletal disorders, fatigue, migraines, anxiety, and burnout	(Costa, 2003a; Dall'Ora et al., 2016; Hoogendoorn et al., 2002)
Lack of Flexibility	Infeasibility of flexi-hours or hybrid work intensifies work-life conflicts	(Noor & Mohd Mahudin, 2015)
Organizational Impact	Reduced focus, higher error rates, safety risks, and lower productivity due to fatigue and disengagement	(Alias et al., 2022b; Khoshakhlagh et al., 2023; Xu et al., 2023)
Insufficient Support Mechanisms	Lack of organizational policies and support systems exacerbates stress and dissatisfaction	Current study; Dall'Ora et al. (2016)

Data Collection

Semi-structured interviews were conducted with all six participants, utilizing a combination of face-to-face and online modes, depending on the participant's preferences. Interview questions were shared in advance via email and WhatsApp to allow participants time to reflect on their responses. Each interview lasted between 60 and 90 minutes and was audio-recorded with the participant's consent. Table 2 presents the instrument used for interviewing the technician.

Data Analysis

The data were analyzed using a thematic analysis approach, following Braun and Clarke's (2006) six-phase method. Transcripts were first reviewed repeatedly for familiarization, then coded and categorized into key patterns. Themes and subthemes were defined and refined to align with the research questions and Spillover Theory. Three main themes emerged: (1) Workplace Culture and Collaboration, (2) Family Life Impacts due to Shift Work, and (3) Physical and Mental Exhaustion from Long Working Hours. These themes reflect the lived realities of technicians working in high-performance, shift-based manufacturing settings. In line with Zhang et al. (2024), who highlighted the value of prompt design and transparency in AI-assisted thematic analysis using ChatGPT, this study ensured methodological rigor through structured manual coding and iterative theme refinement. Table 3 summarizes the step-by-step procedure of thematic analysis.

FINDINGS PRESENTATION AND DISCUSSION

Workplace Culture and Collaboration

A collaborative work culture is highly valued by technicians, particularly in environments that demand teamwork and trust for smooth operations. Ideally, collaboration among technicians and open communication with supervisors can help distribute workload and reduce stress. However, data from this study revealed a mismatch between this ideal and the actual experiences of participants.

"T1 expressed that technicians are supposed to work together, be helpful, and distribute work evenly, but I have to take care of the whole work. Even when the production line has issues, I have to cover alone, despite the availability of the workforce. Every day I feel stressed due to the pile-up of work. I reported this to the supervisor, but no action was taken."

Table 2 Instrument used for technicians (guided by Spillover Theory)

Spillover Dimension	Focus Area	Interview Questions
Work → Personal Spillover	Shift schedule and fatigue	How does your current shift schedule affect your ability to rest or manage personal time?
	Physical and emotional health	Have you experienced physical or mental fatigue due to work demands? How does it affect your personal or family life?
	Stress transfer to home	Does workplace stress influence your mood or how you interact with your family members?
Personal → Work Spillover	Family and caregiving responsibilities	Are there times when personal or family obligations affect your ability to focus at work?
	Health or parenting concerns	How do your personal health or parenting duties impact your job performance or attendance?
Bidirectional Spillover	Work-family conflict or enrichment	Do you feel your work and personal roles often conflict? If so, how do you manage this?
	Support and adaptation strategies	What strategies or support systems help you manage both work and personal responsibilities?
Organizational Influence	HR policies and managerial support	Have your supervisors or HR provided any support to improve your work-life balance?
	Workplace flexibility and accommodations	Are there policies or practices in place that help you balance your job and personal life?

Table 3 Step-by-step procedure of thematic analysis

Braun & Clarke (2006)	Procedures Applied in This Study
Familiarization	Transcribed interviews into labelled files (e.g., T1–T4); read repeatedly to understand depth
Generating Initial Codes	Conducted open coding in Microsoft Word; highlighted emerging issues around work, health, family
Searching for Themes	Grouped similar codes into broader categories (e.g., collaboration issues, family strain)
Reviewing Themes	Refined and validated subthemes with reference to the study's objectives and Spillover Theory
Defining and Naming Themes	Developed clear definitions for each theme and subtheme; eliminated redundant or vague labels
Producing the Report	Structured findings into narrative form with supporting quotes; aligned with study objectives

In this case, the technician, who was seven months pregnant, not only experienced an unequal workload but also a lack of managerial intervention after raising concerns. This reveals a breakdown in organizational support systems and highlights how a weak collaborative culture can cause emotional distress and physical overexertion. According to Spillover Theory (Staines, 1980), negative experiences at work can spill over into personal life domains, affecting not just physical well-being but also personal relationships and recovery time. Lack of support from peers and supervisors can thus reduce job satisfaction and contribute to mental fatigue at home.

Family Life Impacts Due to Rotational Shift Work

Rotational working shifts are a standard requirement in the manufacturing sector, designed to sustain 24/7 production with minimal downtime. While these systems are critical to operational efficiency, they come at a substantial personal cost to technicians. The technicians interviewed emphasized how rotational shifts interfere with family routines, caregiving responsibilities, and social engagement.

"T2 expressed that she is not into working shifts as there's inadequate time to spend with her husband and kids. Her husband is on his off days when she has to work, and if her night shifts clash with her kids' afternoon school sessions, she rarely sees them."

Rotational scheduling leads to chronically misaligned family routines, with technicians missing key family moments despite living in the same household. This contributes to emotional disconnection and parental guilt, which can further reduce motivation and satisfaction. These findings are consistent with previous studies that have shown how shift work negatively affects family cohesion and increases psychological strain among workers, particularly those with caregiving responsibilities (Costa, 2003a; Lee et al., 2021; Ogeill et al., 2021). Additionally, even when off days are available, they are often absorbed by overtime obligations, further limiting opportunities for rest or quality family time (Dall'Ora et al., 2016; Das & Palo, 2025).

"There is a few rotational working shifts scheduled to cater to manpower needs at the production site. Though we have off days, they are often used to work overtime to meet production needs. Only one day is available to rest before starting back to work."

From the Spillover Theory perspective, such persistent conflict between work demands and personal life not only diminishes family satisfaction but also undermines technicians' ability to recover emotionally and mentally, which can lower engagement on both fronts.

Physical and Mental Exhaustion from Long Working Hours

Long working hours, particularly 12-hour shifts, were identified as a key factor contributing to exhaustion, burnout, and physical discomfort among technicians. The physical and mental toll of extended shifts is especially evident among female technicians who are pregnant or have caregiving responsibilities. These individuals often experience compounded fatigue due to the dual demands of their work and home roles. For pregnant technicians, the physical strain is intensified by insufficient rest periods and the absence of appropriate workplace accommodations.

Although rest is crucial during pregnancy, off days are frequently occupied with overtime work, leaving little time for recovery. This situation not only impacts their physical health but also contributes to emotional stress, underscoring the need for more supportive and flexible workforce policies.

"T1 expressed that although the working time aligns with my husband, I am unable to spend time with my kids. During my pregnancy, *I needed more rest on my off days. Before pregnancy, I could still spend some time with my kids, but when both of us are busy, I had to leave them with my father."*

The participant's comment illustrates how workload spillover impacts maternal roles, necessitating reliance on extended family for childcare. Moreover, T1 explained that night shifts are particularly damaging:

"T1's shift rotation consists *of 12 hours morning shift a month and 12 hours night shift a month. T1 prefers the morning shift as night shifts deteriorate her health. Symptoms like migraine and inability to sleep occur."*

This aligns with findings from Costa (2003a) and Lee et al. (2021), who also noted that prolonged shift work is associated with disrupted circadian rhythms and significant health issues. The adverse health outcomes of night work, such as sleep disorders, migraines, and fatigue, represent a critical spillover of physical strain into technicians' private lives. Additionally, male technicians reported needing to perform excessive overtime to support household finances. T4 shared:

"I must perform overtime at least 50 hours a month to have extra money for savings and emergencies. My wife, who works in the public sector, takes care of the kids after her working hours. Our combined income is just enough to cover monthly expenses."

This quote emphasizes the financial pressure technicians face and how it intensifies the need to compromise rest and family time for income stability. Another form of negative spillover occurs when economic demands from home reinforce overwork at the factory. Hence, a summary of the findings is presented in Table 4.

CONCLUSION

This study examines the lived experiences of shift-based technicians in Malaysia's high-tech manufacturing sector, focusing on the challenges they face in achieving work-life balance. Guided by Spillover Theory and qualitative insights, the findings indicate that technicians experience considerable strain from long working hours, rotational shifts, weak collaborative practices, and insufficient rest periods. These pressures are further intensified by family responsibilities, health concerns, and, in some cases, limited responsiveness

Table 4 Summary of the findings

Theme	Subtheme	Description	Illustrative Quotes (Technician ID)
Workplace Culture and Collaboration	Lack of Peer Collaboration	Technician left to handle workload alone despite presence of others	*"T1: I have to take care of the whole work… cover alone despite manpower."*
	Inaction from Supervisors	Supervisor fails to respond to technician's report of stress	*"T1: I reported to the supervisor, but no action was taken."*
Family Life Impacts Due to Shift Work	Incompatible Family Schedules	Technicians' shifts misalign with spouse and children's schedules	*"T2: I rarely see my husband or kids due to my night shift schedule."*
	Parental Guilt and Emotional Strain	Technicians rely on relatives to care for children during shifts	*"T1: I had to leave my kids at my father's place."*
Physical and Mental Exhaustion	Health Effects of Night Shifts	Night work leads to physical health problems	*"T1: Night shifts deteriorate my health. I get migraines and can't sleep."*
	Lack of Rest Due to Overtime	Off days spent working overtime; minimal recovery time	*"Only one day is available to rest before starting work again."*
	Pregnancy and Vulnerability	Pregnant technician lacks recovery time	*"T1: Pregnancy period requires me to rest more… but I still have to manage work."*
	Financial Pressure on Male Technicians	Overtime required to meet financial needs due to inflation	*"T4: I do 50 hours of overtime a month just to save for emergencies."*

and support from management and supervisors. Human resource management plays a critical role in shaping technicians' work-life conditions; however, while initiatives such as medical benefits, panel consultations, and counselling services are available, their effectiveness is reduced when technicians are still expected to provide support beyond official working hours. At the policy level, the Department of Labour under the Ministry of Human Resources has introduced legal amendments, including Sections 60P and 60Q of the Employment Act 1955, to address work-life balance, yet implementation within shift-based manufacturing settings remains limited and insufficiently tailored to technical roles. Moving forward, stronger collaboration among HR departments, production teams, and government agencies is required to develop workforce policies that reflect the realities of shift work. This includes reviewing workforce planning, improving handover procedures, and reducing after-hours dependency. At the national level, continued engagement between the Human Resource Ministry and industry stakeholders is essential to ensure work-life balance initiatives extend beyond office-based settings and effectively support Malaysia's technical workforce, which is vital to the nation's industrial growth..

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