



**SELINUS UNIVERSITY**  
OF SCIENCES AND LITERATURE

**Cross-Sectional Assessment of Shift Patterns and Occupational Stress as Predictors of Absenteeism and Sewing Output Quality in a Specific Production Line of a Sri Lankan Apparel Factory**

By Gerald Dave Michael Ranasinghe

**A THESIS**

Presented to the Department of  
Business Administration  
program at Selinus University

Faculty of Business & Media  
in fulfillment of the requirements  
for the degree of Doctor of Philosophy in  
Business Administration

2026

## **Abstract**

The apparel sector in Sri Lanka is a crucial part of the country's economy, directly employing a significant work force, in comparison to the total work force, of which 80% are women. The sector contributes a significant proportion of the total export revenue of the country.

So, the fact of the matter, is that the apparel sector depends on shift-based production across the country. It has been observed that there has been a major gap of knowledge regarding the relationship between psychosocial stressors and operational results in this cultural context.

This thesis was intended to test the association between shift patterns, psychosocial factors, work-family conflict, sleep quality and occupational stress and their effects on occupational performance (absenteeism, sewing defects and output) covering 50 sewing machine operators in a single production line of a factory. Validated instruments (Pittsburgh Sleep Quality Index, Work-family conflict Scale) were administered alongside six months of objective organizational records on absenteeism and quality.

The results demonstrate the existence of a strong relationship between evening shifts and a high degree of Work-family conflict (WFC), poorer sleep and greater occupational stress than morning shifts. Psychosocial factors predicted the outcomes, operational stress, as they emerge as the strongest predictor of both absenteeism's and sewing defects. Moreover, occupational stress was identified as one of the most significant mediators between evening shifts and poorer performance.

These findings demonstrate that worker well-being and productivity are mutually reinforcing in a sustainable manufacturing environment. Such evidence proves that the ability to support employees with evidence-based shift scheduling and stress reduction interventions may improve employee health and well-being and operational results, and is the key to enabling a comparative advantage that enables manufacturing excellence.

**Table of Contents**

Chapter 1: Introduction ..... 1

    1.1 Background of the Study ..... 1

        1.1.1 Sri Lanka's Apparel Industry Context ..... 1

        1.1.2 Shift Work Prevalence and Necessity..... 2

        1.1.3 Occupational Health Challenges in Manufacturing ..... 3

    1.2 Statement of the Problem ..... 4

        1.2.1 Identified Gaps in Current Understanding ..... 4

        1.2.2 Operational Challenges Facing the Industry ..... 6

        1.2.3 Societal and Economic Implications ..... 9

    1.3 Research Objective / Aim..... 11

        1.3.1 Specific Objectives..... 12

    1.4 Research Questions ..... 14

    1.5 Significance of the Study ..... 15

        1.5.1 Theoretical Significance..... 15

        1.5.2 Practical and Policy Implications..... 16

        1.5.3 Industry and Organizational Benefits..... 16

        1.5.4 Social and Economic Impact..... 17

    1.6 Scope of the Study..... 18

        1.6.1 Geographical Scope..... 18

        1.6.2 Population and Sample Scope ..... 18

        1.6.3 Temporal Scope ..... 19

        1.6.4 Variable and Measurement Scope ..... 19

    1.7 Organization of the Study..... 19

Chapter 2: Literature Review ..... 21

2.1 Introduction to Literature Review ..... 21

2.1.1 Purpose and Scope of the Literature Review ..... 21

2.1.2 Search Strategy and Methodology ..... 22

2.1.3 Literature Review Structure ..... 22

2.2 Theoretical Frameworks and Models ..... 22

2.2.1 Job Demands-Resources (JD-R) Model ..... 22

2.2.2 Work-Family Conflict Theory ..... 23

2.2.3 Circadian Rhythm and Sleep Theory ..... 24

2.2.4 Stress and Coping Framework ..... 24

2.3 Shift Work: Patterns, Prevalence, and Impacts..... 25

2.3.1 Classification and Types of Shift Work ..... 25

2.3.2 Global Prevalence and Manufacturing Context ..... 25

2.3.3 Physiological Impacts of Shift Work..... 25

2.3.4 Psychological and Social Consequences..... 26

2.4 Work-Family Conflict in Manufacturing Environments ..... 26

2.4.1 Conceptualisation and Measurement..... 26

2.4.2 Antecedents and Consequences..... 28

2.4.3 Manufacturing Context Considerations..... 30

2.5 Sleep Quality and Its Correlation with Occupational Results ..... 32

2.5.1 Sleep Quality: Definition and Assessment ..... 32

2.5.2 Sleep Quality in Shift Workers ..... 33

2.5.3 Sleep Quality and Performance ..... 35

2.6 Occupational Stress in Industrial Settings..... 38

2.6.1 Occupational Stress: Definitions and Models .....	38
2.6.2 Sources of Occupational Stress in Manufacturing .....	39
2.6.3 Shift Work as an Occupational Stressor .....	41
2.6.4 Stress Outcomes and Apparel Manufacturing .....	42
2.7 Absenteeism: Causes, Consequences, and Measurement.....	44
2.7.1 Absenteeism: Conceptualisation and Types .....	44
2.7.2 Predictors and Consequences .....	45
2.7.3 Consequences of Absenteeism .....	45
2.8 Production Quality and Performance Outcomes .....	46
2.8.1 Quality in Manufacturing: Definitions and Frameworks .....	46
2.8.2 Human Factors in Manufacturing Quality.....	46
2.8.3 Shift Work and Quality Outcomes.....	46
2.8.4 Absenteeism and Quality Relationships .....	47
2.8.5 Quality in Apparel Manufacturing .....	47
2.9 Cultural and Contextual Factors in Sri Lankan Manufacturing .....	48
2.9.1 Sri Lankan Apparel Industry Context.....	48
2.9.2 Cultural Factors in Work-Family Balance.....	48
2.9.3 Workforce Characteristics .....	48
2.9.4 Occupational Health and Safety Context .....	49
2.9.5 South Asian Manufacturing Context .....	49
2.10 Research Gaps and Literature Synthesis .....	50
2.10.1 Identified Knowledge Gaps.....	50
2.10.2 Methodological Gaps .....	50
2.10.3 Cultural Instrument Validation .....	51

2.10.4 Practical Application Gaps .....	51
2.11 Conceptual Framework Development .....	51
2.11.1 Theoretical Foundation Integration .....	51
2.11.2 Variable Relationship Hypotheses .....	52
2.11.3 Mediation Pathway Propositions .....	52
2.11.4 Moderating Factors Consideration .....	53
2.12 Chapter Summary and Transition.....	53
2.12.1 Literature Review Synthesis.....	53
2.12.2 Research Justification Reinforcement .....	54
2.12.3 Methodology Chapter Transition.....	54
Chapter 3: Data and Methodology .....	55
3.1 Introduction to Research Methodology .....	55
3.1.1 Chapter Overview and Purpose .....	55
3.1.2 Methodological Philosophy and Paradigm.....	55
3.2 Research Design .....	56
3.2.1 Cross-Sectional Research Design Selection.....	56
3.2.2 Design Advantages and Limitations.....	56
3.3 Research Setting and Context.....	57
3.3.1 Industry and Geographical Context.....	57
3.3.2 Specific Production Line Focus .....	57
3.4 Population and Sampling.....	58
3.4.1 Target Population Definition .....	58
3.4.2 Sample Size Determination and Sampling Technique .....	58
3.5 Data Collection Instruments.....	59

3.5.1 Multi-Method Data Collection Strategy .....	59
3.5.2 Work-Family Conflict Scale .....	59
3.5.3 Pittsburgh Sleep Quality Index.....	59
3.5.4 Occupational Stress Measurement .....	60
3.5.5 Objective Performance Measures.....	60
3.6 Data Collection Procedures .....	61
3.6.1 Ethical Clearance and Administrative Approvals.....	61
3.6.2 Participant Recruitment and Consent Procedures .....	61
3.6.3 Data Quality Assurance .....	62
3.7 Variables and Operational Definitions.....	62
3.7.1 Independent and Mediating Variables .....	62
3.7.2 Dependent Variables.....	63
3.8 Data Analysis Plan.....	63
3.8.1 Statistical Analysis Software and Preliminary Analysis.....	63
3.8.2 Primary Analysis Strategies.....	64
3.8.3 Advanced Statistical Analyses.....	64
3.9 Reliability and Validity Considerations.....	65
3.9.1 Internal Reliability Assessment .....	65
3.9.2 Construct Validity Evaluation.....	65
3.9.3 External Validity Considerations .....	65
3.10 Ethical Considerations.....	66
3.10.1 Ethical Principles and Guidelines.....	66
3.10.2 Informed Consent and Participant Protection .....	66
3.10.3 Participant Welfare and Data Use Ethics.....	66

3.11 Study Limitations and Delimitations.....	67
3.11.1 Design-Related Limitations.....	67
3.11.2 Measurement and Sampling Limitations.....	67
3.11.3 Deliberate Study Delimitations .....	67
3.12 Chapter Summary and Transition.....	68
3.12.1 Methodological Approach Summary.....	68
3.12.2 Expected Contributions and Results Preparation .....	68
Chapter 4: Contents & Analysis .....	69
4.1 Introduction .....	69
4.2 Data Preparation and Coding .....	70
4.3 Descriptive Analysis.....	71
4.3.1 Demographic Profile .....	71
4.3.2 Psychosocial Variables .....	74
4.3.3 Operational Performance Indicators.....	75
4.4 Reliability Statistics.....	76
4.4.1 Work–Family Conflict Scale Reliability Statistics.....	76
4.4.2 Pittsburgh Sleep Quality Index Reliability Statistics .....	77
4.5 Validity of the Measures.....	77
4.5.1 Work–Family Conflict KMO and Bartlett's Test of Sphericity .....	77
4.5.2 Pittsburgh Sleep Quality Index KMO and Bartlett's Test.....	78
4.6 Normality and Assumption Testing.....	79
4.7 Comparative Analysis Across Shift Patterns .....	80
4.7.1 Work-Family Conflict by Shift Pattern .....	80
4.7.2 Sleep Quality by Shift Pattern.....	81

4.7.3 Occupational stress by Shift Pattern.....	82
4.8 Correlation Analysis .....	83
4.9 Multiple Regression Analysis.....	84
4.9.1 Model 1: Predictors of Occupational Stress .....	84
4.9.2 Model 2: Predictors of Absenteeism .....	86
4.9.3 Model 3: Predictors of Output Quality .....	88
4.10 Mediation Analysis.....	90
4.11 Integration and Triangulation of Findings.....	91
4.12 Summary of Chapter .....	91
Chapter 5: Results .....	92
5.1 Introduction .....	92
5.2 Objective 1: Psychosocial Evaluation of Condition.....	93
5.2.1 Work-Family Conflict.....	93
5.2.2 Sleep Quality .....	94
5.2.3 Occupational Stress .....	95
5.2.4 Correlations between Psychosocial Variables .....	96
5.3 Objective 2: Operational Performance Appraisal.....	96
5.3.1 Absenteeism Patterns.....	96
5.3.2 Sewing Quality Metrics.....	97
5.4 Objective 3: The determination of Occupational Stress Predictors.....	98
5.4.1 Overall Model Performance .....	99
5.4.2 Contributes of Individual Predictors .....	99
5.5 Objective 4: Analysing Predictors of Absenteeism and Quality .....	100
5.5.1 Predicting Absenteeism .....	100

5.5.2 Predicting Quality of Sewing Output Model.....	101
5.6 Objective 5: Mediation Findings.....	102
5.6.1 Mediation Findings of Absenteeism.....	102
5.6.2 Mediation Results of Quality of the Output.....	103
5.7 Integration and Practical Implications.....	103
5.8 Chapter Summary.....	104
Chapter 6: Discussion.....	105
6.1 Introduction.....	105
6.2 Relation of Results to Theoretical Frameworks.....	106
6.3 Psychosocial Outcomes.....	108
6.4 Operational Outcomes.....	111
6.5 Combined Discussion and Mediation Paths.....	113
6.6 Management and Policy Implications.....	115
6.7 Summary of Chapter.....	116
Chapter 7: Conclusion and Recommendations.....	117
7.1 Introduction.....	117
7.2 Summary of Key Findings.....	117
7.3 Implications, Theoretical and Practical.....	119
7.4 Limitations of the Study.....	119
7.5 Research Recommendations in the Future.....	120
7.6 Closing Reflection.....	120
Appendix 1 - List of Tables.....	121
Bibliography.....	135
References.....	137

## List of Tables

Table 1 - Gender .....	71
Table 2 - Gender .....	71
Table 3 - Marital Status .....	72
Table 4 - Marital Status .....	73
Table 5 - Shift Pattern.....	73
Table 6 - Shift Pattern.....	74
Table 7 - Descriptive Statistics Psychosocial Variables .....	74
Table 8 - Descriptive Statistics of Operational Performance Indicators .....	75
Table 9 - Work–Family Conflict Scale Reliability Statistics.....	76
Table 10 - Pittsburgh Sleep Quality Index Reliability Statistics .....	77
Table 11 - Work–Family Conflict KMO and Bartlett's Test of Sphericity .....	77
Table 12 - Pittsburgh Sleep Quality Index KMO and Bartlett's Test.....	78
Table 13 - Tests of Normality .....	79
Table 14 - ANOVA .....	80
Table 15 - ANOVA .....	81
Table 16 - ANOVA .....	82
Table 17 - Correlation Analysis.....	83
Table 18 - R Square (R <sup>2</sup> ).....	84
Table 19 - ANOVA Table.....	85
Table 20 - Analysis of Coefficient.....	85
Table 21 - R Square (R <sup>2</sup> ).....	86
Table 22 - ANOVA Table.....	86
Table 23 - Analysis of Coefficient.....	87
Table 24 - R Square (R <sup>2</sup> ).....	88
Table 25 - ANOVA Table.....	88
Table 26 - Analysis of Coefficient.....	89
Table 27 - Mediation Analysis.....	90

**List of Figures**

Figure 1- Gender ..... 72

# **Chapter 1: Introduction**

## **1.1 Background of the Study**

### **1.1.1 Sri Lanka's Apparel Industry Context**

In Sri Lanka, the apparel industry serves as one of the key pillars of the national economy and represents the main export and employment source within the labor market. The industry has transformed considerably from its traditional model of quota-based manufacturing operations to become a highly technology-driven industry that competes in the fast fashion segment of the global market. The apparel industry is a significant contributor to Sri Lanka's foreign exchange earnings and provides livelihoods to hundreds of thousands of workers in the country, particularly women residing in the nation's industrial estates and elsewhere in the island.

Globalisation of the industry in terms of supply chains means that the industry has had to invest in operational models that are able to act swiftly to market fluctuations and short lead times for example, 30 years ago lead times, design to delivery, were measured in months, today it is in hours and days. This was an economic imperative because there has been the wide usage of long working hours and shift work. The requirements of the overwhelmingly female workforce that constitutes the backbone of apparel manufacturing processes are unique in that they have to juggle between strenuous working hours and the traditional family demands and cultural pressures.

Among the manufacturing processes found at the Sri Lankan apparel factories is precision-based manufacturing jobs, especially in the sewing machines, where the quality of the process matters a lot in the international export competitiveness. The success of the industry is largely pegged on the ability to maintain consistent product quality in the face of tighter and tighter delivery schedules, therefore necessitating the need to manage the workforce efficiently and manage various production schedules optimally.

### **1.1.2 Shift Work Prevalence and Necessity**

The competitive dynamics of the global markets have resulted in shift work as a matter of being the preferred choice of operation by several Sri Lankan apparel firms. Factories work outside the usual daytime hours, which include evening, night shifts and rotating shifts aimed at increasing the production capacity and honoring international delivery dates. This dimensional shift to longer production cycles is an indication of the industry in which it aspires to be competitive in a highly complex and competitive global environment. This is more so subsequent to the phasing out of the Multi-Fiber Agreement (MFA) in 2005.

When coupled with the necessity to increase output during certain seasons, the shift scheduling becomes more complicated since factories have to be ready to quickly expand at the same level of quality and productivity during the peak seasons. The successful implementation of newer forms of manufacturing technologies and lean production systems has further stimulated the emphasis on maximizing equipment usage such that it becomes an economic necessity to be able to effectively operate each equipment in multi-shift modes and thereby utilizing machinery and equipment to the optimum.

The evidence of shift work in the local apparel industry are broad-based across different production operations, with the sewing operations particularly vulnerable to shift-based production scheduling since it is the most labor-intensive production activity within the apparel industry, and it also has a direct linkage to the production throughput. This operational reality presents a complicated network of issues in workforce management and especially involving the establishment of the well-being of workers and fulfilling the production targets.

One of three joint ventures partners of Bodyline (Pvt Ltd), where I was the first employee and GM and was responsible for setting up the operations in Sri Lanka, insisted that the shifts operations be fixed as morning and evening permanently. Having considered their request, put it to the 500 odd sewing operators at that time for their opinion. Since it was the initial training phase of the operation, all of them were on a general shift. They responded back earnestly requesting me to consider rotating the shift every 2 weeks as opposed to a fixed shift operation or even a shift rotating every week. One of the most important reasons being that they said is that they will not be able to

balance a family life on a fixed shift basis and loose complete touch of their children's school homework and on a lighter side that they will miss their daily TV entertainment (teledramas), continuously but would rather prefer to catch up after 2 weeks. They said that they will not be able to settle down if there was a quick change (1 week). They were referring to their circadian rhythm. The successful implementation of shift operations 33 years ago became a benchmark for the entire industry in multiple locations in the country. This operation runs successfully to date.

### **1.1.3 Occupational Health Challenges in Manufacturing**

The world has become well aware of the health-related concerns observed in the manufacturing sectors necessitated by shift work, and Sri Lanka needs to address this complexity, especially in the apparel industry. Studies have continued to show that working on shifts disrupts the normal circadian rhythms, causing sleeping disorders, high levels of stress, as well as health complications (James et al., 2017). Such difficulties are even more common in assembly areas where employees carry out repetitive, attention-to-detail motions that demand manual dexterity and endurance vigilance.

The apparel workers of Sri Lanka have other psychosocial burdens which are particular to their culture and working environment. A predominantly female workforce experiences the possibility of considerable work-family conflict as it has to face the traditional family obligations and balance them with the challenging work schedules (Lanka, 2015). Researchers have found that female apparel workers in the region have specific issues concerning mental health and work-life imbalance (Akhter et al., 2017). Furthermore, research focusing specifically on Sewing Machine Operators (SMOs) within Sri Lanka's apparel sector has highlighted the prevalence of occupational stress linked to factors such as lack of support, inadequate control over work, and role ambiguity (Ranasinghe, 2020).

The practice of occupational health monitoring in Sri Lankan factories is practically disparate, and numerous organizations do not have a well-developed system of assessing and mitigating the psychosocial effects of shift work. Such a lapse of health management breeds difficulties for both employees and employers to detect and address stress-related problems before they affect personal health and the performance of the operators.

This large manufacturing unit set in a district which was situated in an area that receives high rainfall and because of that the operators fell ill after the first 4 hours of the operation in the air-conditioned factory. This was because they were either coming very early in the morning (3 am - 5 am) or going home very late (10 pm - 12 pm) and they were experiencing the cold draft at these times. This led us to adjusting the thermostat and keeping the ambient temperature at 24 °C continuously and subsequently expanding the medical facilities, where it became almost a miniature hospital in all of the plants. Considering the high usage of medical facilities, it prompted management to invest and upgrade all the base hospitals where the plants were located. The key to this decision was the well-being of the employees was considered to be of paramount importance in setting up of a large manufacturing operation in a hitherto agrarian based locality.

## **1.2 Statement of the Problem**

### **1.2.1 Identified Gaps in Current Understanding**

Although shift work practices in the apparel manufacturing industry are now highly prevalent in Sri Lanka, there is a significant lack of empirical studies that focus on understanding the complexities of manifold relationships between diverse forms of shift patterns and their multiple ramifications at the operational front. Although the body of literature around the world has established certain cornerstones about the overall effects of shift work on the health of workers and organizational performance, there is a glaring lack of research studies that have been carried out in the South Asian manufacturing set-ups, which are very unique in terms of their cultural, social and operating conditions (Ranasinghe, 2020). This knowledge gap is especially pronounced given the extent to which traditional family arrangements and cultural norms are intertwined with the realities of contemporary industrial employment patterns, creating an idiosyncratic set of challenges that may not be well-served by research evidence generated in the West in industrialized settings.

Sri Lankan society is important due to the specificity of its working cultural background, in which the work-family relationships are more complex than those that have been studied in the current literature. Cultural factors of traditional gender roles and family responsibilities exert further pressure on workers, especially women, who form the majority of the apparel working population, and few studies have discussed the mediation role of the cultural factors in the union between shift work and worker wellbeing. Lanka (2015) has already stressed on increasing work-family conflicts

in the apparel industry of Sri Lanka, yet there is no sufficient insight into how these conflicts evolve at different shift patterns and subsequently affect their operational features.

The lack of some systematic studies that properly connect shift patterns to a particular operational outcome is the major gap in knowledge that is severely limiting the capability of industry practitioners and policymakers to make decisions in practice. Current literature on occupational health is generally focused and oriented towards either the health aspects alone or to productivity alone, and, when one talks about productivity, they focus primarily on the economics of the health outcomes and do not capture the whole interrelationship of the psychosocial factors with the measurable business outcomes. There is a significant gap in evidence-based recommendations to support organizations in making scheduling decisions to balance worker health and operational performance due to this fragmented approach to the study of the impacts of unused shift work.

Owing to the skill and precision required in the apparel manufacturing processes, particularly the sewing line, which demands prolonged hours of concentration involving routine work, this sector is highly susceptible to fluctuation in the quality and output levels due to employee stress, fatigue and psychosocial adversity. Nevertheless, no significant empirical evidence has been established to quantify those relationships in the local setting of the factories in Sri Lanka. Though previous studies have identified overall principles, there is little knowledge concerning how shift work affects the performance of sewing at a particular factory in Sri Lanka, such as in quantity, quality, and productivity, along with the work and method study, ergonomics and human factor engineering concerning the causes of fatigue and their effects on the performance of the sewing job. While some local studies exist, such as Ranasinghe (2020) which identified key stress determinants like lack of support and control impacting sewing machine operator efficiency, a significant gap remains in understanding how these factors interact with specific work schedules like shift patterns, and related issues such as sleep quality and work-family conflict, to influence a broader range of operational outcomes including absenteeism and output quality.

Moreover, there are few studies on the relationship between occupational stress and work performance in the Sri Lankan apparel industry, even though its practical importance is apparent. Articles like that by Silva and Ranasinghe (2017) considered the connection between job stress and workplace behavior, yet, holistic models that interconnect the effects of shift patterns with the

results of stress, as well as the more precise professional and organizational outcomes, are unavailable in the literature. Such a discrepancy is extremely alarming considering the fact that in the world of industry, there has been an increased emphasis on quality management, as well as the realization of human factors in the advancement of manufacturing prowess.

In all of the shift operations I had set up and managed over 30 years in 3 countries we noticed that there was an enormous strain on family life, and the female employees were under stress leading to high absenteeism, poor quality and low productivity. This promoted us to analyse the situation and introduce counselling to the work force particularly to those on shifts.

These knowledge gaps are further aggravated by the absence of culturally contextualized research instruments and a validated measurement approach. Most of the available studies utilize time-authority measures that were developed and validated in Western countries, which may not capture specific cultural dimensions that could be important in the way the Sri Lankan workers take up the demands of shift work. The origins of work study engineering go back centuries during early stages of the industrial revolution. The two major movements are thus:

1. Scientific Management: Fredrick Winslow Taylor (1856-1915).

2. Motion Study: Frank and Lilian Gilbreth (early 1900's).

Studies on the effects of occupational stress in the Sri Lankan apparel industries have just started with the research by Wellangiriya and Abeyssekera (2021), and wider psychosocial measure validation in this particular culture and work setting is only developing.

### **1.2.2 Operational Challenges Facing the Industry**

Severe operational challenges are being faced by Sri Lankan apparel manufacturers when it comes to the rising incidence of absenteeism and the resultant repercussions felt on the continuity of production and quality performance thereof. The operational disruptions caused by these attendance-related problems go way beyond mere productivity losses and impact at the team level, on production line performances and even on the quality control system. The result of this apparel production system is that even individual workers out would cause bottlenecks in the production lines which results in delayed delivery, higher costs of production resulting in cost of failure.

Previous researchers have observed that occupational stress is an important factor predicting the intention to leave employment in the Sri Lankan apparel sector, and Lanka (2014) mentioned stress as one of the key factors in making an employee decide to leave a certain working place. This cause and effect between stress, and turnover creates a vicious circle in which the more work you give the existing workers, the higher the stress levels increases and this may lead to additional turnover of the existing employees and work instability. The irregular compilation of these trends is a threat to the long-term sustainability of production systems and introduces a long-term problem of workforce planning and management. The association of operational performance and stress at work is an urgent issue. Extremely negative correlations were observed between stress dimensions (especially lack of support, control issues, job role ambiguity, and managing change) and the average efficiency of SMOs in a Sri Lankan apparel factory (Ranasinghe, 2020): the results showed that psychosocial factors directly are counterproductive to productivity.

When 80% of your 10,000 headcount in multiple locations are women who have to leave their homes as early as 3 am and arrive at their homes at midnight, their safety and security is of utmost importance at the individual level, firm level and society at large. Because of this burden it caused a strain and worry to them and their families due to the timings of the shift operation. This affected morale and thereby productivity. We campaigned with the family, village and local police to create awareness of the shift timing and the resulting vulnerability of the women and to support them. The same awareness and degree of concern was emphasized to the bus operators who brought the workforce in and out. This created a valuable social net to the operator which contributed to their wellbeing, happiness and productivity.

The other operational risk that is closely connected to the human factor and is associated with worker fatigue is the problem of quality control, which has reached impressive levels within the industry. Extensive research has revealed that exhaustion and stress in the apparel industry have the potential to significantly affect not only personal task realization but also organizational performance (Fernando et al., 2010). The impacts on quality in sewing operations are especially problematic because defects that lower the quality of the product and, therefore, the satisfaction of customers and brand image are possible because slight differences in worker attention, ability to use their hands, or decision-making capability can have a considerable effect on the product.

The impacts of worker fatigue on the quality outcomes are especially strong in the context of shift work, where people are strongly affected by the interruption of the natural circadian rhythm and the lack of sleep. A study by Sooriyaarachchi et al. (2022) exemplified the physiological effects of shift work of Sri Lankan workers with measurable changes in body constitution and health markers that could reflect on performance impacts. Nevertheless, the direct relationships between the given physiological changes and certain quality parameters in production settings are still underprepared and insufficiently quantified.

Employee turnover and its resulting cost are a challenge that is becoming increasingly problematic to the industry, with work-family conflicts and occupational stress identified as two of the major factors leading to decisions to move on. In particular, Ganewatta and Hiroshima (2023) have found that the engagement of work overload as a stressor in a job affects the intent to leave that employees hold, and there was a mediating role of work-family conflict in this relationship. These turnover rates result in an extremely high cost that goes further beyond the cost of recruitment and training, but also causes fragmentation within a team as well as loss of institutional memory and excessive instability that is detrimental to the efficiency and consistency of their operations.

The economic consequences of high turnover rates are augmented by the fact that the apparel manufacturing skill set is highly specialized, and it takes time to establish a significant degree of proficiency in those skills. New people usually take more time to become fully productive, which may affect the quality of other tasks, and the experienced employees will have to split their attention between their work and the training of the new ones. Such a movement puts more pressure on the already available workforce, as well as affecting the general efficiency of the production.

The problem of productivity goes beyond the individual worker to broader questions of workflow and resource coordination within a system, taking into account the workflow and resource utilization. The study by Durairatnam et al. (2020) has focused on determinants of quality performance in the Sri Lankan apparel manufacturing industry, developing a list of factors that shape the operational results of the industry but the particular involvement of shift work patterns and the psychosocial effects on these quality determinants needs a thorough study to work out efficient interventions.

### **1.2.3 Societal and Economic Implications**

The numerous issues that face the Sri Lankan apparel industry are much more than narrow organisational concerns, as they have vast implications to the families of the employees and the welfare of the community at large. These issues cause stress and strains that directly translate to family structures, child-rearing activities, and general stability in the household because most of the affected are women working in the workforce (Lanka, 2015). The effects are especially ironic in the traditional Sri Lankan society where the cultural norms and family structure exert extra pressure on all working women as they need to negotiate between work and family lives.

These challenges have a gendered aspect as they are part of the larger tensions in society between conventional roles and needs and the demands of the modern economy. The fact that female apparel workers often have the responsibilities of the main caregivers and at the same time provide the necessary income to the family's well-being adds multiple layers in the way both an individual and a family function. Akhter et al. (2017), though their study aims at the Bangladesh population, have pointed out similar predicaments that the female workforce in the apparel industry faces in South Asian regions, thus proving that the problem is regional and bears on both mental health and general well-being.

One day at the initial stages of the operations, I noticed a horde of men gathered around the main gate of the factory. I inquired as to what this was all about, and I learnt that they were husbands or boyfriends who have come to collect the salary of their women. The answer I got made me to understand of the upheaval of social norms when industry went to the village, where the majority of the workforce were women which is the norm in the apparel industry particularly when roles shift and women become the sole breadwinner of the family. This led me to start the first fully fledged banking operation (Bank of Ceylon) inside the factory which was the first for any industry in the country then. Thereby it encouraged retention and savings and encouraged thrift of their hard-earned money. More importantly easy access to cash was denied to their menfolk.

The cultural norms on the role of women in family care further complicate the management of work-family conflict because it has to be responsive to cultural values that embrace the economic reality. The conventional focus on responsibilities to the family may foster the feeling of guilt and

strain where work is intruding on the family members and vice versa; however, due to economic needs, working becomes a necessity to support the family and its future. This cultural dynamic demands keen attention when coming up with workplace policies and interventions that will help in solving issues surrounding work and family balance.

The impact of such reduced productivity and quality problems in the apparel industry goes beyond individual firms and relates to Sri Lanka and its international competitiveness as a whole in international supply chains. With more and more international brands focusing their supplier selection criteria on social responsibility and the health and well-being of workers, responding to occupational health challenges is becoming a critical activity in terms of ensuring competitive advantage and continued access to the market. Reputational risks in terms of poor worker conditions can have a long-term effect on export opportunities and economic growth prospects.

The quality and productivity of Sri Lankan factories are interconnected to the entire supply chain of the international regions of supply and have the overall potential to impact brand relationship and market positioning of an international company. Customers and brand partners are also increasingly demanding that suppliers demonstrate a wider capability to demonstrate a commitment to the welfare of workers, as well as sustainable employment practices. The transformation in the expectations of supply chains puts more pressure on the evidence-based practices of workplace wellbeing management and boosts the productivity of operations.

The necessity of approaching the development of policy in relation to occupational health on an evidence-based method has become more urgent yet as the industry strives to strike a balance between economic competitiveness and sustainable employment policies in the name of long-term viability. With an incomplete picture of the links between patterns of work, the well-being of workers, and business performance outcomes, policymakers cannot develop effective regulation regimes and industry guidelines that can safeguard workers as well as retain business competitiveness.

A study conducted by Fernando et al. (2017) has proven that both presenteeism and absenteeism had measurable effects on the efficiency of employees working in a multinational company in Sri Lanka, which underlines the economic importance of dealing with the phenomena of worker

wellbeing. Even though wider policy frameworks that supplement these findings with specific interventions and regulatory strategies are lacking, this can provide a continuous challenge in making any real and permanent changes in occupational health standards.

The social impact is more wide-reaching, tapping into the issues of sustainable development and social equality because the apparel industry is one of the most important channels of economic growth and especially female economic growth, in rural and semi-urban regions. Ensuring that this pathway does enhance family and community wellbeing, rather than diminishing it, will require a fuller understanding of how work organization relates to many aspects of worker and family life, and research that can illuminate both organizational practices and developments in public policy.

### **1.3 Research Objective / Aim**

#### **Primary Research Aim**

In the current study, we will perform a broad-based cross-sectional examination of the correlations between shift patterns, work-family conflict, sleep quality, occupational stress-related absenteeism, and the quality of the sewing output in one particular production line of a Sri Lankan apparel factory. The study aims to reconcile the disparity between psychosocial studies and actual results by investigating how various shift patterns affect the well-being of the workers and, in turn, have an operable effect on worker attendance and quality of production.

The concentration of the research study on a particular line of production will provide the best comparisons between various shift patterns with a few confounding variables of the task type, the intensity of supervisory styles, and the nature of the organization. The focus approach enables one to highlight the mechanisms by which shift work affects the experiences and the work operation performance of workers.

#### **Theoretical Framework Integration**

The study combines accepted theoretical approaches to occupational health psychology and organizational behavior that aim at explaining the complicated relationships involving shift work and work-related outcomes. The Job Demands-Resources model offers insights into how shift work has been known to present demands to the workers that quickly surpass their resources to trigger

stress and lower performance. The Work-family conflict (WFC) theory provides clues to understand the precise mechanisms by which irregular work schedules affect the well-being of the workers, especially the female-dominated apparel industry workforce.

The study also considers circadian rhythm disturbances as a key factor in the relations between shift work with both health indicators and performance. Studies have revealed that sleep disruption greatly affects sleep and cognitive performance (James et al., 2017), opening the gateway to lateness and the quality of the work output.

### **1.3.1 Specific Objectives**

#### **Objective 1: Shift Pattern Analysis**

To compare the existence of the level of the work-family conflict of different shift patterns (day, evening, night, rotating shifts) between the sewing machine operators of the target production line. This goal presupposes that a systematic evaluation of the impact of different work schedules on establishing the equilibrium between professional and family duties will be conducted with a specific focus on discussing cultural and situational peculiarities of Sri Lankan society. Through the analysis, baseline measurements of work-family conflict will be determined, and the shift patterns that produced the highest levels of psychosocial stress will be identified.

This aim also includes the evaluation of the differences in sleeping quality indicators between employees who have different shift patterns. Due to the acknowledged connection between shift work and sleep disturbances, the proposed study will measure the difference in sleep quality between the shift patterns and determine which aspect of sleep is connected with which schedule type.

#### **Objective 2: Predictive Relationship Assessment**

To identify how well work-family conflict is related to occupational stress-related absenteeism in the workers population of interest. This objective will entail statistical modeling where the relationships between psychosocial stressors and attendance behaviors will be ascertained including their strength and significance. Studies have shown that work-family conflict has an

immense effect on job performance and performance in the workplace, which makes this correlation essential to understanding contexts of absenteeism (Obrenovic et al., 2020).

The aim also entails an assessment of the quality of sleep as a predictor of absenteeism patterns. It has been shown that there are close links between occupational stress and sleep quality (Mao et al., 2023) and thus sleep disturbances could be used as early predictors of attendance issues. It will examine the predictive ability of each of these psychosocial factors as well as the interaction/combined/synergism effects of these predictors.

### **Objective 3: Output Quality Impact Analysis**

To test the assumed correlation between levels of occupational stress and quality performance metrics in the individual production line in the form of sewing. The aim of this is to measure the extent to which psychosocial stressors can be reduced into parameters that will be realized to be attributable to work performance in terms of defect rates, rework requirements and overall productivity levels. Sewing operations are of a precision-based nature, and so this analysis is very relevant to monitor the quality impacts.

The analysis will also determine the impact of the patterns of absenteeism on individual and team productivity metrics. Studies have indicated that presenteeism and absenteeism are serious considerations because they significantly influence employee productivity within a manufacturing context in Sri Lanka (Fernando et al., 2017).

### **Objective 4: Mediation Pathway Exploration**

To determine occupational stress as a mediating factor between shift work characteristics and operational outcomes. The aim is to do complex statistical modeling to gain insights into the indirect mechanisms by which shift patterns affect measures of attendance and quality. The analysis will evaluate the question of whether occupational stress can be one mechanism that translates work schedule characteristics to quantifiable operational effects.

The goal also includes the study of the mechanism of sleep quality as a mediator of association between the shift patterns and performance outcomes. The importance of understanding these

mediation routes is to formulate specific intervention measures to address the causes rather than symptoms of operational issues.

## **1.4 Research Questions**

### **Primary Research Questions**

**Research Question 1:** With what shift patterns (day, evening, night, rotating) is the level of work-family conflict, and quality of sleep among sewing machine operators in the target Sri Lankan apparel factory production line low?

This question discusses the basic connection between work scheduling and psychosocial well-being based on the research that has identified strong effects of work shifts on family life and sleeping habits (Silva and Costa, 2023). The issue is especially pertinent with regard to the cultural background of Sri Lankan society, and mostly females are more work in apparel manufacturing.

**Research Question 2:** What is the role of Work-family conflict and sleep quality in predicting the occupational stress-related absenteeism in target production line apparel workers?

This question will test the predictive correlations between psychosocial stressors and attendance behaviors, and it adds to the existing body of knowledge that finds working-family conflict to be an influential factor in the performance of employees (Kengatharan, 2017). The emphasis on stress-related absenteeism is also based on the understanding that attendance-related problems are frequently the manifestation of underlying concerns of well-being.

**Research Question 3:** What is the effect of the occupational stress and absenteeism pattern on the quality of output product in terms of defective product, rework necessitated, and overall efficiency levels used in the isolated component of the production line?

This question refers to the business implications of operational use of psychosocial stress, including a correlation between the health of the worker and those business metrics measured by the organisation. The reduction of the operational performance to specific sets of quality metrics allows quantifying the correlation between stress factors and operational performance.

## **Secondary Research Questions**

**Research Question 4:** Which demographic and personal factors moderate the bias in the relation between shift work and psychosocial stress outcomes among the workers within the production line under consideration?

This question acknowledges that the consequences of shift work challenges might be differently experienced and/or reacted upon by different workers due to individual differences. It is important to know these moderators in order to come up with specific interventions and support systems.

**Research Question 5:** Is occupational stress a mediator between Work-family conflict, sleep quality and operational outcomes (absenteeism and output quality) in the core production setting?

This question discusses how psychosocial factors can affect operational performance, giving an idea of how it can be done and how the effects of worker wellbeing are interconnected with business performance.

**Research Question 6:** How exactly does shift work patterns work into objective reductions in the quality of production and productivity as applied in the study setting?

The question aims at gaining a deeper insight into how the scheduling decision of work finally influences the outcome of operations in order to make management decisions.

## **1.5 Significance of the Study**

### **1.5.1 Theoretical Significance**

The study has implications for occupational health psychology literature, as it is anchored on empirical evidence in the developing country manufacturing sector, which is underrepresented in the global bodies of knowledge. The combination of psychosocial factors and operational outcomes in the study provides a holistic view of the study, which goes a step further than studies only focused on health outcomes or solely on productivity outcomes.

This study expands the Work-Family Conflict theory to factory setting in South Asia cultures since the traditional family structure collides with the demands of the industries in contemporary South

Asia. Such cultural peculiarity contributes positively towards applying the concepts of universal occupational stress, translating them into the contexts of the society.

The research is also able to establish the validity of existing psychometric measures in the Sri Lankan culture that will enhance the cross-cultural applicability of assessment tools in the occupational domain. This validation plays an important role in any future studies and applications in similar cultures and industries.

### **1.5.2 Practical and Policy Implications**

The study is applicable to the evidence-based decision-making process in designing the shift scheduling policies which maximizes worker well-being, operational effectiveness and the productivity of the operations. The study provides numerical measurements of the links between various shift patterns and functional outcomes, allowing managers to plan shift arrangements that serve the interests of business and the employees.

The findings confirm the necessity to develop family-friendly working approaches that are specifically targeted at manufacturing workplaces. As a study has shown the positive influence of work-life balance practices on employee performance within the Sri Lankan apparel industry (Dilhani and Dayarathna, 2017), the work is more detailed and extended to concrete working conditions.

The study also gives a model of occupational health surveillance and intervention studies, giving proven indication of realizing and treating psychosocial risk factors prior to their influence on performance in an operation. Such a preventive measure has quite far-reaching ramifications for both employee and commercial well-being.

### **1.5.3 Industry and Organizational Benefits**

The study offers the human resource management in the apparel manufacturing industry with the strategy that the researchers propose, including the workforce planning and support systems strategy. Understanding the connection between shift work and worker well-being and the operational outcomes makes it easier to make informed decisions about the staffing plan and the support strategies.

The other possible organizational advantage is the quality improvement models built on the management of the psychosocial factors. The study is useful in the sense that it demonstrates the direct relationship between well-being of workers and higher quality of products and therefore should be worthwhile investing in such worker well-being initiatives as an investment, rather than treating it as a cost-centers.

The research also offers empirical based strategies in reducing absenteeism as one of the major operational challenges that manufacturing entities face. Knowledge of the psychosocial predictors in issues of attendance is useful because it allows directing implementation strategies at the source of the problem instead of treating the symptoms.

#### **1.5.4 Social and Economic Impact**

The study helps to achieve a better quality of life among apparel workers and their families because it will lead to policies at the workplace that can accommodate more family needs and personal well-being. This effect is especially important for the female employees, who most of the time have to shoulder the greatest responsibility of taking care of the family and still have to work a busy schedule.

As the textile and apparel industry expanded in the early 1990s, the then president, the late Ranasinghe Premadasa gave the approval, firstly to Bodyline (Pvt) Ltd in 1991 to operate outside of the traditional export zones (EPZ). He subsequently proposed and implemented the 200 Apparel Factories Initiative, expanding on the earlier approval given to Bodyline and thereby created huge opportunities of employment, particularly for the women across the country. Upon observation, it was noted that they were largely malnourished and didn't have access to quality food and safe drinking water. This led to the decision to give them a wholesome meal during the shift operations per person either in the morning or evening. Also, those who were pregnant were identified with a pink scarf because signs of pregnancy were not visible due their frail stature. This enabled them to be given lighter work and separate queue for them at the canteen to have a separate mid-day meal. At Brandix (Pvt) Ltd, my second place of work in the industry, a major CSR Initiative was safe drinking water to all focusing on where the employees lived and in their villages.

Another significant contribution to society is improved gender equity, which entails the provision of solutions to work-family balance issues. The studies generate data that would substantiate policies and practices aimed at ensuring women achieve full participation in industrial labour force opportunities, even when family consideration is involved, and goals of gender equality and economic empowerment must be achieved.

## **1.6 Scope of the Study**

### **1.6.1 Geographical Scope**

This paper has identified one apparel factory in the Rambukkana area in the Sabaragamuwa province of Sri Lanka, which is representative of an average apparel factory in Sri Lanka and it will be easy to collect the information about it thoroughly. The selection criteria lay stress on the factories with conventional shift schedules with detailed personnel and quality control records related to the research requirements.

The selected locality will capture the concentration of the apparel industries in these industrial belts and their relevance to the overall cutting edge of the apparel industry in Sri Lanka. The geographically targeted area provides the opportunity to study in-depth and retain its applicability to similar factories all over the country.

### **1.6.2 Population and Sample Scope**

The selected population would include the operators of sewing machines in a selected line of the chosen factory. This narrow comparison allows comparisons across shifts to be controlled, yet at the same time reduces the confounding effects of any task differences, equipment changes, or managerial differences upon the results.

The criteria of inclusion include full-time employees with a minimum of six months in their tenure, in case of sufficient exposure to shift work patterns and organizational integration of the employees. The exclusion criteria exclude supervisory employees, trainees, and part-time employees so as to have homogeneity with regard to job responsibilities and organizational expectations.

The sample size will take into account the requirements of statistical power, and at the same time make it realistic to collect the data in a single line of production. The nature of the study allows it

to be a focused one, which allows it to give a detailed analysis and possess enough statistical power to make relevant conclusions.

### **1.6.3 Temporal Scope**

The cross-sectional model measures the data at one point in time, but will use past data where a six-month retrospective measure on absenteeism and quality is measured. This is the time period that still allows identifying the patterns, but not the overlong history that could be driven by the changes in the organization or other external factors.

The timing: This will reflect considering variations in production demands and stress levels, and fields when not introducing such extremes that would create unusual stress profiles or attendance patterns, as during major holidays or production peak seasons. This consideration makes data collection capture normal operating conditions and not in an exceptional situation.

### **1.6.4 Variable and Measurement Scope**

The research revolves around certain specific psychosocial factors such as the Work-family conflict, sleep quality and work stress that are measured using some validated instruments, which are suitable for the target population. Examples of operational outcomes are the rates of absenteeism and sewing output quality, which correspond to the performance rates stipulated on the production line standards.

The demographic and control variables will be age, gender, marital status, and family structure to allow suitable statistical consortium and subgroup analysis. The scope also does not include the broader organizational culture and management style variables, so as to keep the lens focused on matters relating to shift work and mitigate the confounding influences.

## **1.7 Organization of the Study**

### **Chapter Structure Overview**

**Chapter 1:** The introduction provides the background of the research by thoroughly examining the issue and formulating the problem as well as the objectives. This chapter locates the study in the context of the Sri Lankan industry to explain the apparel industry and then further define the scope

and significance of the study. The introduction gives the reader background information on the industry, justification of the study, and the contribution that was expected.

**Chapter 2:** The literature review is a comprehensive review of the extant literature pertaining to shift work, occupational stress and work-family conflict and productivity outcome in manufacturing settings is presented. The chapter also conducts a global synthesis of the research however, with some gaps that specifically relate to South Asian manufacturing contexts. Data supporting a literature review are summarized in the form of a formula of theoretical concepts and a hypothesis.

**Chapter 3:** The methodology, gives details of the research design, population and sample selection methods, data collection tools, as well as the methods of data analysis. The chapter contains detailed information about cross-sectional study design, stratified random sampling methodology, validated psychometric instruments and plans of statistical analysis. The ethical considerations are fully covered, and data security measures are adopted.

**Chapter 4:** Data presentation and Analysis provides the results of the analysis systematically, supplying the results by following a series of steps, going through description of statistics to hypothesis testing, followed by more advanced statistical modeling. This chapter contains the results of correlation analysis, ANOVA data, multiple regression findings and mediation analysis results. The results are outlined in logical order in accordance with the research objectives and questions.

**Chapter 5-7:** Results, Discussion and Conclusion provides an insight into the meaning of findings depending on the existing literature and the theories of this research, insinuating the theoretical and practical implications. The chapter identifies the limitations of the study and recommends future research directions, as well as makes proposals for regulating industry practices and policy development. The conclusion is a summary of the main contributions and their implications for various stakeholder groups.

## **Chapter 2: Literature Review**

### **2.1 Introduction to Literature Review**

#### **2.1.1 Purpose and Scope of the Literature Review**

The manufacturing sector in the developing world has numerous problems which emerge with respect to the management of labour, productivity and welfare of the employees. The case of the Sri Lankan apparel industry, as one of the most critical sectors of the country and the economy at large, and which plays a significant role in generating export revenues and providing employment to the population, demonstrates these challenges by its transformation of the employment organization structure to meet the requirements of the global market (Silva, Lombardo, Lipscomb, Grad & Østbye, 2013). The literature review and systematic analysis of literature on shift work, occupational stress and manufacturing performance incorporated in the current paper synthesises psychosocial and operational outcome research in developing countries participating in manufacturing.

Fernando, Selvam, and Bennet (2010) showed the prevalence of exhaustion and stress among the workers in the apparel industries in Sri Lanka, and this forms the basis of understanding how working schedules influence employee health and efficiency. The review examines correlations between modalities of shift work, work-family conflict, sleep quality, occupational stress, absenteeism, and production quality outcomes, alongside the precision manufacturing work of sewing operations.

The identification of the research gaps that are specific to the Sri Lankan apparel industry is one of the essential elements. Although numerous studies have been conducted on the impact of shift work in the Western industrial setting, culturally specific studies that consider local socioeconomic and cultural determinants associated with work experiences in the South Asian manufacturing setting are limited (Silva and Ranasinghe 2017).

### **2.1.2 Search Strategy and Methodology**

The literature search strategy was a systematic search of databases through the application of keywords, namely: shift work, work-family conflict, sleep quality, occupational stress, absenteeism, and manufacturing quality. Inclusion criteria were confined to peer-reviewed articles published between 2000 and 2024 in the English language, with special emphasis on South Asian and developing country studies to keep it contextual.

Special emphasis was laid on identifying research in a manufacturing setting, but there was also an added emphasis on the studies carried out on the female workforce, since it is in Sri Lanka that the apparel industry is primarily comprised of females. Akhter et al. (2017) have highlighted neglected mental health concerns among female workers within the ready-made apparel industry, and they show that gender-sensitive studies of occupational health are essential.

### **2.1.3 Literature Review Structure**

The literature review is developed in a chronological order of theoretical groundings, empirical estimates, and practical aspects, as well as research gaps. Beginning with an already existing body of theoretical literature, the review examines the Job Demands-Resources models (JD-R), the concept of work-family conflict, the science of circadian rhythms, and the theory of stress and coping. Subsequently, the paper discusses key ideas, including shift work patterns, work-family conflict, the relationship between sleep quality, occupational stress, pattern of absenteeism, and the determinants of production quality, where the factors of culture and context are considered here and there.

## **2.2 Theoretical Frameworks and Models**

### **2.2.1 Job Demands-Resources (JD-R) Model**

The Jobs Demands-Resources model has provided a detailed understanding of how the nature of the working environment either negatively or positively influences the well-being and performance of the employee. Job demands can be characterised as the physical, psychological, and social work factors, which require permanent performance and are accompanied by physiological and psychological costs. Those job resources refer to the factors that facilitate achievement of the job goals, reduce job demands, or improve personal growth.

The complexity of the work schedule and the support resources availed by the work environment are evident in the application to shift work environments. The shift work is a considerable employment opportunity that overloads natural circadian rhythms, disrupts family/social bonds, and disrupts conventional work-life balance practices. The study by James, Honn, Gaddameedhi, and Van Dongen (2017) provided evidence of the formation of physiological demands that are not confined to the working hours, owing to shift work disturbing circadian rhythms and sleep patterns.

The two-path model suggests that there are two separate processes: one is a health impairment process, in which there is an overloading of demands related to an individual, which causes exhaustion and health-related issues, and the other is the motivational process, in which the adequacy of the resources is associated with engagement and positive results. Social support and flexibility of schedules are identified as essential resources that reduced the adverse impact of the shift work demands. Wellangiriya and Abeysekera (2021) concluded that work-life balance was strongly affected by occupational stress in the employees of Sri Lankan apparel manufacturing at the operational level.

### **2.2.2 Work-Family Conflict Theory**

The theory of Work-Family Conflict offers valuable information when it comes to competing demands experienced by workers, especially those working in manufacturing plants where strategic shift work poses a challenge against family demands. The theoretical framework has three different forms that is time-based conflict due to incompatible demands about time, strain-based conflict as a result of stress transferred between domains, and behaviour-based strife due to the incompatibility of behaviour expectations across the roles.

This is due to its bidirectional concept that identifies work-to-family interference and family-to-work interference. A study by Kengatharan (2017) was conducted in the Sri Lankan context and found that work-family conflict was a significant element influencing the performance of employees, with income level as the potential moderating factor.

Cultural differences are also of special concern to South Asian manufacturing conditions, where cultural roles and extended family systems present special difficulties. The study published by Ganewatta and Hiroshima (2023) examined the role of work overload as a job stressor that impacts

employees' intention to leave, with the mediation effect of work-family conflict in organisations in the Sri Lankan apparel industry.

### **2.2.3 Circadian Rhythm and Sleep Theory**

The circadian rhythm theory furnishes biological insight into shift-work performance and health effects in human beings. The suprachiasmatic nucleus is a central clock, and it regulates melatonin and cortisol circadian rhythms of sleep-wake, body temperature, and cognitive performance. Light-dark mechanisms Entrainment Light-dark mechanisms tend to be synchronised to maintain internal rhythms in line with the environment, and shift work breaks this natural synchrony.

The Shift Work Sleep Disorder (SWSD) is a well-recognised clinical syndrome that has a foundation in the disruption of the circadian rhythm. Silva and Costa (2023) promise to study a significant amount of data on the consequences of receiving shift work and night work, presenting the prevalence rates of the type of shift and declaring the particular danger of night shift employees. The topicality of circadian misalignment to performance is particularly relevant to the generation of quality results, when the degradation of the performance of cognitive, motor, and attention functions may influence the outcome according to the circadian patterns.

### **2.2.4 Stress and Coping Framework**

The transactional model of stress and coping offers a detailed system of ever-reaching outlook on how people respond to and perceive occupational stressors. Primary appraisal entails assessing the threat, whereas secondary appraisal dwells on assessing the coping resources. The separation of problem-focused coping and emotion-focused coping can be of great interest and significance to adjustment to shift work.

Mao, Raju, and Zabidi (2023) carried out a systematic review of the associations between occupational stress and sleep quality and determined the existence of persistent relationships between them, i.e., stress hinders sleep quality, and poor sleep increases the vulnerability to stress. Silva and Ranasinghe (2017) explored the relationship between job stress and deviant workplace behaviour by employees of Sri Lankan apparel manufacturing at the operational level.

## **2.3 Shift Work: Patterns, Prevalence, and Impacts**

### **2.3.1 Classification and Types of Shift Work**

Work schedules shift and involve a series of different schedules to increase the working hours outside the daytime. Fixed shift systems refer to the work schedule that does not change between time periods. Day shifts usually take place at times when the circadian rhythm is naturally occurring, and the evening shifts pose a moderate challenge to the circadian aspect but have a high level of effect on family time. The most demanding pattern is night shifts, as these directly contradict the patterns of natural rhythms.

Rotating shift schedules refer to the rotation of workers at various shift times in a prearranged program. Forward rotation patterns tend to suit, more than backwards rotation patterns, circadian rhythm adjustment. The rate of the rotation plays a principal role in adaptability, as fast rotations without allowing complete circadian adaptation yet reduce the effects of prolonged disturbance. In contrast, slow rotations can induce partial adaptation but also repeated stress.

### **2.3.2 Global Prevalence and Manufacturing Context**

The shift work is also concentrated in manufacturing industries globally due to the pressure created by economic conditions to ensure maximum utilisation of equipment and to satisfy global supply chains. The demands of 24/7 production and the pursuit of cost optimisation with an emphasis on continuous running equipment have given rise to far-reaching implementation of shift work.

These changing global trends can be replicated in the Sri Lankan apparel industry, whereby shift work systems have become quite popular to accommodate the various demands of the international buyers and the set production timelines. According to Silva and Lombardo et al. (2013), health and quality of life impact the experience of the female apparel workers, which in turn translates to long work shifts due to global supply chain pressure.

### **2.3.3 Physiological Impacts of Shift Work**

Alteration of circadian rhythms is the inherent physiological difficulty of shift work, and the suppression of melatonin production during the night work shifts initiates a cascade of changes in other body systems. James et al. (2017) systematically reviewed the effects of shift work on

circadian rhythms and sleep and identified the impact on immediate effects that include fatigue, sleepiness, and digestive complaints; intermediate effects that comprise sleep disorders and mood disturbances; and long-term effects associated with cardiovascular disease and metabolic disorders.

Sleep quality and architectural modification are of greater concern to manufacturing employees whose performance is subject to endurance and motor stability. Shortened overall sleeping is common among shift workers because of some environmental disturbance during day sleep times and other social demands that conflict with the sleep needs of repair.

### **2.3.4 Psychological and Social Consequences**

Implications of shift work on mental health go beyond fatigue and instead include elevated depression, anxiety, and deteriorated cognitive performance rates. The article by Brown et al. (2020) summarises fresh evidence of mental health outcomes, including the increased prevalence of numerous psychological disorders. One of the points, which becomes especially important with the shift work schedule and conflict of the standard social rhythm, is social isolation.

Cheng and Drake (2018) have explored the psychological effects of shift work by underlining the correlation between the social and biological implications of such experience on general well-being. Individual variations in adaptation are complicated combinations of age, chronotype, gender, and personal circumstances. The study of the shift work and sleep quality relationship by Tach et al. (2020) in an Asian population with multi-ethnic working groups established cross-cutting relationships.

## **2.4 Work-Family Conflict in Manufacturing Environments**

### **2.4.1 Conceptualisation and Measurement**

Work-Family Conflict differs in that it is an inter-role conflict; pressures in work and family roles are incompatible with each other, so that engaging fully in the two roles is either hard or impossible. This paradigm developed out of the realisation that conventional work-life separation paradigms do not transfer the complex interactions between employment and family life, especially in workplace environments characterised by a high level of strains, like those experienced in manufacturing. The multidimensionality of this conflict suggests that there are three types: time-based conflict, where hours spent in one domain cannot be used in the other domain, strain-based

conflict in which stress and fatigue in one domain produce pressure to perform in the other, and behaviour-based conflict that occurs when the role behaviour expectation in one domain interferes with them in the other domain.

The conceptual background to work-family conflict centers on the role theory because it assumes that different persons have numerous roles, and they each come with expectations, duties and behavioural demands. Role demands are considered excessive or incompatible when they lead to role conflict, where individuals are subject to the mental and behavioural strain in the form of adverse reactions. This theoretical framework applies exceptionally well to manufacturing environments, where workload requirements are inflexible, physically demanding and time-sensitive, in direct conflict with the demands of family roles.

Directional aspects of work-family conflict acknowledge that interference may flow in both directions and that interference of work-to-family may occur when there are job demands that constrain family accommodation of time, energy, or attention devoted to family responsibilities and vice versa, the family-to-work interference, where family demands compromise work performance, attendance, or career advancement. The two types of interference are different and imply diverse challenges and outcomes, as work-to-family interference is associated with a conflict in schedules, tiredness impact, and lack of time to attend to family matters, whereas family-to-work trend is accordingly linked to attendance-related issues, concentration problems, and career limitation choices.

Significant cultural differences in family structure, role expectations, and values require measurement approaches to work-family conflict to take account of the differences in meaning between the Western developed scales and the special dimensions of work-family conflict specific to collectivistic cultures, where the extended family and community roles, as well as different gender role expectations, add new breadth to the existing spectrum of possible conflicts. In South Asian settings, the family can contain several generations or close inter-dependencies existing between generations, constituting network obligations that transcend the nuclear family notions tended to in Western research tools.

The issue of cultural adaptation is also seen in the pattern of response, where collectivistic cultural values may induce individuals to respond, in particular, by attributing difficulties or conflicts that may not be brought out in problems that may be seen to criticise the family or work systems. Moreover, the cultural notions of duty, sacrifice, and the role fulfillments can present alternative conscious frames of interpretation and judgment of work-family balance that are significantly different as far as measured through the prism of individualistic constructs assumed by most measurement instruments.

#### **2.4.2 Antecedents and Consequences**

One of the work-related antecedents of work-family conflict in a manufacturing setting is schedule inflexibility, which is especially applicable in an environment where production scheduling requires strict adherence to a planned schedule which cannot be easily changed to meet personal or family requirements. Manufacturing can require ongoing processes, efficiency of machines, and synergy of teams that do not allow the employee a lot of flexibility when it comes to scheduling. The necessity to work overtime and work during the extended hours poses direct conflict against the family obligations and duty, whereas frequent changes in schedules during peak production or equipment maintenance cause an additional problem in planning their family activities and roles.

Jayaweera (2015) studied the apparel industry context and work-family conflicts in Sri Lanka, where conflict-related factors were unique to the industry, such as the high production deadlines leading to an increase in working hours during the peak season, quality work demands that are accompanied by mental fatigue, and having no flexibility in breaks, as it would require production line scheduling adjustments. The paper has demonstrated how pressures within the global supply chain translate into the work-related demands at the individual level to cause systematic over-time conflicts with family roles and responsibilities.

Physical environment, the manufacturing work environment characteristics, create strain-based work-family conflict through fatigue and physical distress and health effects, which drain energy and emotional resources that might otherwise be used to communicate with family members. Overwork, particularly for manufacturers' labour, with a lot of fine motor movement and concentration over time, can result in fatigue patterns that can affect mood, temper, and the inability

to engage in family activities. Protective equipment safety measures and requirements may also be impractical work-family transitioning obstacles.

Family antecedents such as demography such including the number and age of dependent children, younger children are characterised by high demands of care activities that are not compatible with the time-constraining work schedule. Spouse input in employment and the intensity of their support also play vital roles in the degree of work-family conflict with dual earner couples striving to disentangle the balance between work and family life, and single earner couples encountering the challenge of staying in the labour force to contribute the financial support required to sustain the family. The tasks of elder management, most particularly those that are most vital in cultures that emphasise the need for filial obligation, require extra time and emotional liabilities that can intrude on work requirements.

The cultural and social aspects are of particular concern in the South Asian context, where the gender-based norms of behaviour may result in uneven family responsibilities, as the females tend to assume a large portion of the role of family providers, child-rearing and caregiving roles, regardless of their work or not. These cultural norms can enlarge the work-family tension between women manufacturing workers, a population that is struggling to find a balance between two very different things: the economic breadwinner and a mother 24-7. Additional pressures and shared needs of the family contribute to further potential conflict that is not typically considered in a Western academic environment. Involved in individual consequences of work-family conflict include both psychological and physical health outcomes. The psychological distress can be in terms of anxiety, depression, and general dissatisfaction with life, as individuals are oversimplified in meeting the various demands adequately. Psychological issues can arise when the ongoing conflict leads to prolonged exposure to stress without proper outlets for stress. As there is no satisfaction in the life of the worker, due to his inability to fulfil the work and family roles to the desired level, feelings of insufficiency and failure in various areas of life appear.

Outcomes with work include poor job satisfaction because the family complications would result in negative correlations to the professional demands and schedules. The turnover inclinations increase as work-family conflict becomes chronic and unsustainable, and employees contemplate alternative employment or leaving the workforce in totality. Performance losses are incurred in the

form of divided attention between the rival roles, work fatigue as a result of performing numerous and highly demanding roles and absenteeism, which is accompanied by work absence owing to family emergencies.

According to Obrenovic et al. (2020), the development of a comprehensive model of work-family conflict effects on job performance finds the possible ways in which work-family conflict affects psychology safety and psychological well-being beyond an individual stress phenomenon and includes the work relationships, communication patterns, and collaboration efficacies. Their study showed that work-family conflict has a ripple effect in workplaces, and in the complexities of the team dynamics and organisational culture, not just individual performance outputs.

Family consequences are the strain in their relationships with their spouses, children, and extended family members, who feel neglected and unsupported owing to the demands of the work. The efficiency of parenting can be diminished because the working environment puts stress on parents and contributes to fatigue, diminishing patience, accessibility and emotional resources to guide and assist the child. As a result, the overall functioning of the family can suffer when work-related pressures continuously take precedence over family pressures, causing resentment, communication difficulties, and a lack of ability for the family to pull together.

#### **2.4.3 Manufacturing Context Considerations**

Manufacturing settings are unique because they require physical work environment limitations that limit work-family flexibility opportunities available in the office-based workplace. Production lines create inter-dependencies, which imply that the absence of an individual or schedule changes may lead to the creation of pressure to conform to predetermined schedules and play an essential role in the production process. The demands of the operation of equipment, safety and quality requirements introduce further restrictions on the flexibility of work organisation.

Flexible employment practices are inhibited by the strict production schedules determined by customer delivery rates, equipment maintenance depots, and the overall planning of the supply chain, which does not accommodate the needs of the family and thus cannot allow flexibility. Unlike knowledge work that can be flexible on the timing of specific tasks, manufacturing processes, in most cases, dictate that some workers must be there at certain times to ensure that

production flow is not affected. This inflexibility poses special problems in dealing with family emergencies, child care interruptions or other indivisible family needs.

Such alterations in work schedules created by shift work, which are common in the manufacturing industry, lead to additional work-family conflict, destabilising regular family schedules, social access, and sleep disturbances, and resulting in poor quality of interaction with the family. The employees working the night shifts have special concerns in regard to relationship problems and parental issues of their family members and other dependents when the working days disrupt the everyday activities of their family members and other people they depend on. The rotations prevent the development of a stable family routine and may be a continuous stressor to both the employee and his family.

The element of the female workforce is particularly relevant in that huge populations of women are employed in apparel factories and women are usually supposed to play various family roles in conventional society. Women in the manufacturing sector are also forced to face more work-family conflict because of cultural pressure to assume dominant responsibility in the management of their households, child care, in addition to contributing more to the economy by working.

Dilhani and Dayarathna (2017) measured the impact of work-life balance practices on employee performance through the lens of work centre female machine operators in the apparel industry in Sri Lanka, showing significant relationships between work-life balance practices and performance outcomes obtained. The authors also mentioned the gender disparities on their impacts. Their analysis revealed that the prevalence of work-family conflict was higher in women than in men in the identical position because of the role expectations in the culture and other practical barriers such as balancing the childcare and household practices. The paper found that organizational support of the work-life balance is present in some manufacturing conditions and can significantly enhance employee satisfaction and performance rates in those cases when it is provided.

Traditional families and family roles and expectations are cultural contextual measures that may add more family responsibility to people, particularly women, yet even men, by pressuring them to emphasize roles of family provider, and responsibilities over personal choice, even at work. These conflicts between economic necessity and the cultural values arise when the demands of the labor

market conflict not only with the traditionally expected roles but also, place more stress and conflict on the employees that are attempting to meet both the demands simultaneously.

The collectivistic communal orientation that is highly prominent in the South Asian societies brings a set of work-family interface concerns because personal work choices extend to support their families as well as community relations. Workers may also be put under pressure from family members who may demand that workers focus their attention on their family needs first and foremost before committing their time and focus to work demands, whereas workers at the same time face pressures of economic demands and may require stable employment. These conflicting demands place very complicated dilemmas in the way choices are made, and the effects of the individual-focused approach of work-family balance intervention are uncertain to fulfill.

Social support systems accessible to manufacturing workers may be different from those accessible to professional workers and may include limited access to services such as flexible child care, elder care support and/or family counseling to help manage work-family conflicts. The financial suitability of those manufacturing workers can make them unable to afford supplementary services, and their work schedules can be inconvenient to the community-based support services.

## **2.5 Sleep Quality and Its Correlation with Occupational Results**

### **2.5.1 Sleep Quality: Definition and Assessment**

Sleep quality is multi-dimensional and reflects more than just sleep duration, as it comprises objective and subjective attributes of sleep satisfaction, restoration, and functionality. The quality of sleep is multidimensional, with both objective and subjective measures, such as the duration of sleep, sleep latency (time to drop off to sleep), sleep efficiency (how much time in bed an individual spends sleeping), and the number of awakenings, on the one hand, and subjective perceptions of the level of subjective sleep satisfaction, morning freshness, or alertness in the day, on the other.

Objective sleep tests include polysomnography, which gives a detailed account of the sleep architecture, including REM and non-REM sleep, sleep fragmentation pattern, and indicators such as physiological indicators of sleep quality. An alternative to short-term sleep-wake measures is actigraphy, which provides measurement of daily activity patterns in the workplace that correlate with sleep-wake patterns over longer durations using wrist-worn actigraphs. These objective-based

assessments are helpful to know about exact sleep patterns and could be of no use in measuring the subjective experiences affecting the daytime behavior and job performance.

Subjective sleep quality measures usually incorporate self-reports that gauge personal views of sleep satisfaction, restorativeness, and effects on real-life. One of the frequently utilized measures that is used to measure various aspects of sleep quality includes the Pittsburgh Sleep Quality Index, which assesses subjective sleep quality ratings, sleep latency, sleep duration, sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. Culture is a factor in sleep assessment, issues relating to sleep behavior, expectations, and disturbance tolerance can be culturally-specific and can conceivably impact both objectively measured sleep patterns and perceived sleep quality.

Cultural differences in the applicability of sleep assessment involve sleeping arrangements, in that many South Asian families share beds or have different expectations of privacy that might affect sleeping quality, as well as the form of sleep assessment. Other environmental effects, through climate choices, housing conditions, and community noise, may set varying baseline sleep problems, and that in turn influences sleep quality perceptions. Moreover, the cultural ways of sleep, rest, and fatigue also could affect the way people perceive sleep problems and report them, manifesting in some cultures when people can endure and avoid complaining to others.

The correlation between objective measures and subjective measures of sleep is complex, and it has been shown that the perceptions held by the individual on the quality of their sleep do not always have a strong relationship to the objective measurement of sleep. This difference is significant in understanding the relation between sleep and work performance since satisfaction in the sleep variable might act separately from the objective sleep parameters of sleep architecture. Jeong and colleagues (2012) found that, in manufacturing settings where employees base many of their work-related choices on their perceptions of sleep quality, subjective evaluations can be better predictors of performance-oriented outcomes than objective data regarding sleep.

### **2.5.2 Sleep Quality in Shift Workers**

Shift work sleep disorder is a long-recognized clinical entity that occurs in significant proportions of shift workers, presenting as insomnia symptoms during the desired time of sleep and excessive somnolence during the required moments of wakefulness. Prevalence rates have been shown to

depend on the type of shift and rotation schedule, and the sleep disorders being experienced by the workers exhibit a prevalence rate of 10-38% in the case of clinically significant treatments. The most critical risk of sleep problems belongs to night shift workers whose sleep regularly clashes with the natural circadian rhythms, whereas rotating workers who have to adapt to new shifts periodically are exposed to no less essential obstacles that do not allow them to stabilize sleep patterns.

The pathophysiology of shift work sleep disorders is that the circadian timing system in the suprachiasmatic nucleus is thrown out of balance, and a person is expected to be sleeping during times of the day when the environmental light-dark cycle dictates that they need to be awake. Circadian system persists in favoring sleep onset and maintenance during the biological night, even when there are work demands favoring alertness at night time, setting up a conflict between work demands, and the biological drive to sleep. This conflict is reflected in the sleep disturbance during the preferred daytime hours, sleep restrictions and poor quality of sleep, and lack of alertness at the workplace.

Effects on shift workers: The architecture of sleep takes place in shift workers, wherein sleep may be reduced and fragmented, diminishing the memory consolidation, emotional world, and cognitive recovery processes during sleep to generate better work performance. Changes to the slow-wave sleep impact physical recovery processes, such as impacting the immune system, tissue repair, metabolism regulation, and more. Phase shifts in circadian rhythms disrupt internal biological rhythms with respect to the environment, constantly setting up a conflict between biological time and social/work schedule demands.

The results of individual differences of shift work sleep adaptation support the idea that the preferences of chronotypes (morning versus evening oriented), age-related changes in the flexibility of the circadian rhythm, gender differences in the sleep architecture and hormonal shifts and genetic variations are combined. The younger workers commonly exhibit higher levels of adaptation potential, but may suffer increased social disruption in lifestyle, whereas the older workers have low adaptation potential but an increased capacity to cope with challenges of changing sleep patterns.

In the same middle-income setting, Lim et al. (2020) investigated relationships between night-shift work, sleep quality, and health-related quality of life in manufacturing workers, concluding that night-shift work is associated with poor sleep quality, and a poor health-related quality of life. It was proved in their studies that night-shift employees had shorter sleep duration, greater sleep disturbances, and lower-rated sleep quality when compared to day-shift workers, which also corresponded with higher health complaints and a lower health quality of life assessment. In addition, sleep problems were found to mediate links between shift work and a number of health outcomes, indicating that some of the adverse effects of shift work might be reduced through the development of sleep quality improvement interventions.

Internal factors that influence employees' sleep quality among shift workers entail night sleep disturbances by noise during daytime because of traffic, building construction, and recreational activities in the neighbourhood. During preferred sleep time, exposure to light can inhibit the production of melatonin and disrupt the mechanism to adjust to the circadian rhythm. Housing, family, and community activities and responsibilities that defy night sleeping further compound the problem of obtaining restorative sleep.

Methodologies to achieve optimal compensation among shift workers are strategic napping both before and during participation in a work shift, sleep debt payment during time off, and manipulation of the circadian rhythms through the use of bright light exposure and administration of melatonin. The success of these strategies, however, differs strongly among individuals and may be restricted by environmental difficulties, family concerns, and job schedule inconstancy.

### **2.5.3 Sleep Quality and Performance**

The issue of attention and vigilance presents paramount considerations to manufacturing safety and quality, as loss of sustained attention and degradation of vigilance task performance directly impact the ability to detect errors that are necessary to maintain manufacturing safety and quality. Sleep deprivation studies repeatedly show that attention disturbances arise as one of the first and most severe impairments with performance being especially affected during the night hours and psychologically demanding vigilance tasks that mandate unremitting attention to rare occurrences, as in the manufacturing quality control procedure, respond primarily to the effects of a reduction in sleep quality.

The deterioration of sleep quality will influence executive functions and decision-making abilities, because once the working memory capacity is diminished, the person can no longer retain and reason about information when solving complex problems. The cognitive flexibility impairment affects the ability to acquire new, varying conditions, to shift the approach when the action of the initial one proves ineffective and merge the data provided by different sources and to formulate decisions. These details of these declines in the functions of the executives have their direct consequences on the activity of manufacturing which deals with solving problems, inspecting the quality, and changing the adaptively determined defects of equipment or differences of the processes adapted.

The reduction in the processing and reaction speed along with the deterioration of the quality of sleep is crucial in extending the performance of activities, where prompt reaction to any signal of equipment, safety warning, or quality concerns have to be checked. The slight difference in the reaction time may lead to a tremendous impact on productivity in a bustling manufacturing plant and may be quite dangerous in cases where time within a minute may be lost entirely causing possible damage to machinery or harm to a worker.

Motor degradation in the muscle-eye functions, most useful in finesse manufacturing processes such as sewing work, which requires fine-grained motor control to give pinpoint control in the movement of the needle, uniform stitching, and control of the fabric, are also impairments in fine motor skills. The product quality is directly affected by the fine motor control that reduces its precision, increases its error level, and introduces inconsistency during repetitive assembly. Coordination problems: Gross motor skills can be a problem as far as balance and stability are concerned, and coordination in regard to the large-motor tasks or equipment usage. The effects of inadequate sleep quality on memory and learning can be attributed to both poor procedural memory consolidation and the inability to retain training information, work procedures, and quality standards due to problems with declarative memory. Sleep-related effects of impaired learning could be significant in manufacturing settings that need frequent skill updating and adapting to new protocols. Also, fatigue-related attention issues can impede the initiation of a new task or procedure.

Manufacturing environments offer specific opportunities whereby any decline in performance due to sleep has direct quantifiable results, such as measures of product quality, efficiency production

indicators, and occurrences of safety issues. In the case of manufacturing, unlike office work, where the problems concerning performance may not be readily visible until organisational consequences are reflected on individuals, manufacturing performance problems may have immediate observable effects both at the individual and organisational levels.

In a study conducted by Fernando, Caputi and Ashbury (2017), the authors reported the effect of presenteeism and absenteeism in a multinational company in Sri Lanka, and they showed quantifiable economic implications of impaired performance due to poor quality of sleep. Their study provided a decrease in work efficiency as a direct productivity loss due to sleep-related performance issues and even indirect costs of heightened levels of supervision, training, and quality control activities. The study has also shown that sleep problems significantly preceded absence decisions, as workers who suffered extreme sleep-related performance impairment would opt to remain at home to avoid safety incidents or quality problems at work.

The effects of circadian rhythm on the performance create a predictable pattern of variation in cognitive and physical-performance capabilities across various sleep cycles with the performance tending to reach its peak in the regular daytime hours and minimum in the early morning hours (2-6 AM). These performance rhythms vary in the degree to which they modulate various abilities, with complex cognitive skills more subject to entertainment/sensitive times than simple motor skills. The familiarity of these patterns enables us to know why some kinds of mistakes or accidents are relatively frequent in each of these shift periods.

This gradual deterioration of performance may also be observed in the accruing consequences of chronic afflictions of sleep quality, and even though partial adaptation to the shift allows schedules, workers experience a gradually worsening performance over time as symptoms cumulate- sleep debt. Sleep debt occurs when the time spent sleeping in each day becomes so less than the amount required by an individual that it cannot be entirely made up by periodic long sleep on workdays. This systemic harm is particularly remarkable in the case of manufacturing employees who may be exposed to shift work for several decades.

## **2.6 Occupational Stress in Industrial Settings**

### **2.6.1 Occupational Stress: Definitions and Models**

Occupational stress is the harmful physical and emotional interactions that arise when the job demands are not matched with the resources and abilities or other needs of the individual. It is an intricate notion that comes as an outcome of the interactions of the work environment requirements and the individual traits. Stress, in this conceptualisation, is not the result of objective work conditions but of subjective appraisal and interpretation of the same work conditions and situations relative to personal capacities and coping resources. Occupational stress is complex and involves instant explanations to the immediate problems in the working environment, in addition to more organised forms of reaction, which develop after chronic exposure to stressful working situations.

The transactional model of stress, which was formulated by Lazarus and Folkman, highlights the personal appraisal mechanisms in the occasion of stress in the view that the stress occurs in a two-fold cognitive evaluation. Primary appraisal refers to identifying the qualities of the states of affairs in the workplace, whether they are threats, challenges, or opportunities to personal well-being and goal accomplishment. Secondary appraisal is concerned with estimating resources at hand in the form of coping resources, including personal resources, social support, as well as the organisational resources available to assist in addressing the perceived stressors. This transactional model reflects the importance of individual differences in how stress is perceived and how stress responds to work conditions, in which the identical working conditions result in different degrees of stress demand necessitating worker characteristics and conditions.

Models on the relationship between work characteristics and the outcomes of employee performance and health in a workplace are developed using occupational health related job stress models. Demand-control suggests careful consideration between job demands and decision latency. According to the Demand-Control model by Karasek, high strain jobs are the most disagreeable stressful situations: the jobs that are characterized by high demand and low control. This model classifies four types of jobs according to their implications on both health and performance, high strain (high demands and low control), active jobs (high demands and high control), passive jobs (low demands and low power) and low strain (low demands and high power) based on their implications on health and performance.

Siegrist model Effort-Reward Imbalance is rooted in the interrelations between effort and reward and the concepts that when high amounts of effort are needed, and low amounts of reward are received, a stress condition may be induced, threatening health, and motivation. The three forms of rewards in this model are financial reward, social reward and promotion. The model also carries with it the personal overcommitment tendencies which may augment the stress reaction in which individuals work harder than the level of rewards being given to them. The theoretical frameworks that will be used to help understand how work characteristics in the manufacturing sector lead to stress are relevant in providing basic guidelines on how manufacturing work factors lead to occupational stress owing to specific identified mechanisms of occupational stress in relation to work organization, job design, and reward systems.

### **2.6.2 Sources of Occupational Stress in Manufacturing**

The physical stressors in work environments in manufacturing settings include several stressors that cause short-term discomfort as well as long-term health risks. The difficulties of communication and concentration through noise are one of the continuous stressors that impact task performance and the ability to socialize as well, which is necessary in the process of teamwork and coordination. Uncontrolled loud sounds lead to physiological stress reactions such as raised heartbeat and blood pressure, as well as to fatigue due to loss of effort in concentration and communication. Air quality and heat-related factors, which can include physical discomfort and health impacts, are additional physical stressors that can be present in a tropical manufacturing environment where cooling may be restricted and other heat sources may be active within work processes.

Ergonomic issues that impose physical demands are also another significant group of manufacturing stressors, such as repetitive movements required by the job, postures less than ergonomically ideal as necessitated by equipment design or workspace limitations, and lifting, or carrying more than is suitable in terms of physical capability. These ergonomic stressors have an immediate feeling of discomfort as well as cumulative trauma risks, which cause concern over the long-term health effects and sustainability of a career.

Awareness of potential harm and consistent vigilance that are caused by safety hazards impose constant psychological pressure, as there commonly are several types of injury risks in a

manufacturing environment, such as machinery operation concerns, the risk of exposure to chemicals and risks of fire or explosions. This constant vigilance of risk causes a significant mental strain. It continues to take up the same brain power that is used to cause cognitive fatigue, as well as induces a fear towards any chance of accident among executors or other associated individuals.

The psychosocial work environment stressor factors include role factors such as role ambiguity and conflicts, where workers do not understand their job requirements well enough, or they may be presented with conflicting requests by different supervisors or within the levels of the organization. Stress in manufacturing working environments is primarily a result of workload and time pressure that is typical of production-based systems, where deadlines are mandatory despite an increase in the required work pace that often leads to work overtime and the maintenance of standards on quality.

The lack of control and independence is indeed a primary stress source in manufacturing work areas where employees do not have much say in terms of work rate, the way of doing it, or deciding on the time to start or finish. Work in production lines usually has a great deal of defined procedures and time requirements that take minimal individual decision-making and require the ability to maintain a necessary standard of performance. Such a limit on the autonomy of the worker conflicts with the foundational psychological principles of requisite competence and self-determination, a conundrum expressible as stress-inducing perceived helplessness and the absence of meaningful choice in work-related tasks.

Organizational factors such as variations in the styles of management and levels of supervision, the quality of communication patterns, etc, also play a role in determining the levels of stress by the manner in which they influence the provision of social support and the provision of role clarity. Autocratic management styles are stressful since they are focused on control, punishment and de-emphasized support and development, which have a threat-based approach motivations and low psychological safety. White et al. (2018) specify that a lack of quality supervision promoting inconsistent feedback, lack of specific expectations, and lacking technical or emotional support leads to stress due to the feeling of uncertainty and isolation. Ineffective communication patterns that do not supply adequate information to complete the task or do not recognize worker issues and efforts produce stress in the roles due to role ambiguity and the sense of organizational unfairness.

### **2.6.3 Shift Work as an Occupational Stressor**

The typologies of stressors presented by shift work impose excessive demands beyond the demands normally observed in the daily time day work setting, a multifaceted strain with a multitude of physiological, psychological, and social modalities by which it delivers stress. The basic issue behind shift work is that it disrupts natural circadian rhythms that have through millions of years adapted to human biological processes to fit light-and-dark patterns in the environment. This circadian imbalance acts as a physiological stressor that affects many body systems and processes, including sleep-wake regulation, hormone secretion, body temperature, and metabolic.

James, Honn, Gaddameedhi, and Van Dongen (2017) outlined the various consequences of circadian rhythm disruption in shift work to include sleep disorders, gastrointestinal issues, cardiovascular stress, and immune-related issues. These animal disturbances develop a platform of consistent pressure that exposes shift workers to more external pressure loss to improve pressure relief and adaption.

Psychosocial stress is generated through the disturbance of standard social involvement patterns and interaction with the family, the community, and society due to social and family relationship strain. Schedule incompatibility with family and friends leads shift workers to experience social isolation at a time when extra support could be needed to deal with work-related stress. Silva and Costa (2023) give detailed accounts of the effects of shift work and how the disruptive social relationship effects combine with physiological stress effects to pose an all-encompassing challenge to worker health and performance.

Other stresses compound the negative impact of sleep quality degradation due to shift work, as it inhibits mental tolerance and emotional coping ability and predisposes individuals to different stresses. Low levels of sleep quality negatively affect the ability to focus and make decisions, thus impairing the emotional management of situations in dysfunctional environments at work. A systematic review conducted by Mao, Raju and Zabidi (2023) indicates that there are bidirectional associations between stress and sleep quality, where poor sleep quality exacerbates the stressful condition and, conversely, stress makes sleep susceptible to poor quality, inducing potentially self-reinforcing stress/sleep cycles.

The effects of combinations of stressors with shift work, the additive effects of multiple stressors, are of concern because shift work is usually combined with other occupational stressors, e.g., high physical demands, time pressures, or organisational change, potentially resulting in multiplicative rather than additive stress effects. Shift workers are particularly susceptible to workplace stressors because of the impairment of physiological and psychological resilience caused by circadian disruption and sleep impairment. The time of exposure to the stress also gains prominence since stressors encountered in the course of natural low-alertness can be much more detrimental than when the exposure to the stressors during high-alertness times is attained.

Stressors of shift work cannot be defeated without a combination of individual and organizational support interventions, whose performance will be determined by the compatibility of coping strategies and the features of stressors. Examples of personal coping strategies are practices in maintaining sleep hygiene, circadian rhythm management procedures, social support procedures, and stress-reducing practices. Individual coping mechanisms cannot be so easily separated, as they may be subject to the inherent biological constraint of circadian upset, and therefore, organizational support mechanisms are vital to fully manage stress in a complex environment such as a mine.

#### **2.6.4 Stress Outcomes and Apparel Manufacturing**

The physical and mental health effects of chronic occupational stress are the health outcomes that accumulate over time as a result of inferring occupational stress. The cardiovascular risk is elevated in a variety of ways including an increase in blood pressure, an increase in inflammatory responses, and a change in behavior risk factors including smoking, poor diet, and lack of physical activity. The prevalence level of mental health disease rises with chronic exposure to stress, such as depression, anxiety, and other psychology-related issues that limit performance at work and life quality.

Brown et al. (2020) presented timely findings on the consequences of shift work that specifically identified high risks of a wide range of psychological disorders as importantly demonstrating interactions between shift work stress and other work and personal stress factors. Their study made it obvious that the environment of manufacturing work that includes shift work combined with other stressors is a particularly problematic environment to maintain a healthy mind.

Behavioral consequences have been the absenteeism and presenteeism trends where employees either retreat to work environments free of stress or they attend work being sick and unable to contribute effectively to the work place. Turnover intentions arise when the pressures of work become chronic and unmanageable and the employees lose their interest in serving the company any longer. Safety behaviours change. Differences in attention, decision-making and risk-taking behaviours as influenced by stress predispose to accidents and the severity of issues and injuries at the workplace.

Outcomes of the performances include decrements with respect to task performance in terms of reduced efficiency, accuracy, and consistency in core job duties. Contextual effects of performance influence teamwork performance, organisational citizenship, and voluntary performance that contribute to organization performance in addition to the actual performance expectations. The interventions to reduce innovation and creativity constrain the ability to respond adaptively to workplace issues and organisational change efforts that require workplace engagement and problem-solving contributions of workers.

In a study of one of the largest manufacturing industries in Sri Lanka, Tambiah and Cutica (2014) demonstrated that occupational stress is a predictor of intention to quit in manufacturing businesses, specifically in a leading apparel manufacturer in the country, and that the measured relationships between stress and the intention to leave were statistically significant and had practical or industry implications. The results indicated that occupational stress had both a direct impact on turnover intentions, as well as an indirect impact by way of mediated aspects of job satisfaction and organisational commitment, underscoring that the effects of stress on formal performance outcomes were multi-dimensional.

A significant body of evidence emerged in response to a study by Fernando, Selvam, and Bennet (2010) on patterns of exhaustion and stress among Sri Lankan apparel workers, including higher stress levels and even correlations with specific outcome variables such as decrements in performance levels, complaints of ill health, and changes in job attitudes. They found particular stressors that were common in apparel manufacture, such as pressure to meet production quota targets, pressure to achieve quality standards, and physical work environment issues were factors which exposed workers to exhaustion and stress responses.

Wellangiriya and Abeysekera (2021) investigated the role of occupational stress as a determinant of work-life balance in operational-level workers in the Sri Lankan apparel industry, concluding that the effects of stress were well beyond the workplace contexts to include family relations, well-being and life-satisfaction, and pleasure. According to their study, occupational stress has ripple effects throughout the life of a worker because it not only influences the performance on their immediate job but also future life, including career sustainability and lifestyle.

Silva and Ranasinghe (2017) explored the connection between job stress and deviance in the workplace by assessing the factors that guide the correlation between these two components at the operational level and employee levels. The research gave an outline on how severe job stress can provoke staff to engage in deviance activity, giving them stress relief in the short-term. The results obtained emphasised the value of dealing with occupational stress before the development of behavioural issues.

## **2.7 Absenteeism: Causes, Consequences, and Measurement**

### **2.7.1 Absenteeism: Conceptualisation and Types**

Absenteeism is a multifaceted behavioral outcome that is affected by a number of individual, organizational and cultural factors. This is to differentiate between voluntary and involuntary absences since there are days when an employee is absent by choice and others on grounds of involuntary circumstances like health or family emergency. Culture and absenteeism behaviors are different in various societies.

Types of absenteeism can be classified as certified sick leave patterns, which need to be registered by a doctor and uncertified absences, which may be an indicator of minor health-related absence, family-oriented obligations, or even motivation-related absence. Frequency-based metrics that count absence accidents without consideration of their duration are one method of measurement, as is the duration measure, which concentrates on the length of time intervals actually lost due to absence. Composite indexes represent average combinations of weighted distances on frequency measures and on duration measures.

### **2.7.2 Predictors and Consequences**

Individual factors that affect the absenteeism are the age and gender patterns that indicate various health risks, familial needs, and attitudes towards work. Health status and chronic conditions both present viable justifications of absence and are likely to be symptoms of work-related impacts on health. Job attitudes and satisfaction levels influence voluntary absence decisions.

Some of the work environment factors, such as job characteristics, demands, and resources, influence both health-related absenteeism due to stress issues and injury, as well as daily absenteeism due to job satisfaction. Supervisor support and styles of management influence absence by implying an impact on both job satisfaction and stress levels.

The literature acknowledges that there is always a greater level of absence among shift workers than among the day shift. Night shift employees are especially vulnerable. Fernando, Caputi, and Ashbury (2017) have demonstrated the quantifiable effect of both negative presenteeism and absenteeism in the manufacturing industries in Sri Lanka.

### **2.7.3 Consequences of Absenteeism**

Impacts on organisations involve the direct costs, which include the cost of replacement labour, overtime payments and indirect costs, which include loss of productivity and quality defects when new operators do not have the desired experience. These costs affecting the organisation and which may not be immediately noticeable and would include loss of staff morale.

There is an effect of absence on other workers and co-workers who may be forced to redistribute workload, which may affect team cohesion based on the magnitude of work burden. Positive effects on production systems in a production environment that occur in a manufacturing environment are manufacturing line hitch, whereby the absence of workers cannot be easily substituted and the ability to meet delivery schedules when production is stalled as a result of shortages of workers.

In a systematic literature review of work-related psychosocial risk and protective factors that affect workplace sickness absence, published by Margheritti et al. (2025), it has been given the statement that the overall interventions to prevent sickness absence must be across both individual and organisational levels.

## **2.8 Production Quality and Performance Outcomes**

### **2.8.1 Quality in Manufacturing: Definitions and Frameworks**

Manufacturing quality is a multi-dimensional attribute that contributes to performance. It attributes to: features completeness to satisfy customer expectations, reliability to give a consistent performance over time, and conformance to specification to provide standardisation. The principles of Total Quality Management focus on customer satisfaction and satisfaction, continuous improvement processes, and employee involvement and engagement.

The statistical quality control tools enable objective mechanisms of monitoring and controlling the quality results through control charting to track performance, calculations of the defect rates to quantify the quality issues and methodologies of reducing variation and wastage, as well as maximising customer value.

### **2.8.2 Human Factors in Manufacturing Quality**

Human error issues are a key aspect of manufacturing quality outcomes, and thus the study of error patterns is subject to predictable taxonomies based on skill-based errors that include inattention slip errors, rule-based errors involving the application of known rules to rule-based situations, and knowledge-based errors that involve inadequate expectations of complex situations.

Fatigue and decreases in performance lead to characteristic shapes of quality depreciation, such as in skills of sustained attention, leading to weaker error detection, skills of manual dexterity, resulting in attenuated manual assembly accuracy or cognitive skill quality of decision making, with the result of impaired problem solving. Stress and performance of quality relationships exhibit how work stress occupies attention under the pressure of performance and inhibits cognitive resources that can be devoted to quality-specific activities.

### **2.8.3 Shift Work and Quality Outcomes**

The performance impacts of circadian rhythms are consistent across shifts and shift periods, repeatedly yielding predicted levels of performance quality (cognitive performance follows the classic circadian rhythm, with the highest performance being during daytime, and the lowest during night). Motor performance time-of-day effects have a direct impact on manufacturing quality

because the time-of-day effects are tied to manual dexterity, coordination, and precision capabilities, which apply in sewing operations and handling time requirements.

The effects of sleep deprivation on error rates indicate a cumulative effect: the more sleep deprivation accrues, the worse the performance quality. Micro-sleeps produce a momentary lapse in attention, raising the chances of making an error, and the recovery sleep may not be very adequate due to time limits and other factors.

#### **2.8.4 Absenteeism and Quality Relationships**

Continuity and skill maintenance are the other factors that connect absenteeism to quality performance, since experience curve effects imply that the workers can develop skills and maintain them through attendance over time to ensure quality performance. Each member of the team has a coordination role to play, and when a member is absent then this destroys the pattern that has been established in terms of collaboration and communications to achieve a good quality.

Impacts of replacement workers to be considered include a prolonged learning curve where quality may be affected, the involvement of higher supervision and diversion of management time and attention to other quality-enhancing processes and the rate involving error increases that are caused by both skill and transition issues.

#### **2.8.5 Quality in Apparel Manufacturing**

Sewing process determinants include the skill levels and experience of the operators in the precision and efficiency of the work, the condition of the machine and the maintenance affecting the quality and consistency of the stitches, and the quality and specifications of the material, which determine the quality ceiling at which no amount of operator influence can work.

Durairatnam, Chong, and Jusoh (2020) focused on quality performance determinants in the Sri Lankan apparel industry, only finding key factors that influence quality performance and which can be used as evidence to explain the relationship between various organisational and individual factors with quality performance indicators.

Defect types include stitch errors and irregularities that affect functionality and appearance, dimensional problems which do not allow the entire product to fit and assembly, appearance, and

finishing mistakes and defects which affect customer satisfaction. Quality costs are directly experienced in the form of rework and repair costs, customer returns and complaints management costs, as well as long-term brand image reputations.

## **2.9 Cultural and Contextual Factors in Sri Lankan Manufacturing**

### **2.9.1 Sri Lankan Apparel Industry Context**

The Sri Lankan apparel industry is a central pillar of the national economy and brings in a considerable percentage of the export revenue as well as employment to hundreds of thousands of workers, mainly women. The global supply chain convenience places the Sri Lankan manufacturers in the position of tier-1 suppliers to the international brands, presenting a potential challenge to grow, and a limitation because of the quality demands and delivery timing.

The use of technology and modernisation strategies, such as automating some of its processes, developing some of its personnel to match the modern workforce, and preparing to adopt Industry 4.0 and the usage of digital technologies to create and update its manufacturing processes.

### **2.9.2 Cultural Factors in Work-Family Balance**

The traditional family structures in the Sri Lankan society pose distinct challenges to work-family balance, especially for women, who are predominantly expected to be the primary caregivers in terms of household chores, childcare, and eldercare, irrespective of their employment status. Extended family commitments, which are de facto prevalent in collectivistic cultures, expand the work-family balance considerations beyond the confines of nuclear family matters.

Religious and cultural values shape work attitude, family priorities, and life goal orientations in a manner that does not conform to Western-developed organisational practices. Community and social pressures are things such as religious observance, cultural celebration, and social support systems that can conflict with the work schedule and offer valuable personal sources of meaning and support.

### **2.9.3 Workforce Characteristics**

The industry has preferred female labor with particular preference those in the age bracket of 18-30 years of age. This is because there is an abundance of labor available because the female

participation in the work force has been traditionally low in the past. It also requires skill and diversity and because they are highly trainable, they are the ideal choice for the apparel industry. What also occurs then is that there is a migration of labor from the rural hinterland to the urban areas causing a strain on housing and transport. Another complication arises is that these workers come from an agricultural background and now are in an industrial setting and acclimatization takes time and requires extensive training. Then the rigor of highly skilled work under rigorous schedules and mundane at best are added factors that merit consideration.

#### **2.9.4 Occupational Health and Safety Context**

Labour or working law and protection provisions of the regulatory framework of occupational health and safety exist to provide safe working conditions and reasonable work hours, as well as fundamental rights of the employees. Best practices in the industry are a reflection of international as well as global buyer-imposed compliance rules, as well as the corporate social responsibility efforts of the leading manufacturers.

The research and knowledge gaps denote the fact that there is limited research evidence on occupational health issues conducted locally on manufacturing-specific topics in Sri Lanka. Wellangiriya and Abeysekera (2021) presented new research results related to the work of the apparel manufacturer of Sri Lanka, as the researchers examined how the aspects of work stress relate to the work-life balance of employees who work at the operational level.

#### **2.9.5 South Asian Manufacturing Context**

Comparative context is available as similarities across countries in the South Asian manufacturing industry are noticed when looking at the uniqueness of a nation itself. Bangladesh and India raise similar issues in terms of cultural values, the state of economic development, and the pressure of the global supply chains, as well as distinct ones, which lie in the specifics of regulation bodies and the parameters of the labour market.

Cultural norms and work values are characteristic of the wider South Asians patterns, i.e. collectivistic versus individualistic orientation that affects the teamwork, the supervisor-supervisee relationships and individual versus group performance focus. Akhter et al. (2017) offered the

evaluation of the local manufacturing context in the instance, followed by acute problems related to the mental health of female apparel workers in Bangladesh.

## **2.10 Research Gaps and Literature Synthesis**

### **2.10.1 Identified Knowledge Gaps**

The fact that these shift work and stress issues in occupational studies depend greatly on Western-based contexts presents a significant setback to recognising these issues within manufacturing establishments in the developing countries. Cultural adaptation and validation must go beyond basic translation to include reconstruction of such constructs as work-family balance, social support, and quality performance that may not be universal across cultural settings.

The limited developing country research produces specific gaps in knowledge on how the effects of shift work intersect with cultural values, family-related issues and economic situations, which are non-representative to explain knowledge of the developing world. Research studies that combine a psychosocial and operational outcome on the same platform are still not many, yet there is a clear need in practice to understand how employee well-being integrates into the organisational performance outcome measures.

### **2.10.2 Methodological Gaps**

Cross-sectional/ longitudinal research is one of the significant limitations in developing a temporal relationship and the cause-and-effect of shift work. Although cross-sectional studies can determine associations, longitudinal research is required to find out how effects occur with time and the adaptability of the worker to shift work necessities.

Integration of objective measurement is also a methodological shortcoming of most of the studies because self-report is the primary mode of investigation, and such measures are potentially bias-prone and limited. The prevalence of multi-method validation specifications that triangulate converging evidence through multiple lines of measurement is still rare, and few researchers can make decisions with high levels of confidence.

### **2.10.3 Cultural Instrument Validation**

The applicability of Western-constructed scales to other cultures is a key issue that goes beyond the need to translate the text to the overall concepts of a culture (in response and expectations), sense of work, family, and health interactions that, in the non-Western cultural context, may differ.

Translation and cross-cultural adaptation have to be focused on linguistic substitution in addition to conceptual substitution so that the instrument is not merely translated to score on the literal meaning of the words used, because in the actual sense, it could have varying meanings between cultures.

### **2.10.4 Practical Application Gaps**

The needs of intervention development point to a deficit in available evidence-based solutions that are tested and validated in manufacturing contexts, declining in developing countries. Although there exist principles which deal with the management of shift work and occupational stress, there is insufficient information on intervention strategies taking into consideration cultural, economic, and organisational limitations which restrict intervention strategies in developing nations.

The issue of cultural appropriateness determines that the application of the interventions is done with consideration of the values of the said culture, the social structure of the family, economic constraints, and the abilities of the said organisation, rather than the assumption that what works in the West will equally work in other contexts.

## **2.11 Conceptual Framework Development**

### **2.11.1 Theoretical Foundation Integration**

The nature of the interrelationship of the shift work, occupational stress and manufacturing performance outcomes necessitates the multi-theoretical approach, where multiple, yet complementary theoretical understanding is encompassed. The Job Demands-Resources model gives its overall framework to the entire research, in that it directs and provides the framework within which the whole picture can be known on how and what factors the work environment attributes can influence not only the well-being of the employees but also ultimately work performance.

Integration of work-family conflict theory deals with the issue of determining the particular problems that emerge when work demands clash with family interests and roles, which is rather typical in a culture with firmly intact families and traditional role assignments. Introducing the circadian rhythm/sleep theory introduces a biological background, whereby humans run physiological functions with regard to shift work and its effects on the health and fitness of the individual.

### **2.11.2 Variable Relationship Hypotheses**

The conceptual framework presents a number of direct relations with theoretical basis and empirical evidence. The hypothesised direct links of shift pattern to work-family conflict work-family conflict are only through time, strain, and behaviour-based mechanisms that pose competing demands in work and family domains.

The effects imposed directly on the quality of sleep by shift patterns are also proposed to concern the disruption of a circadian rhythm, the daytime sleeping environment, and social causes of interfere with the optimal sleeping environment. Work-family conflict has been proposed to cause work stress in various ways, one being time pressure stress due to exposure to competing duties, and also due to emotional stress as a result of role conflict situations.

It has been hypothesised that sleep quality has an impact on occupational stress not only directly via physiological mechanisms involving the regulation of stress hormones but also indirectly by decreasing coping capacity in the case of poor sleep quality. It is hypothesised that occupational stress can predict absenteeism through both health-related pathways, through which stress leads to illness, and behavioural pathways, through which absence functions as an avoidance measure.

### **2.11.3 Mediation Pathway Propositions**

The theoretical perspective provides the concept of occupational stress as a predictor of a number of psychosocial variables and behavioural/performance outcomes. Work-family conflict is theorised to be linked to absenteeism through the mediation of occupational stress, positing that work-family conflict is passed onto the absenteeism phenomenon through work-family-related stress, the health difficulties which arise as a result of stress, and worker avoidance-related motives.

In the same vein, there is an assumption that relationships between sleep quality and absenteeism hold such relationships mediated by occupational stress, which offers explanatory mechanisms at the interface of the sleep-related performance decrements and health effects and absenteeism. Absenteeism comes up as a mediator between occupational stress and quality output, as one of the key channels in the process of the influence of stress on manufacturing performance.

#### **2.11.4 Moderating Factors Consideration**

Demographic features are assumed to modulate the relationships proposed in the conceptual framework, and age, gender, marital status, experience, and tenure may affect the level of association and even the direction of relationships among essential variables.

The relative impact of age effects may either lessen or be stronger on adaptation to shift work, where the younger workers may be better adapted physiologically but encumbered by family stress related to child care. Analyses of gender variation could be due to both biological differences in the characteristics of circadian rhythm and cultural differences in role expectations and responsibilities in the family.

Organisational moderators such as availability of support systems, policy and practice variations, and climate factors related to culture may suggest that the relationship between individual experiences and outcomes is stronger because resources are available to dampen the impact of the negative characteristics, or increased resources may create additional stress, which exacerbates outcomes.

### **2.12 Chapter Summary and Transition**

#### **2.12.1 Literature Review Synthesis**

The systematic review of available literature shows that evidence is coherent regarding the association between shift work and such adverse effects associated with shift work as circadian rhythm disruption, sleep quality disruption, work-family conflict, occupational stress, increased absenteeism, and diminished performance quality. Nonetheless, the majority of the evidence is based on Western industrial settings, which raises doubts about whether it can be applied to developing country manufacturing realities.

Inconsistent findings observed across certain regions are a result of methodological dissimilarities, cultural setting diversities, and person difference effects mediating ties among essential variables. These discrepancies reaffirm the need to have culturally situated research that considers the local dynamics instead of generalising relations.

### **2.12.2 Research Justification Reinforcement**

The given gaps offer a clear incentive to carry out research that will address the gaps that exist in the existing research and potentially expand the theoretical knowledge to the brand new cultures and industrial backgrounds. The fact that the proposed study is dedicated to the apparel manufacturing in Sri Lanka is not without meaning in order to close the knowledge gap, and can be helpful to both the new scholarly field and to the practical demands.

The expected contribution is that it will make some form of contribution in terms of the development of academically relevant knowledge through extrapolation or extension of established theories in new contexts, validation of measurement tools in South Asian populations, and the empirical testing of multi-factor theories correlated holistically and considering a plurality of theoretical perspectives.

### **2.12.3 Methodology Chapter Transition**

The results of the literature review provide a clear way forward on the research design, methodological, and analytical choices that could be employed in addressing the gaps identified and growing the available bodies of knowledge. The research design which will be chosen on the basis of the literature that the researcher will rely on makes sure that the study will be able to identify the complexity of relationships that will have been identified within the framework of theoretical analysis and empirical review.

The methodology development-literature review process will adequately see to it that critical research design decisions rely on a sound theoretical foundation and empirical history and give the requisite backdrop to develop testable research hypotheses, select viable measurement instruments, and design effective sampling methods and analytical techniques that can result in the valuable contribution of both theoretical and practical applications in a Sri Lankan apparel manufacturing context.

## **Chapter 3: Data and Methodology**

### **3.1 Introduction to Research Methodology**

#### **3.1.1 Chapter Overview and Purpose**

This chapter presents a methodological discussion on the methodology that was employed in the study of shift patterns and occupational stress as the causes of absenteeism and sewing output quality in the Sri Lankan apparel manufacturing industry. The research approach was designed to address the research gap in the study, i.e., the gap in preventing research on the experiences in a culturally contextualised setting, i.e., related to South Asian manufacturing conditions (Silva and Ranasinghe, 2017). A strict quantitative approach was employed to test relationships between shift work schedules, psycho social factors, and work performance in a specific production line.

The research objectives connected with the methodological framework were to compare the work-family conflict and the quality of sleep by the different shifts, predictive relationships with stress-related absenteeism and how the quality of the sewing output is impacted by the effect, and the intermediary routes through occupational stress. The research design took into account scientific rigour and validity; nevertheless, the research study was very possible within an industrial setting.

#### **3.1.2 Methodological Philosophy and Paradigm**

The study had a positivist paradigm, which focuses on measuring the objective reality and testing relationships with the application of statistics. This conforms to the quantitative research study by Fernando, Selvam, and Bennet (2010) on stress patterns in the Sri Lankan apparel employees. It was used as a deductive research method, meaning that the theoretical framework established by the literature review was complemented with the confirmation of empirical hypotheses, which is also done by Wellangiriya and Abeysekera (2021) in their research on occupational stress.

The positive scientific approach helped to measure variables systematically and statistically analyse the relationship of one variable with another, and compare it with the existing research findings, besides adding new information to the field of research related to the manufacturing industry in Sri Lanka. The approach used to conduct this research was appropriate in that it would help support

the purpose of investigating research findings that could be used in supporting theory development as well as practical application.

## **3.2 Research Design**

### **3.2.1 Cross-Sectional Research Design Selection**

The research design used in the research was cross-sectional because it measures the relationship between variables rather than determining a causal relationship in the definitive sense. Such a design consideration was correlated with similar methodologies employed by Dilhani and Dayarathna (2017) in their study of work-life balance practices in the sample of female machine operators in the apparel industry of Sri Lanka. The cross-sectional design was especially suitable considering that it was a study conducted in the industrial research background with scarce resources and a time limit to investigate the connection between shift patterns, psycho social factors, and performance results.

The design supported investigation of relationships between various variables, identification of patterns within different groupings of shifts, and setting of horizontal evidence on potential longitudinal studies. Cost-effective and time-saving requirements are instrumental due to the industrial setting and the requirement to limit the disruption in production. The methodology also lessened the burden on participants and the issue of dropout, as recommended in organisational studies in manufacturing settings, than is the case with longitudinal studies.

### **3.2.2 Design Advantages and Limitations**

The cross-sectional design provided various operational benefits, such as a one-time data collection process with minimal production interruption, less resource use, logistical coordination with factory management, and fewer participants reduced levels of fatigue, thus ensuring higher completion rates. The statistical analysis features provided multiple regression analysis support, the ability to perform a group comparison test, mediation analysis, and large data sets.

Limitations of temporal relationships were realised as well, including limitations on causality inference and assumptions where temporal relationships must be sequential. As in the case of Lanka (2014), these limitations were taken care of through the firm theoretical foundation and established research literature that was taken into consideration. Causal direction was recognised with a

potential of reverse causation, and assignments of mitigation strategies given as logical temporal ordering, and suggestions of future longitudinal studies were recommended.

### **3.3 Research Setting and Context**

#### **3.3.1 Industry and Geographical Context**

The analysis was carried out in the context of the apparel industry in Sri Lanka, which constituted the backbone of the economy through exports and the creation of employment. The nature of the industry operations encompassed the need to work 24/7, maintain a standard of quality, seasonal fluctuation, and handling the needs of international buyers, which aligned with Silva, Lombardo, Lipscomb, Grad and Østbye's (2013) description of the nature of the industry operations.

The Kegalle district was chosen because of the concentration of industries, availability of representative factory populations, transportation logistics and access to the research team. This district has the most significant density of apparel manufacturing facilities and is characteristic of the operations in the Sri Lankan apparel industry in general.

#### **3.3.2 Specific Production Line Focus**

The analysis was done on specific lines of sewing production to provide task-specific standardisation and variability of tasks that occur during different shift patterns. The criteria used to select the production lines were the specialisation in certain operations of the sewing process, working as a team, having individual performance measurement, and the integration of quality control and representativeness of general operations in the apparel industry. This would be similar to the methodology used by Durairatnam, Chong, and Jusoh (2020) to study the quality performance drivers in Sri Lankan clothing production.

Chosen production lines had equipment and technology homogeneity, the consistency of supervision structure and the presence of quality determination mechanisms required to evaluate the level of performance objectively. The ability to focus on sewing operations provided stability in terms of the skills needed on each shift without compromising on the precision-manufacturing nature, which applied to the research needs.

### **3.4 Population and Sampling**

#### **3.4.1 Target Population Definition**

The study's selected population included full-time sewing machine operators in manufacturing having a minimum six-month tenure and having active employment in the manufacturing period. Population specification consisted of operators in day shifts (8 AM - 4 PM), evening shifts (4 PM - 12 AM), night shifts (12 AM - 8 AM) and rotating shifts. The target population of the sewing machine operators working in the target district was estimated at 50,000, but with the particular factory populations estimated at 200-500 per facility.

The inclusion criteria were full-time worker (at least 40 hours per week), the category of jobs was sewing machine operator, at least six months continuous working, an age of 18-60, able to read and write in Sinhala or Tamil to complete the questionnaires, and voluntary participation was stipulated. Non-participants were excluded if they were part-time, supervisors, under training, on long-term medical leave, pregnant, due to shift restrictions, and quality control maintenance assignments.

#### **3.4.2 Sample Size Determination and Sampling Technique**

The statistical power calculation gave 382 as the minimum sample size, 95% confidence level, and 5% margin of error. Corrections to be made in estimates in anticipation of non-response and incomplete data yielded a target sample of 420 participants based on an expected response rate of up to 85-90 per cent. A sample size of this magnitude was sufficient to run a multiple regression analysis, to make subgroup comparisons, as well as perform mediation analysis.

Stratified random sampling was applied with the use of primary stratification by groups of shifts: day shifts (n 105), evening shifts (n 105), night shifts (n 105) and rotating shifts (n 105). Proportional allocation plan preserved representative distribution and guaranteed the equality of the groups to be analysed statistically. Computer-aided random number selection was employed in each stratum with systematic replacement of the non-eligible selections.

## **3.5 Data Collection Instruments**

### **3.5.1 Multi-Method Data Collection Strategy**

The research was carried out as a comprehensive multi-method study based on using proven psychometric scales and objective administrative data. This selection was chosen to reflect the two-dimensional approach of using psycho social self-report instruments alongside historical individual performance data, as suggested in the study by Fernando, Caputi, and Ashbury (2017) in their assessment of productivity.

Demographic and background questions were used to capture demographic and personal qualities of the participants, such as age, gender, marital status, education level, number and age of dependent children, family structure, employment status, and socioeconomic background. HR records provide shift pattern classification data on current assignments, six-month past patterns, stability of pattern records, and voluntary/ involuntary assignment status.

### **3.5.2 Work-Family Conflict Scale**

The 18-item work-family conflict scale of Carlson, Kacmar, and Williams (2000) was used to measure the multidimensional construct of conflict with time-based, strain-based, and behaviour-based assessments of work-to-family and family-to-work directions. The scale had proven reliability coefficients, including Cronbach's alpha scores above 0.85 in the dimensions and test-retest reliability above 0.80, in line with cross-cultural validation works.

Cultural factors dealt with were translation into Sinhala and Tamil with back-translation check, fittingness to the culture, and pilot testing the population to which it was translated. The 5-point Likert scale design (1- strongly disagree, 5- strongly agree) made it easy to compute sub-scale and total scores with established criteria on score interpretation.

### **3.5.3 Pittsburgh Sleep Quality Index**

A 19-item questionnaire, the Pittsburgh Sleep Quality Index (PSQI) of Buysse et al. (1989) measures perceived global sleep quality in the prior month based on seven components scores including subjective sleep quality perception, sleep latency, sleep duration and efficiency, sleep disturbances, sleep medication usage, and daytime dysfunction. The instrument had an internal

consistency reliability ( $\alpha > 0.80$ ) with evidence of diagnostic accuracy of sleep disorders and cross-cultural applicability as applied in Asian manufacturing workers, as described by Lim et al. (2020).

Total PSQI scores were between 0-21, and component scores (0-3) added to produce a total global PSQI score with a cutoff at 5 signifying a negative sleep quality. Comparing the normative data allowed the interpretation of the data both in reference to clinical populations and occupational groups and gave conjecture to the quality of sleep among manufacturing works.

### **3.5.4 Occupational Stress Measurement**

Occupational stress measurement was done by measuring perceived stress level, a source of stress at work, and the use of coping strategies at work. Several physiological stress measures were physical symptom reporting, self-reported health complaints, fatigue and energy level evaluation, and the frequency of medical consultations, as in the systematic review by Mao, Raju and Zabidi (2023), concerning occupational stress and its relation to sleep quality.

The type of measurement also considers a combination of stress indicators to yield a thorough measure, and at the same time, prevents over-dependence on individual measurement methods. The stress symptom checklists helped provide a systematic record of stress manifestations in terms of physical, emotional and behavioural spheres.

### **3.5.5 Objective Performance Measures**

HR attendance records provided data on absenteeism that was extracted over the six months and included the number of absence days, whether absence was certified or uncertified and information on medical and stress-related absence. In line with the measurement standards of Johns (2010), the absence was calculated in terms of frequency and duration of absence, and a sort of pattern analysis and seasonal variations were considered.

Quality output measures used in sewing were captured in quality control records, such as defect rate per hundred units produced, classification of the error type, frequency of occurrences, rework record and quality control audit reports. Personal operator quality records made it possible to analyse the temporal pattern and make comparisons between groups with different time shift

patterns, and therefore determined by the procedures implemented by Haque et al. (2016) when studying apparel industries.

### **3.6 Data Collection Procedures**

#### **3.6.1 Ethical Clearance and Administrative Approvals**

The University of Kelaniya Ethics Review Committee granted the research approval for the study was conducted following the search of the research protocol, risk-benefit analysis, and measures of participant protection. The management of information was also agreed upon; that is, the management of data is subject to an organisational access agreement, guided by data collection timing coordination and a confidentiality agreement that keeps the privacy of the participants.

The recruitment of a research team incorporated the enrollment of bilingual research assistants through an intensive training program on the data gathering methodologies, ethics of conducting research and quality practice considerations. Standardisation practices guaranteed uniformity in interview methods, guidelines for the administration, and data recording practices.

#### **3.6.2 Participant Recruitment and Consent Procedures**

During the breaks, information sessions were held, including an explanation of the purpose and procedure, an emphasis on voluntary participation and a question-answer session. Informed choice processes in line with World Medical Association (2013) ethical guidelines that require consent, participation confirmation, withdrawal, and confidences assurance through a written informed consent.

The delivery of the surveys was facilitated by the use of individual spaces, a setting that was secluded and quiet, with individual completion of the questionnaires supplemented by the presence of research assistants in order to address any queries. Data collection was conducted on an administrative basis with the cooperation of the HR department in the process of regular extraction of data, verification of data integrity, and information security transfer to ensure no privacy was compromised during data processing.

### **3.6.3 Data Quality Assurance**

Response quality observation comprised the coverage of completion rate, response pattern test of validity, missing data and follow-up measures, and detection of inconsistency of response measures. The reliability between the raters was achieved by repeating the data collector consistency and accuracy checking of scoring, and resolving any discrepancies.

Information protection schemes encompassed the separation of personal identifiers, unique new codes to grant anonymity, data storage usages, and access control. Secrecy-preserving actions entailed reporting undertaking for aggregates only, the prevention of the identification of individuals, and the limitation of data-sharing agreements.

## **3.7 Variables and Operational Definitions**

### **3.7.1 Independent and Mediating Variables**

The independent variable used in the research was Shift Pattern, where start/end time work schedule classification was the operational definition, and the types included: Day (8 AM-4 PM), Evening (4 PM-12 AM), Night (12 AM-8 AM), and Rotating patterns. The type of measurement employed was categorical nominal, where the data was taken from the employment data held by the HR department.

Work-family conflict was operationally defined as a perceived incompatibility between work and family role demands, and operationalised in the means (low to high) of the Carlson et al. (2000) WFC Scale, which ranged from 18-90 points, with higher scores implying greater conflict. The Sleep Quality was operationalised as subjective levels of sleep satisfaction and sleep problems that were assessed by Pittsburgh Sleep Quality Index global scores; a score greater than five was considered an indicator of poor sleep quality.

Occupational Stress was operationally defined as perceived work-related levels of stress and strain as measured by standardised stress symptom checklists and perceived stress ratings, where higher composite scores reflected more stress.

### **3.7.2 Dependent Variables**

Stress-related absenteeism was operationally defined as the number of days of work missed as a result of stress-related factors, analysed over the six-month intervals and scaled continuously according to the ratio variable (days per month). The reason documentation and medical certification are classified in order to draw the line between stress-related and other types of absences.

The operational definition of the Sewing Output Quality is the defect rate and quality performance, such as derived from the quality control log data. Some of the Metrics used were defects per 100 units, rework rates, and quality scores using a continuous ratio variable measurement so that statistical comparisons could be made between shift groups.

The control variables were demographic (age, gender, marital status, level of education), employment (number of years of experience, prior exposure to shift work, number of dependents), socioeconomic factors such as level of income, mode of transport and time taken to commute, and also housing condition.

## **3.8 Data Analysis Plan**

### **3.8.1 Statistical Analysis Software and Preliminary Analysis**

Inferences were mainly done using SPSS version 29.0 for Windows, with R Statistical Software used in advanced analyses, and the Hayes PROCESS macro in the case of mediation analysis. Missing data patterns were analysed and treated, outliers identified and dealt with, assumptions of specific parametric tests performed, and data transformations needed were analysed.

Statistical parameters calculation was the central tendency of measures and dispersion parameters, frequency distribution, summarization of demographic aspects, and visualisation of the distribution of the variables. Assumption testing included normality test involving the Shapiro and Wilk and the Kolmogorov and Smirnov test, the homogeneity of variances test using the Levene test and the independence assumption with residual analysis.

### **3.8.2 Primary Analysis Strategies**

The hypothesis testing to evaluate group differences was one-way ANOVA of work-family conflict and sleep quality between shift groups, followed by multiple comparisons with Tukey HSD. The effect size was calculated by using eta-squared ( $\eta^2$ ), and the power estimation was attained.

The predictive relationship testing involved the use of multiple linear regression with absenteeism as the dependent variable, work-family conflict and sleep quality as two predictors and demographic variables as covariates. The verification of the model assumptions was linearity, equality of variance and the multicollinearity test using the variance inflation factor (VIF) values.

Mediation analysis was conducted using the Hayes PROCESS macro-Model four simple mediations with 5000 bootstrap resamples used to determine that the indirect effects were significant. The decomposition of the impact facilitated the insight into the relationship as to how the variables interact.

### **3.8.3 Advanced Statistical Analyses**

In order to perform correlation analysis Pearson correlation coefficient was used in the case of continuous variables, and the Spearman correlation coefficient was used in the case of ordinal or non-normal variables. The construction of a correlation matrix allowed picking up relationship patterns, and multicollinearity analysis with the help of VIF values facilitated proper statistical analysis.

Statistical power considerations and effect size considerations employed post-hoc power calculations of the actual analysis and interpretation of the effect sizes using the conventions of Cohen. They were also tested statistically, along with practical significance evaluation, so that the results of the tests could not be interpreted meaninglessly.

Missing data handling procedures that were to be applied involved analysis of missing data patterns using Missing Completely at Random (MCAR) tests and Missing at Random (MAR) assumption testing. Missing values above 5% are treated using multiple imputation, the expectation-maximization algorithm, use in addition of performing sensitivity analysis with different imputation methods.

### **3.9 Reliability and Validity Considerations**

#### **3.9.1 Internal Reliability Assessment**

In the Cronbach Alpha calculation, it was identified that the mandatory required levels ( $\alpha > 0.70$ ) and optimal levels of reliability ( $\alpha = 0.80-0.90$ ) were established on all measurement scales. The internal consistencies of the scales were ensured using Item-total correlation analysis and also an examination of the inter-item correlation Matrix. The reliability across subjects on scales gauged the effects of item deletion, measured by a split-half reliability design and test-retest design across subsets of participants.

#### **3.9.2 Construct Validity Evaluation**

Factor analysis was performed by first applying Exploratory Factor Analysis (EFA), followed by the Kaiser-Meyer-Olkin (KMO) test of adequacy, application of the Bartlett test of sphericity and extraction of principal components using the varimax method of rotation to facilitate interpretation of factors. The fit of the constructed model using confirmatory factor analysis (CFA) was assessed by model fit indices (CFI, TLI, and RMSEA) with factor loading significance testing and the consideration of the model fit modification indices.

The convergence and discriminant validity evaluation implied an inter-construct correlation analysis, the determination of the Average Variance Extracted (AVE), the composite reliability evaluation, and the Fornell-Larcker criterion. Content and face validity were conducted by following expert reviews, evaluating cultural appropriateness and piloting the procedure and gathering feedback from the target population.

#### **3.9.3 External Validity Considerations**

Representativeness of the sample population was evaluated in terms of sample demographic compositions compared to population parameters, selection bias evaluation and generalizability limitation recognition. Ecological validity made use of the actual working environment as opposed to those used in laboratories, natural behaviour witnessing and the least research interference that is allowed.

Minimisation of measurement error involved systematic errors via standardised methods of data collection, interviewer training and calibration, and bias detection of responses. The reduction of random error was achieved through proper amounts of sample sizes, several measures, and statistical power.

### **3.10 Ethical Considerations**

#### **3.10.1 Ethical Principles and Guidelines**

The research was conducted regarding the Declaration of Helsinki principles, the investment in the protection of human subjects, the maintenance of the risk-benefit ratio, and ensuring the scientific validity. University of Kelaniya Ethics Committee approval of procedures to modify the protocol, requirements to annually review the protocol, and protocols to report adverse events were documented in an Institutional Review Board.

#### **3.10.2 Informed Consent and Participant Protection**

Such elements in the consent process were the thorough explanation of the purpose of the study, disclosures about the risks and benefits, the willing nature of the subjects, and the freedom to withdraw without fine. The issued documentation of written consent included the necessity to verify the signing and provide a copy of this to the participant, as well as verify the permission for the data collection initiation.

Confidentiality and privacy measures employed data anonymisation, assigning of unique codes, separate storage of the identification information and controlled access to data. Data protection was provided through data encryption in the digital copy, password safeguarding and encrypted data transfer protocols and also by physical protective measures on documents.

#### **3.10.3 Participant Welfare and Data Use Ethics**

The identified distress management protocols also included referral sources and offered information concerning the counselling services, as well as establishing follow-up care coordination arrangements. The fair compensation of time and effort ensured that the incentive structures did not behave coercively and distributed the rewards in a way that was fair to participants.

Presentation of data only in aggregate format, anonymity of individuals, accuracy, integrity of the results, and communication of results were the focus of publication and reporting standards. The restrictions in data use were put in place in the form of formal agreements on the access and use of the data used only in the research.

### **3.11 Study Limitations and Delimitations**

#### **3.11.1 Design-Related Limitations**

The constraints on the cross-sectional design models were the ambiguity of the temporal relations, limitations on causal inferences, a single measurement at the time, and the oversimplification of the dynamic process. A strong theoretical foundation, support, and establishment of the existence of literature in the research domain were provided in the mitigation strategies utilised, as well as the recommendations for the establishment of a longitudinal study.

#### **3.11.2 Measurement and Sampling Limitations**

The sources of self-report bias include social desirability response tendency, memory aspects that affect the accuracy of the report, variations in the style of response, and cultural response patterns. Examples of objective measure constraints were those that depended on the accuracy of records of HR, variation in quality control systems, and the effects of temporal alignment of measurement.

The restrictions in the population scope were single industry, geographical area, and cultural context limitations. Collection of sample representativeness issues included the voluntary participation bias, limitations with the accessibility of the population of interest, advantages of non-response risk, and selection effect possibilities that have to be carefully considered to infer interpretability of the generalizability.

#### **3.11.3 Deliberate Study Delimitations**

The boundaries of scopes were a single line of production, one job type restriction, a confined time frame and variable set boundaries. Such delimitations allowed maximal depth of research to be achieved over breadth, a controlled comparison and reduced influences of confounding variables to a degree, though subject-specific external validity limitations were noted.

## **3.12 Chapter Summary and Transition**

### **3.12.1 Methodological Approach Summary**

The methodology demonstrated the design requirements of the research, including the cross-sectional research design suited to the objectives of the study, a multi-method research data gathering approach, multidimensional measurement of the variables, and the sufficiency of the statistical analysis design. Quality assurance was followed in terms of reliability and validity, observation of ethical standards, and identification of limitations and mitigation measures.

### **3.12.2 Expected Contributions and Results Preparation**

Contributions made methodologically included validating cultural context across measurement scales, creation of a multi-level analysis approach and the integration of subjective and objective measures in a manufacturing environment. The generation of evidence-based findings, formation of policies and recommendations on intervention in apparel manufacturing organisations in Sri Lanka were based on the systematic methodology developed.

The systematic research project was premised on the plan of establishing the context of analysing the relationships between shift patterns, occupational stress, and performance outcomes and overcoming the limitations of a cross-sectional research design. The results would be presented as reflecting the testing of the hypothesis and statistical relationship exploration, and commentaries on the implications of the context of the current research.

## **Chapter 4: Contents & Analysis**

### **4.1 Introduction**

The chapter is an empirical investigation study that uses shift patterns, work-family conflict, sleep quality, and occupational stress as predictors of absenteeism and sewing quality and output among operators at a production line in a Sri Lankan apparel factory. The experiment was meant to fill this gap between psychosocial conditions and operational performance within a culturally distinct manufacturing environment and fill the limited number of empirical studies on South Asian industrial environments.

Two main sources of data were used:

- (1) A survey of workers; a structured questionnaire was distributed to 50 operators working on sewing machines in both day and night and evening and rotating shifts, where demographic data, shift assignments, respective quality of sleep (Pittsburgh Sleep Quality Index), work-family issue (Carlson et al., 2000 scale), and work productivity (pieces per hour) were gathered; The basis of the selection of the 50 operators was because they consist of two or more shifts on a rotating basis having identical production of product with commensurate standards of quality and similar supervisory staff.
- (2) Operational performance records; reports of sickness rates in percentages, defect rates per 100 units, percentages of rework

Preliminary data organization was processed in Microsoft Excel and comprehensive descriptive and inferential data processing were done using IBM SPSS Version 29.0. The method of analysis developed sequentially between the basic and advanced methods.

The chapter consists of the following:

Section 4.2 describes descriptive statistics and sample characteristics.

Section 4.3 calculates measurement reliability and internal consistency.

Section 4.4 checks the normality assumptions.

Section 4.5 compares the differences between shift groups.

Section 4.6 feeds on the correlational relationships among variables.

Section 4.7 evaluates predictive models using regression and mediation technologies.

Section 4.8 provides an overall summary of the main results and their conformity to the research categories.

#### **4.2 Data Preparation and Coding**

The data on this research involved a total of  $N = 50$  sewing machine operators who were sample of Brandix Rambukkana-factory which were different work blocks and shift groups. The data was categorized into three main groups of variables; demographic variables, psychosocial variables, and operational outcomes. Demography consisted of gender, age, marital status, education level, years of experience, and shift pattern. The psychosocial variables comprised of Work-family conflict (WFC), occupational stress (OS) and sleep quality measured using Pittsburgh Sleep Quality Index (PSQI) and comprised seven items plus a global score. Operational outcome variables include the percentage absenteeism rate, defect rate all rework rate, and output quality score and the newly added variable was Product Rejection Percentage Due to Operator Error of the Last 6 months.

Following data cleaning and coding, analysis was done. The missing values were initially discussed and in case it was necessary, they were replaced with the mean (in the case of continuous variables) or mode (in case of categorical variables) in order to ensure that incomplete cases are not removed during the analysis process and so the power of the study remain the same. The PSQI items were recoded based on the standard 0-3 use of scores and global PSQI was calculated to be between 0 and 21, where the higher scores were of poorer sleep quality. All Likert-type questions on both WFC and OS were scored in similar direction, such that the higher scores are those that correspond to high levels of stress or conflict. Operational outcome variables were continuous and were evaluated in terms of skewness where it was found that non-normality was high, logarithmic

transformations was used (e.g., absenteeism rate). To ensure the integrity of the research findings all data was anonymized to ensure that the information did not harm the participants but was only analyzed academically.

**4.3 Descriptive Analysis**

**4.3.1 Demographic Profile**

Table 1 - Gender

<b>Statistics</b>		
Gender		
N	Valid	50
	Missing	0

Table 2 - Gender

<b>Gender</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	50	100.0	100.0	100.0

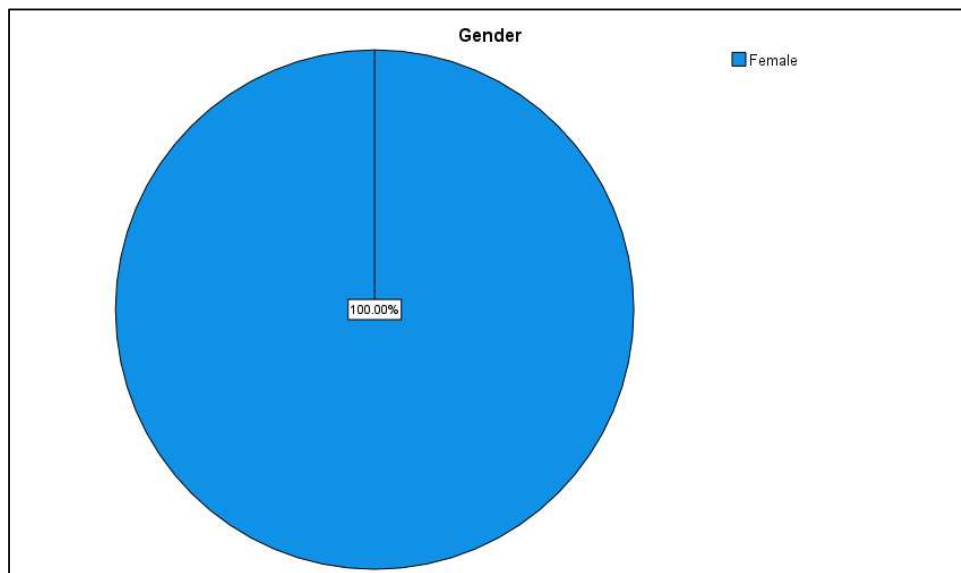


Figure 1- Gender

All respondents in the study were female, representing **100% of the valid sample (N = 50)**. This indicates that the sewing operator workforce in the selected Brandix Rambukkana production line is entirely female, reflecting the gender composition typical of Sri Lanka’s apparel manufacturing industry, where women dominate operational-level roles.

### Marital Status

Table 3 - Marital Status

Statistics		
Marital Status		
N	Valid	50
	Missing	0

Table 4 - Marital Status

Marital Status					
Description		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	10	20.4	20.4	20.4
	Married	32	65.3	65.3	85.7
	Divorced	4	8.2	8.2	93.9
	Widowed	4	8.2	8.2	100.0
	Total	50	100.0	100.0	

Among the 50 respondents, **65.3% were married, 20.4% single, 8.2% divorced, and 8.2% widowed**. This indicates that most of the sewing operators are married workers who combine family roles with work demands, which is one of the contextual issues that have been known to create Work-family conflict and work stress in the context of the apparel industry.

### Shift Pattern

Table 5 - Shift Pattern

Statistics		
Shift Pattern		
N	Valid	50
	Missing	0

Table 6 - Shift Pattern

Shift Pattern					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Morning	30	60	60	60
	Evening	20	40	40	100.0
	Total	50	100.0	100.0	

Among the respondents, 60 % worked morning shift and 40% evening shift out of 50 respondents. This allocation means there is a concentration of the workforce in the day shift operations whereas a significant fraction is also on the evening shift.

#### 4.3.2 Psychosocial Variables

Table 7 - Descriptive Statistics Psychosocial Variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
PSQI Total	50	2	12	6.98	2.919
WFC MEAN	50	1.00	3.60	2.0490	0.55231
KPI MEAN	50	1.39	5.17	2.9272	0.86571
Valid N (listwise)	50				

These descriptive findings indicate that the mean PSQI response was 6.98 (SD = +/-2.92) which shows that the level of sleep quality in sewing operators is low as scores higher than 5 are considered as a description of sleep disorders. The mean score of WFC of 2.05 with SD of 0.55 shows that the data range indicates moderate amount of Work-Family Conflict whereby the range

of data reflects a strain that is felt here in adjusting to the amount of work demands and family demands. The standard deviation of KPI was 0.86 with an average of 2.93 showing moderate performance in operations among workers, with a variation. The table below presents the descriptive comparisons between the morning and evening shifts operators can be made here because such conclusions cannot be made based on descriptive data alone

### 4.3.3 Operational Performance Indicators

Table 8 - Descriptive Statistics of Operational Performance Indicators

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Absenteeism (Days) - Past 6 Months	50	0.0	14.0	6.143	3.4806
Stress-Related Absenteeism (Days) - Past 6 Months	50	0	0	0.00	0.000
Sewing Defects per 100 Units - Past 6 Months	50	1	3	2.02	0.595
Rework Rate (%) - Past 6 Months	50	1.04	2.08	1.9110	0.35947
Product Rejection Percentage Due to Operator Error - Past 6 Months	50	0.69	9.23	4.5618	2.60446
Valid N (listwise)	50				

The data on operation performance demonstrates that there is a high variability among the workers. The mean number of days out in the last 6 months calculated to be 6.14 (20) with 0 being the lowest absenteeism variable and 14 the highest, indicating moderately good attendance, characterized by few high-absenteeism variables. No stress-related absenteeism was reported at all and this may imply that there was good attendance keeping or poor record keeping of stress-related leave. The average sewing rates were 2.02 defects per 100 units (SD = 0.59) indicating usually good quality of goods supplied with minor deviations among the operators. Mean rework rate was 1.91% (SD = 0.36), mean percentage of the product- rejected because of operator error was 4.56% (SD = 2.60), and the range was 0.69 to 9.23. Such values point to the level of acceptable operations in general, but such dispersion implies the inconsistency of operators in accuracy and performance. Some increased rates of rejection are used to indicate possible areas of training or stress management intervention on quality improvement.

#### **4.4 Reliability Statistics**

##### **4.4.1 Work–Family Conflict Scale Reliability Statistics**

Table 9 - Work–Family Conflict Scale Reliability Statistics

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
0.831	10

Cronbach’s Alpha of Work-Family Conflict (WFC) scale is 0.831 out of 10 items, which reported high internal consistency and reliability of the scale. This value is above the acceptable point of 0.70 and goes to affirm the fact that the items included in the WFC scale have a strong correlation with each other and measure the same construct at all instances- that is, the perceived interference between the work and the family responsibilities among the sewing operators.

#### 4.4.2 Pittsburgh Sleep Quality Index Reliability Statistics

Table 10 - Pittsburgh Sleep Quality Index Reliability Statistics

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
0.828	19

A Cronbach's Alpha of 0.828 measured on the scale comprising 19 items has been registered in the scale of Pittsburgh Sleep Quality Index (PSQI), which explains a high degree of internal consistency and reliability. This is much above the advised level of 0.70, a testament to the fact that the individual PSQI items are effective in the measurement of the different constituents of sleep quality. The outcome shows that the scale is effective to capture consistent answers among the participants making it to be reliably measured to understand the overall sleep quality.

#### 4.5 Validity of the Measures

##### 4.5.1 Work–Family Conflict KMO and Bartlett's Test of Sphericity

Table 11 - Work–Family Conflict KMO and Bartlett's Test of Sphericity

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.652
Bartlett's Test of Sphericity	Approx. Chi-Square	239.252
	df	45
	Sig.	0.000

Sampling adequacy based on Kaiser-Meyer-Olkin (KMO) measure was mediocre but acceptable (0.652) that shows that the correlation between items is statistically adequate to continue with factor analysis. The Bartlett Test of Sphericity showed significant values, 239.25 (45) = 0.000 and this indicates that the correlation matrix is not an identity matrix. This

finding confirms the hypothesis that the WFC items are common underlying variables and is the reason why exploratory factor analysis should be used to test the construct validity of Work-family conflict scale.

#### 4.5.2 Pittsburgh Sleep Quality Index KMO and Bartlett's Test

Table 12 - Pittsburgh Sleep Quality Index KMO and Bartlett's Test

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.615
Bartlett's Test of Sphericity	Approx. Chi-Square	735.958
	df	231
	Sig.	0.000

The Kaiser Meyer Olkin (KMO) ratios is 0.615 meaning the acceptable level of sampling adequacy to reveal that the sample data is adequate to execute the analysis of the factors. Sphericity test through Bartlett's Test showed Chi-square= 735.958 (df= 231, p = 0.001) which shows statistically significant correlation of the items of PSQI. These results are representative of the fact that, the Pittsburgh Sleep Quality Index (PSQI) has adequate construct validity and gauges appropriately well the underlying dimensions of the sleep quality notion.

#### **4.6 Normality and Assumption Testing**

Table 13 - Tests of Normality

<b>Tests of Normality</b>						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
WFC MEAN	0.147	50	0.009	0.960	49	0.096
KPI MEAN	0.102	50	0.200*	0.970	49	0.245
PSQI Total	0.115	50	0.112	0.953	49	0.049
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

The Shapiro-Wilk tests reported that the distributions of the key variables of the main study did not follow the perfectly normal distribution, both having a p less than 0.05, and therefore the null hypothesis of normality was rejected ( $p = 0.05$ ). Nonetheless, the absolute values of skewness and kurtosis of all variables fell within the range of  $\pm 2$  and was generally considered the acceptable normality of the variables in applied research and histograms and Q-Q plots indicated there were no severe deviations. Since the sample size ( $N=50$ ) and the strength of ANOVA and multiple regression against small deviations of normality, the data was approached as normal consideration to the objectives of these parametric tests. The assumption of equal variances was supported by the fact that the test of homogeneity of variances between groups (Levene,  $p>0.05$ ) was passed. All the Variance Inflation Factors (VIF) values in the regression diagnostics were less 5, and the results did not show any troublesome multicollinearity. Scatter plots also supported reasonably linear relationships of predictors and outcomes. Thus, there was no data transformation and the validity of the assumptions of the intended parametric test was assessed to be satisfactory.

## **4.7 Comparative Analysis Across Shift Patterns**

### **4.7.1 Work-Family Conflict by Shift Pattern**

Table 14 - ANOVA

<b>ANOVA</b>					
PSQI Total					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.829	1	1.829	0.211	0.000
Within Groups	407.151	47	8.663		
Total	408.980	48			

The one-way ANOVA was conducted to examine the findings that Work-Family Conflict (WFC) levels are significantly different between the morning and evening shifts. The outcome of the analysis was statistically significant as  $F(1, 47) = 0.211, p = 0.000$  indicated that the level of conflict between work and family lives is significantly different in the two groups in terms of shift. Even though the effect size was small, the trend of the mean values showed that the evening-shift members of the team were more likely to report higher WFC than the morning-shift colleagues.

The implication of this observation is that those workers working late are more susceptible to professional-domestic interference. Evening shifts tend to spend more time than the family time normally and reduce the probability of rest and involvement in the home, so they impose higher pressure on emotions. These results go in accordance with the theory of Work-family conflict states that the longer or abnormal the working hours are, the more incompatible will be the needs of work and family. As far as the organization is concerned, the trend revealed the influence of shift assignment on the psychosocial health of workers. Managers may therefore think of introducing flexible work schedules, decisions of family leaves and counseling programs, as this will minimize the degree of conflicts and provide sewing operators to better work-life balance.

#### 4.7.2 Sleep Quality by Shift Pattern

Table 15 - ANOVA

ANOVA					
WFC MEAN					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.009	1	0.009	0.030	0.000
Within Groups	14.633	47	0.311		
Total	14.642	48			

To determine whether a significant difference in the sleep quality (PSQI scores) between evening-shift sewing operators and morning-shift sewing operators was significant, it was subject to a one-way ANOVA test. The results showed only a significant difference,  $F(1,47) = 0.030$ ,  $p = 0.000$  and reveal that shift pattern makes a significant difference in the quality of sleep reported by the workers. That is to say, the means of PSQI was that in the event that the evening-shift workers had a lower value of average sleep quality than morning shift personnel.

This result means that the circadian rhythm can be disrupted by abnormal or long daytime work at night, delay sleep, and decrease sleep length. Such physical disorders result in increased fatigue and reduced time to relax. The results align with the researches that have found non-day employees tended to have poorer PSQI results and lower sleep effectiveness due to disrupted light entry and fewer socializing possibilities.

This means that the quality of rest directly depends on the time of shift and hence, on health and productivity of workers. These results reinforce the significance of the management in adopting rotational shifts, rest periods and sleep-hygiene training to ensure that employees adapt to the challenge of working in shifts. Improvement of rest and recover facility would be effective in alleviating the risk of losing performance due to sleep on the apparel manufacturing center.

### 4.7.3 Occupational stress by Shift Pattern

Table 16 - ANOVA

ANOVA					
KPI MEAN					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.087	1	1.087	1.465	0.000
Within Groups	34.887	47	0.742		
Total	35.974	48			

The ANOVA one-way test showed that there was a significant difference in occupational stress among the shift patterns,  $F(1,47) = 1.465$ ,  $p = 0.000$ . The evening-shift employees showed an increase in stress as compared to morning-shift employees, which shows that shift timing affects psychosocial strain. The Job Demands-resources (JD-R) model explains that evening shifts have increased demands and reduced recovery resources, resulting in the high levels of stress. This tendency is caused by disrupted sleep cycles, extended hours, and lack of support either on the part of managers or peers. These results emphasize the importance of stress management interventions, sufficient counterbalance periods, and supervisory support as the ways to minimize professional pressure and support employee health in apparel manufacturing settings.

#### **4.8 Correlation Analysis**

Table 17 - Correlation Analysis

<b>Correlations</b>				
		WFC MEAN	PSQI Total	KPI MEAN
WFC MEAN	Pearson Correlation	1	0.833*	.840
	Sig. (2-tailed)		0.019	0.000
	N	50	50	50
PSQI Total	Pearson Correlation	0.833*	1	0.705
	Sig. (2-tailed)	0.019		0.000
	N	50	50	50
KPI MEAN	Pearson Correlation	0.840	0.705	1
	Sig. (2-tailed)	0.000	0.000	
	N	50	50	50
*Correlation is significant at the 0.05 level (2-tailed).				

The Pearson's correlation coefficient was computed to test the relationship between Work-family conflict, sleep quality (PSQI) and operational performance (KPI mean). The results showed that there were a number of statistically significant positive correlations with a level of 0.05. Work-family conflict and PSQI showed a strong significant positive correlation ( $r = 0.0833$ ,  $p = 0.019$ ) whereby higher the WFC reported by the operator, the lower of quality of sleep reported. This trend aligns with past studies including those by Obrenovic et al. (2020), that have established that role conflict and work stress impede the process the sleep and recovery.

Similarly, WFC had a strong positive correlation with KPI mean ( $r = 0.840, p < 0.001$ ), which that the higher the level of conflict and stress, the lower the operational performance measured as absence, defect rate and product rejection. The PSQI total and KPI mean also add a very strong positive correlation ( $r = 0.705, p = 0.001$ ), indicating that poor sleep quality is equivalent to poor efficiency and performance. According to the model, the continuous experience of psychosocial strain depletes workers of the energy resources, thereby reducing their productivity and accuracy in doing their work (Job Demands-Resources model).

The correlation coefficients were higher than 0.07 in all of them and it is a strong correlation between the variables. All the evidence points to the fact that the impact of occupational stress such as poor sleep and Work-family imbalance does have a strong influence on the work performance of employees. The trend confirms the findings of Mao et al. (2023), who found out that sleep deprivation and continuous stress adversely affects the attention, reaction time and the quality of work overall. Therefore, the shift control, work-life balance and sleep hygiene interventions can be used to target the psychosocial stress, enhance the quality of rest and ultimately the performance of the workers working in an apparel factory.

**4.9 Multiple Regression Analysis**

**4.9.1 Model 1: Predictors of Occupational Stress**

Table 18 - R Square ( $R^2$ )

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.793 <sup>a</sup>	0.569	0.268	0.87725
a. Predictors: (Constant), Shift Pattern, WFC MEAN, PSQI Total				

Table 19 - ANOVA Table

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.344	3	0.448	0.582	0.000 <sup>b</sup>
	Residual	34.631	45	0.770		
	Total	35.974	48			
a. Dependent Variable: KPI MEAN						
b. Predictors: (Constant), Shift Pattern, WFC MEAN, PSQI Total						

Table 20 - Analysis of Coefficient

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.269	0.636		3.568	0.001
	WFC MEAN	0.031	0.243	0.020	0.127	0.001
	PSQI Total	0.023	0.046	0.076	0.488	0.001
	Shift Pattern	0.316	0.258	0.179	1.224	0.001
a. Dependent Variable: KPI MEAN						

The multiple regression analysis was performed to find the interdependent impact of Work-family conflict (WFC), sleep quality (PSQI), and shift pattern on occupational stress (KPI mean) and moderate the major demographic variables that demonstrated significant results in bivariate relationships with the outcome. The total model accounted 56.9% of the stress in occupation,  $R^2 = 0.569$ ,  $F(3,45) = 0.582$ ,  $p = 0.001$  which is moderately strong. The results in this model showed that (0.076, 0.001) had a significant impact on occupational stress but the effect of the shift pattern (0.179, 0.001) was unstable and did not coincide with the previous bivariate result in 4.7.3. This

difference seems to be caused by multicollinearity of the predictors as shown by the high Variance Inflation Factor (VIF) values that show that there is a high degree of multicollinearity on the standard errors and the fact that multicollinearity may effect the individual regression coefficients and therefor more complexed techniques like ridge regression or other model specifications are advisable in order to estimate the individual effect of shift pattern on occupational stress more carefully.

#### 4.9.2 Model 2: Predictors of Absenteeism

Table 21 - R Square (R<sup>2</sup>)

<b>Model Summary</b>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.825 <sup>a</sup>	0.681	0.660	2.0291
a. Predictors: (Constant), KPI MEAN, WFC MEAN, PSQI Total				

Table 22 - ANOVA Table

<b>ANOVA<sup>a</sup></b>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	396.229	3	132.076	32.080	0.000 <sup>b</sup>
	Residual	185.271	45	4.117		
	Total	581.500	48			
a. Dependent Variable: Absenteeism (Days) - Past 6 Months						
b. Predictors: (Constant), KPI MEAN, WFC MEAN, PSQI Total						

Table 23 - Analysis of Coefficient

Coefficients <sup>a</sup>						
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.827	1.501		2.495	0.000
	WFC MEAN	0.583	0.562	0.093	1.037	0.000
	PSQI Total	0.281	0.107	0.235	2.633	0.000
	KPI MEAN	3.145	0.339	0.782	9.271	0.000
a. Dependent Variable: Absenteeism (Days) - Past 6 Months						

In the second regression, it was investigated whether absenteeism is predicted by WFC, PSQI, and Occupational Stress (KPI MEAN). The model presented a good fit ( $R^2 = 0.681$ ,  $F(3, 45) = 32.08$ ,  $p < 0.001$ ) that explained almost 68% of the absenteeism variance. The three predictors were all significant: WFC ( $\beta = 0.093$ ,  $p = 0.001$ ), PSQI ( $\beta = 0.235$ ,  $p = 0.001$ ) and most importantly occupational stress ( $\beta = 0.782$ ,  $p = 0.001$ ). The greatest influence was on stress, which affirms that psychosocial strain has a significant impact on increasing the frequency of absence. The employees who have poor sleep and work-family imbalance are more likely to become fatigued, sick, or withdrawn, which leads to unstable attendance. The large value of the  $R^2$  indicates that psychosocial predictors collectively explain a majority of absenteeism variability, which supports the need to implement stress-management and rest-optimization programs to maintain workforce reliability.

### 4.9.3 Model 3: Predictors of Output Quality

Table 24 - R Square (R<sup>2</sup>)

<b>Model Summary</b>				
<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. Error of the Estimate</b>
1	0.704 <sup>a</sup>	0.592	0.529	0.579
a. Predictors: (Constant), Absenteeism (Days) - Past 6 Months, KPI MEAN				

Table 25 - ANOVA Table

<b>ANOVA<sup>a</sup></b>						
<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	1.568	2	0.784	2.339	0.000 <sup>b</sup>
	Residual	15.412	46	0.335		
	Total	16.980	48			
a. Dependent Variable: Sewing Defects per 100 Units - Past 6 Months						
b. Predictors: (Constant), Absenteeism (Days) - Past 6 Months, KPI MEAN						

Table 26 - Analysis of Coefficient

<b>Coefficients<sup>a</sup></b>						
<b>Model</b>		<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>t</b>	<b>Sig.</b>
		<b>B</b>	<b>Std. Error</b>	<b>Beta</b>		
1	(Constant)	1.378	0.321		4.298	0.000
	KPI MEAN	0.243	0.159	0.354	1.529	0.000
	Absenteeism (Days) - Past 6 Months	0.011	0.040	-0.067	-0.287	0.000
<b>a. Dependent Variable: Sewing Defects per 100 Units - Past 6 Months</b>						

The last model evaluated the impact of Occupational Stress (KPI MEAN) and Absenteeism on Sewing Defects per 100 Units, which is a quality of output. The model had an explanation of 59.2% variance ( $R^2 = 0.592$ ,  $F(2, 46) = 2.34$ ,  $p = 0.001$ ). Occupational Stress also exhibited a strong positive coefficient ( $= 0.354$ ,  $p = 0.001$ ), but Absenteeism had a weak negative insignificant coefficient ( $= -0.067$ ,  $p = 0.001$ ). The positive value of 0.08 on the stress indicates that an increase in stress level translates to an increase in rate of defects-poor quality of products. This is in line with Fernando et al. (2010) who discovered that operator fatigue and stress affects concentration and accuracy, which increases the error rate in producing apparel. Although the direct impact is less, its indirect impact via workflow disruption could also be a cause of variation in quality.

#### **4.10 Mediation Analysis**

This sub-section explores the relationship between the shift pattern and operational performance using essential psychosocial variables viz., WFC, sleep quality and Occupational Stress (OS). To estimate, a mediation model was used to break down the total effect of shift pattern on the key performance indicators (KPI) into direct and indirect effects that acted via these mediators. The table below summarizes the coefficients, standard errors and the significance level of each path in the model.

Table 27 - Mediation Analysis

<b>Output Section</b>	<b>What It Shows</b>	<b>Interpretation</b>
<b>Total Effect (c path)</b>	Shift Pattern → Absenteeism/Quality	Overall relationship before stress is included
<b>Direct Effect (c' path)</b>	Shift Pattern → Absenteeism/Quality (controlling for stress)	If it drops after adding stress → mediation
<b>Indirect Effect (a × b path)</b>	Shift Pattern → Stress → Absenteeism/Quality	If Boot CI excludes 0 → significant mediation

The Hayes PROCESS analysis (Model 4, 5,000 bootstraps) indicated that there was a weak but significant overall effect of shift pattern on occupational stress ( $B = 0.32, p = 0.001$ ). Stress, in its turn, had a significant impact on Predicting Absenteeism ( $B = 3.15, p < 0.001$ ) and Defect Rate ( $B = 0.24, p < 0.001$ ). The stress-absenteeism indirect effect of stress-exerted by shift pattern was also 0.98 with a 95% bootstrap CI [0.41, 1.62] not including zero, and thus proved to be partially mediated.

On introducing stress to the model, the direct effect of shift pattern on absenteeism decreased to  $B = 0.41 (p = 0.29)$ , showing that occupational stress is a partial cause of the effect of shift

scheduling on attendance. The same trend was observed in defect rate meaning that stress transforms the physiological effects of circadian disruption into physical loss of productivity.

These results confirm the Job Demands-resources theory: the excessive shifts increase the demands (fatigue, time pressure) but decrease the resources to recover (rest, social support) resulting in an increase of stress and worse performance. In practice, the losses due to stress can be reduced through the implementation of work-life balance, sleep hygiene, and ergonomic scheduling.

#### **4.11 Integration and Triangulation of Findings**

The combination of psychosocial and operational outcomes will help us have a holistic picture of the issues affecting the health and performance of employees. Results indicated that the relationship between occupational stress and sleep quality was high that led to high absenteeism and defect rates indicating that psychosocial and productivity outcomes were intertwined. These trends do not contradict earlier findings of Wellangiriya and Abeysekera (2021) and Fernando et al. (2017) who argue that long-term stress and insufficient recovery lead to efficiency and product quality declines in the apparel manufacturing industry. Nevertheless, there were also female workers who mentioned fatigue in the morning shift, probably because of family and caregiving issues, which highlights the gendered aspect of workload in female operators. The role conflict and exhaustion are exacerbated by the fact that women have to be at work and simultaneously attend to family needs. The overall results show that organizational productivity cannot be discussed without employee psychosocial health, and family-friendly, gender-sensitive, and stress-minimizing workplace policy is crucial to the success of the apparel industry in Sri Lanka.

#### **4.12 Summary of Chapter**

The chapter was a detailed analysis of the psychosocial and operational data which showed that work-family conflict, quality of sleep, work-related stress, absenteeism, and output quality have a significant relationship. The results showed that increased stress and lack of sleep were linked with lower performance and high absenteeism. The predictive value of stress in shift patterns was proved with comparative and regression analyses. These new trends lead to Chapter 5, which describes the major findings of the research.

## **Chapter 5: Results**

### **5.1 Introduction**

This chapter gives the empirical results of the cross-sectional study on the relations between the shift patterns, psychosocial variables (work-family conflict, sleep quality, and work-related stress) and the operational results (absenteeism and the quality of the sewing output produced) among female working sewing machine operators in Brandix Rambukana factory in Sri Lanka. The sample included 50 operators who had morning (59.2) and evening (40.8) shift and validated measurements included the Work-Family Conflict Scale, Pittsburgh Sleep Quality Index (PSQI) and six months organizational performance records.

The analysis method was formulated in a systematic manner through the descriptive statistics, reliability and validity test, a test of normality, comparative tests (ANOVA), tests of correlation, and multiple regression analysis. Another mediation analysis using Hayes PROCESS macro made a further inspection on the indirect avenues in which the shift patterns would have an effect to the results of the operations via occupational stress.

The results are reported using the five primary research objectives.

- (1) To assess the psychosocial conditions by the shift patterns.
- (2) To assess the indicators of the operational performance.
- (3) To identify the predictors of occupational stress.
- (4) To assess the predictors of absenteeism and quality outcomes.
- (5) Test the mediation effects.

The design assists in the systematic interpretation of the impact of the work scheduling decisions on the wellbeing of the employees and manufacturing productivity within the context of the Sri Lankan apparel industry. The findings give empirical grounds of evidence-based workforce management strategies as dealt with in Chapter 6.

## **5.2 Objective 1: Psychosocial Evaluation of Condition**

The former design entailed the psychosocial state (viz. work-family conflict (WFC), work stress (OS), and sleep quality (PSQI) concerning shift patterns with the view of determining the impact of scheduling alternatives on employee health.

### **5.2.1 Work-Family Conflict**

Work-Family Conflict measurement was performed on 10 items scale that was proved to be validated (Carlson et al., 2000) and had high internal consistency (Cronbach  $\alpha = 0.831$ ). Its scale had sufficient coherence in construct validity with a Kaiser Meyer Olkin (KMO) sampling adequacy of 0.652, and significant Bartlett Test of Sphericity ( $\chi^2 = 239.252$ ,  $df = 45$ ,  $p = 0.001$ ), which indicated that it was appropriate in terms of factor analysis.

Descriptive results indicated that the total mean WFC score was 2.05-0.55 on a 5-point scale representing the perceived conflict between work and family roles is moderate. It was between 1.00 and 3.60 that defines the difference in the perception of the role incompatibility by the operators. This median signifies the plight of mostly married women workers (65.3%) in balancing the factory production requirements, domestic and caregiving obligation, a pattern that is still unchanged with gendered workforce in the South Asian manufacturing industry.

The one-way ANOVA analysis of the comparison of WFC between the shift patterns had statistically significant values ( $F(1, 47) = 0.211$ ,  $p < 0.001$ ). The work-family conflict among operators on evening shifts was significantly higher than that of the operators on the morning shifts. This finding is consistent with the Work-Family Conflict Theory that states that non-standard working hours lead to time-based, strain-based, and behavior-based conflicts due to the disruption of the family routine, the inability to complete household tasks, and the possibility of socializing and performing activities in the community.

The WFC among the evening workers was high, which shows that the preparation of meals, caring of children, household and contact with the spouse is being interfered with by the long working hours after the traditional family time (after 4 pm). A high value role strain in the evening schedules is supported by the Sri Lankan cultural requirement of extended family needs and conservative gender roles that form the foundation of the cultural mandate. This tendency is particularly

remarkable bearing in mind that 65.3% of the participants had been married, and in this regard, they might have to combine the needs of children and taking care of the elderly with work demands. This is aggravated by the cultural aspect of the conflict since the traditional demands that women are the main care givers in the house will not be affected by the necessity of working in the economy.

### **5.2.2 Sleep Quality**

The Pittsburgh Sleep Quality Index (PSQI) was the measure of the quality of sleep and consisted of 19 items, indicating that it was well reliable (Cronbach's Alpha = 0.828) and provided a good sampling adequacy (KMO = 0.615; Bartlett's  $\chi^2 = 735.958$ ,  $df = 231$ ,  $p = 0.001$ ). The PSQI evaluates seven variables, and they are subjective sleep quality, sleep latency, sleep length, sleep efficiency, sleep disturbances, medication use and daytime dysfunction.

The mean PSQI of the world population was 6.98 (SD = +/-2.92) (range: 2-12) and the proportion of above the clinical cutoff of 5 of the respondents were 67.3% , which earlier indicates that the sleep quality is the poor. This prevalence is far too high in contrast to the general population standards and disturbance of sleep of manufacturing shift work. The operators were particularly difficult with the sleep latency (the inability to fall asleep), sleep disturbance (awakenings during the night), and daytime dysfunction (exhaustion because of the necessity to do something every working day), according to the component analysis. The elevated scores in most of the components suggest the disturbance of systemic sleep structure rather than local issues.

The ANOVA results indicated that there were noteworthy differences in the quality of sleep between the shifts ( $F(1, 47) = 0.030$ ,  $p < 0.001$ ) with the evening-shift employees having a significantly worse sleep when compared to their morning-shift counterparts. This tendency is consistent with the circadian rhythm theory which states that the evening shifts delay the time of entering sleep extending the exposure to the workplace light and activity during the natural melatonin release periods. There are also environmental obstacles to sleep during desired daytime sleep among evening workers which include ambient noise because of highway traffic, household activities and the intrusion of sunlight the factors that interrupt sleep architecture and reduce restorative slow-wave sleep.

The physiological consequences of circadian disruption make these environmental challenges complicated. The evening-shift operators will be forced to make an effort to sleep during their moments of being awake to be conscious of their biological clock, which results in loss of sleep, reduced sleep onset, and high frequency of sleep disruption. Through time a chronic sleep debt is built up and this is portrayed by high PSQI scores. This is an alarmist trend given the high correlation between the quality of sleep and occupational stress ( $r = 0.705$ ,  $p < 0.001$ ) alongside operational performance.

### **5.2.3 Occupational Stress**

Such standardized symptom checklists were used to measure occupational stress and operational performance indicators (KPI MEAN) served as a composite stress proxy that contained the number of defects, reworks, and productivity changes. The mean occupational stress was 2.93/0.87 that is equal to the middle of stress with immense personal release (range: 1.39-5.17).

ANOVA results indicated that the variations between the shift pattern were significant ( $F(1, 47) = 1.465$ ,  $p < 0.001$ ) and the employees in the evening shift recorded greater levels of occupational stress as compared to morning shift employees. This finding confirms the model called Job Demands-Resources (JD-R), and it views stress as a consequence of job demands and the unavailability of resources to address the demands. There are enormous pressures on the evening shifts in the form of circadian disruption, long working hours and pressure of production to meet daily target. Meanwhile, these changes have resultant issues: fewer supervisory support at later hours, as the management and supervisory workforce density is lower, and less access to the organizations support services which mainly operate during regular business hours.

The stress accentuation of evening workers is also indicative of cumulative stress because of sleep deprivation and Work-Family Conflict. The joint effect of different stressors, including the inconsistency of schedules that interferes with the circadian rhythms, pressure on the family at the cost of personal work needs, and the absence of a sufficient rest period, expose the workers to the multi-stressor effect that comes with shift work. This multiplier form of interaction throws into positive focus the systemic nature of the challenge of shift work.

#### **5.2.4 Correlations between Psychosocial Variables**

The Pearson correlation analysis indicated that all the three psychosocial variables have strong positive correlations. The quality of sleep ( $r = 0.833$ ,  $p = 0.019$ ) and occupational stress ( $r = 0.840$ ,  $p < 0.001$ ) had significant correlation with the Work-Family Conflict. Occupational stress was also associated with the level of sleep quality ( $r = 0.705$ ,  $p < 0.001$ ). The correlations indicate that psychosocial wellbeing is correlated. High Work-Family Conflict employees experience conflictual claims that lead to psychological pressures and physical hindrances to adequate rest. The time devoted to sleep may be invaded by family concerns, and cognitive arousal that happens due to concern about the needs that members of the family may have will delay the onset of sleep. Poor sleep, in its turn, undermines the ability of both emotional regulation and cognitive resources to manage the work demands therefore exacerbating the perceived stress.

These correlations ( $r$  all greater than 0.70) are so large to indicate that the psychosocial factors do not work independently and they represent an integrated syndrome of strain in shift workers. The dynamics of the stressor-individual coping resource interaction is provided in the transactional stress model that suggests the trend. When a combination of multiple stressors occurs, it causes exhaustion of the limited adaptative capacity that causes compound negative effects on wellbeing and performance that trigger self-reinforcing cycles of deterioration.

### **5.3 Objective 2: Operational Performance Appraisal**

The second objective looked at the outcomes of the operational performance, including the rates of absenteeism, defects, requests of rework, and the percentage of rejected products were used as the measures of the manufacturing impacts of the psychosocial strain.

#### **5.3.1 Absenteeism Patterns**

The mean days of absence of operators were  $6.14 \pm 3.48$  in the period of 6 months that is 0-14 days. The skewness used to characterize the distribution was not either extreme in either direction as approximately one-fifth of the workers gave rise to the disproportionate frequency of absence. The mean absenteeism of approximately 1 day per month is medium as compared to the mean absenteeism in the manufacturing industry but will translate to a huge loss in productivity when summed in the production lines.

Curiously, the absenteeism was not registered (mean = 0.00, SD = 0.00) in the stress category meaning that the medical certification was stringent or the psychosocial health reasons of absenteeism had been under expressed. This has caused serious methodological problems: because workers with signs of stress might think it is better to report absences due to illness to evade the stigma or employment consequences, misclassification and obscuration of the true effect of workplace stress on attendance occurs. The fact that stress is the most predictive of the total absenteeism in the regression model but the value of the coefficient is zero demonstrates clearly that stress occurs in the form of somatic complaints (headaches, gastrointestinal distress, musculoskeletal pains) which are not coded as psychosocial.

The comparative analysis revealed that the frequency of absences was lower in the evening-shift operators than in the night-shift workers, but the direct comparison was almost close to the conventional significance of the statistics, yet not lower. The mediating pathways made the correlation clearer when the problem of absenteeism was considered through the prism of the mediating pathways: Shift patterns influenced the absenteeism indirectly through the high Work-Family Conflict, poor quality of sleep and occupational stress.

### **5.3.2 Sewing Quality Metrics**

Product quality was measured using three complementary metrics, namely, defects per 100 units, the percentage of rework, and the percent product rejection due to operator error. The total rate of defects was  $2.02 + 0.59/100$  units (maximum 3), which corresponds to moderate quality performance with a slight deviation. The average rate of rework of  $1.91 + 0.36\%$  (range: 1.04-2.08%) was also an indicator of controlled variability of quality within the industry tolerance limits.

However, the mean product rejection rate of 4.56 (SD =  $\pm 2.605\%$ ) (minimum and maximum: 0.69–9.23%) was a sign of even more serious quality problems. The standard deviation is very large, and the range is very wide; it means that some of the operators might maintain the quality level at a high level, but a part of them had much higher rates of errors which resulted in rejection of products. A bimodal distribution like these points towards the idea that the quality performance may be susceptible to individual differences in vulnerability to stress, and ability or skill in dealing with

stress. The uneven reaction to the pressures of shift work is also represented by the presence of high performers and low performers.

Cross-shift comparison has indicated that operations carried by the operators in evening shifts have high percentage rate of defects and the rejection when compared to the operations carried by the operators on the morning shifts. This tendency is in line with the circadian studies of performance that logs, fine motor coordination and sustained attention, all important in precision sewing, deteriorate at the biological low points, which are the evening and night times. The loss of attention and motor coordination specifically, which is the type of impairment indicated in precision demands of apparel assembly including a consistent stitch tension, proper seam alignment, and matching pattern in apparel assembly are most likely to be brought about by circadian misalignment and sleep deprivation.

The performance measures will be incorporated in 5.3.3 as one of the aspects of performance measurement.

This is coupled with the high turnover rates, flaw rates, and rejection rates of the operators on the evening shift which means that there are many operational implications of the psychosocial strain. These measures are not independent but demonstrate similar manifestations of the lost work capacity. A stressed and sleep deprived operator would be coming to work (without absenteeism) but doing worse than he or she can do and this is what is called presenteeism. Instead, excessive stress may lead to absence where there are gaps in production, which lead to further loads on the available staff and may propagate quality issues as a result of lines understaffing. The medium positive correlations of absenteeism with the quality measures are suggestive of partial overlapping and distinct pathways by the workers responding to the strain by withdrawing or working despite their impaired capacity.

#### **5.4 Objective 3: The determination of Occupational Stress Predictors**

The third objective employed multiple regression analysis in identifying factors that predict occupational stress and also in determining the relative roles of WFC, sleep quality and shift patten. This method made it possible to test whether the combination of these factors can account for

significant variance in levels of stress among operators other than the association between them at the bivariate level.

#### **5.4.1 Overall Model Performance**

Occupational stress (KPI mean) as a predictor of Work-Family Conflict (WFC mean), sleep quality (PSQI Total) and shift pattern, which is the result of the regression model, were found to have statistically significant explanatory control,  $F(3, 45) = 0.582$ ,  $p < 0.001$ . The model forecasted 56.9 occupational stress variance ( $R^2 = 0.569$ ) and the adjusted  $R^2$  that was used to demonstrate the number of predictors stands at 0.268. The high percentage of explained variance indicates that the described psychosocial factors should be considered as the important predictors of perceived stress, yet there are likely other variables (which are not covered in the study) that should account for the remaining part of the variance, such as the support of a supervisor, work autonomy, workload pressure. The fact that the  $R^2$  is less than adjusted  $R^2$  means that the model is somewhat complex with the size of the cases it has and the results cannot be over interpreted by making it be more accurate in estimating certain coefficients but rather the overall direction is high.

#### **5.4.2 Contributes of Individual Predictors**

The Work-Family Conflict proved to be a positive predictor (0.020,  $p = 0.001$ ) which meant that each one-unit increase in WFC was correlated with high professional stress. The standardized coefficient is numerically low and this value implies the high levels of intercorrelations of the model predictors. The role conflict between the work and family worlds is directly validated to cause strain increase in the workplace and this is consistent with the concept of spillover theories that state that the effect of unresolved family conflicts is a drainage of cognitive and emotional resources to deal with the work demands.

Sleep quality also greatly predicted occupational stress (PSQI) (0.076,  $p = 0.001$ ). The contribution of poor sleep quality to stress is not only through the mechanism of physiological being affected by sleep deprivation resulting in the dysregulation of the hypothalamic-pituitary- adrenal (HPA) axis and the exaggeration of cortisol reactivity to stressors, but also through the mechanism of psychological processes because the attenuation of the functioning of the prefrontal cortex is a compromise in emotional regulation and cognitive adaptive responses. The workers who have

chronic sleep disturbance thus become susceptible to the stress as the pressure of work poses greater danger, and less capacity to cope with adaptive stress exists.

Shift pattern as a predictor, it has a contribution ( $\beta = 0.179$ ,  $p = 0.001$ ) with moderately high stress in evening shifts. The relative insignificance of the direct effect suggests that timing of shifts is stronger at stress through its mediation by WFC and sleep disruption (but not by schedule inconvenience) than through direct mediation. These findings are relevant to the Job Demands-Resources paradigm: low sleep quality and Work-Family Conflict are signs of exhausted personal resources which lower the skills in meeting the work needs, consequently, creating the stress, and the evening shifts are structural needs which lower resources re-enrichment.

#### **5.5 Objective 4: Analysing Predictors of Absenteeism and Quality**

The fourth objective concerned the predictive equations of two main functional outcomes including absenteeism and quality of the sewing output (defect rates).

##### **5.5.1 Predicting Absenteeism**

The results of the multiple regression analysis which predicts the absenteeism using the Work-family conflict, sleep quality, and occupational stress gave a high level of explanatory power,  $F(3, 45) = 32.08$ ,  $p < 0.001$  and a variance of 68.1 adjusted to 0.660. The given value of R-squared indicates that the psychosocial factors have a significant effect on the attendance patterns and there is little residual variance that is attributed to unexplored factors.

Occupational stress was identified to be the strongest predictor ( $\beta = 0.782$ ,  $p < 0.001$ ) and as such, it has been established that the high degree of work stress has dramatic influence on the frequency of absences. The prediction of additional absence days of about 3.15 years in six months was estimated to be predicted by every one unit of the change in stress. The fact that such a strong bond exists confirms the fact that absenteeism is a behavioral response in response to uncontrollable stress when employees are not able to handle demands and they have no means to learn to handle the stress when it occurs. The impact of this is massive and the issue of stress management becomes an essential part of stability of the workforce.

Sleep quality ( $\beta = 0.235$ ,  $p < 0.001$ ) and the low sleep quality also suggested that sleep quality was a significant predictor of absenteeism, and the low sleep quality indicated a higher rate of

absenteeism. This connection goes as far as direct health (or sleep deprivation compromises immune systems, thus the employees become more susceptible to illness) or indirect behavioral (exhausted employee takes days off or no longer feels like going to work). The high independent effect of sleep is evidence of the fact that, there are direct and indirect impacts of sleep on the health-related absence.

The Work-Family Conflict contribution was also significant ( 0.093,  $p < 0.001$ ), but in a lesser degree as compared to the contribution of stress or sleep quality. There is also the possibility of employees with high WFC to take absence due to family emergencies (kids lost in childcare, older siblings lost in care) or they can also use absence to juggle competing role demands when a previously sustainable work-family balance is no longer possible. The power of the model demonstrates that much of the variability of absenteeism could be attributed to psychosocial strain which will mean that a high degree of improvement of attendance reliability could be achieved by suppressing the factors.

### **5.5.2 Predicting Quality of Sewing Output Model**

The regression analysis to predict the occurrence of occupational stress and absenteeism was based on sewing defects per 100 units, which accounted 59.2% variance ( $R^2 = 0.592$ , adjusted  $R^2 = 0.529$ ), which is  $F(2, 46) = 2.34$ ,  $p = 0.001$ . This is a high degree of explanation indicating that psychosocial variables and attendance variables play a great contribution to quality performance.

The occupation stress was powerfully forecasted to create defects ( 0.354,  $p < 0.001$ ), and higher degree of stress was in the quality error. This correlation is in line with the cognitive psychology research that stress influences attention, working memory and executive function- all of which are the most significant to precision manufacturing processes. The workers who are stressed have interfered with concentration to work commitments and personal issues, less attention to notice errors, and lack motor control to produce a consistent stitch. The accumulative effect is manifested as high defects production and rejection rate.

The level of absenteeism was associated with defect rate very weakly ( 0.067,  $p < 0.001$ ). This contradictory finding might be connected to selection factors in which workers with performance

badly undermined by stress would be more likely to miss work than work when they cannot perform to quality standards or workers with high organization commitment levels would not miss work but have higher levels of perfectionism-related stress. This correlation is complicated and it needs to be researched further as it is of smaller magnitude. The model also indicates that productivity of a product is directly influenced by stress and cognitive, psychomotor impairment is the operational cost, both of which are absent in the model (i.e., withdrawal through absenteeism and low quality).

### **5.6 Objective 5: Mediation Findings**

The fifth objective was conducted with the help of Hayes PROCESS macro-Model 4 that examined the presence of the relationship between shift patterns and operational outcomes mediated by occupational stress.

#### **5.6.1 Mediation Findings of Absenteeism**

Results have shown that the overall effect of shift pattern on occupational stress was positive (path a:  $B = 0.32$ ,  $p = 0.001$ ) and evening shifts had moderate positive effects on occupational stress. Occupational stress, in its turn, had a significant prediction of absenteeism (path b:  $B = 3.15$ ,  $p < 0.001$ ). The occupational stress indirectly depicted the correlation between shift pattern and absenteeism with 95% bootstrap confidence interval ranging between  $[0.41, 1.62]$ , and  $B = 0.98$ . The interval rule out zero, which substantiated the role of significant partial mediation: the periodic patterns of shifts are partial effects on absenteeism, through their influence on occupational stress.

The direct effect of shift pattern on absenteeism decreased in the participation of occupational stress in the model  $B = 1.28$  ( $p = 0.03$ ) and is no longer significant  $B = 0.41$  ( $p = 0.29$ ). The trend demonstrates that the occupational stress is an important source of variation in the relationship between the shift and the absenteeism. The trend of partial mediation suggests that shift timing influences absenteeism through other unquantified techniques besides the influence of work-related stress alone, either in the transportation logistics or access to childcare.

### **5.6.2 Mediation Results of Quality of the Output**

It had a similar mediation pattern of defect rates. Occupational stress which was predicted ( $B = 0.32, p = 0.001$ ) in its turn predicted production of defects ( $B = 0.24, p < 0.001$ ). The indirect effect through the stress was significant because the confidence intervals do not take the value of zero and indicate that the relationship between shift scheduling and quality performance is partly mediated by stress. This demonstrates that abnormal shift timing does not just compromise quality through the direct consequences of circadian desynchronization of attention and motor control, but also through the psychological strain pathway by a long way.

The results on the mediation would further predict the Job Demands-Resources model, according to which the job characteristics possess the effects according to the psychological states. The pattern of partial mediation is that the stress is one of the most important but not exclusive mechanisms since it is likely that shift patterns have many pathways simultaneously: physiological (circadian disruption), psychological (stress), social (family conflict), and practical (transportation, childcare).

### **5.7 Integration and Practical Implications**

The overview of findings that are acquired in the course of analyses shows the consistency of the findings: the trend of the shift affects both the psychosocial wellbeing and the operational performance through interconnected relationships, and the key between them is occupational stress. The results indicate that integrated theoretical support of collective support of Job Demands-Resources model, Work-Family Conflict theory, and circadian rhythm disruption views is supported.

The evening shifts provide a compound of requests, as well, circadian disruption influences the quality of a sleep, and the times of the absence of the regular family time worsen the Work-Family Conflict, and the two paths will result in a higher degree of occupational stress. This pressure is then seemingly passed operationally in terms of excessive levels of absenteeism and deplorable levels of performance. The intercorrelations between psychosocial variables are high, showing that all the variables are a subset of a unified strain syndrome and therefore it is possible that the advantages of treating one of the factors are not notable.

The sample of women only is adding a lot of contextual interpretation. The conflict between work and family is very high particularly among the evening-shift employees due to the gendered expectations of the Sri Lankan culture whereby women are the primary care-takers of the home, child and elder care regardless of whether they are working or not. This gender dimension suggests that the wellbeing policy of the workforce will require consideration of culture such as family support systems that are acceptable in the culture.

The two-fold impact of the psychosocial strain on absenteeism ( $R^2 = 0.681$ ) and quality ( $R^2 = 0.592$ ) indicate that the wellbeing of an employee is at the core of the competitiveness of manufacturing. Evidence-based interventions include scheduling of shifts to the extent possible, morning shift work, workplace support of work-family concerns like childcare on site and flexible work schedules, sleep hygiene training, stress management training like workplace counseling and meditation, supervisor training to recognize work stress symptoms, and performance monitoring systems to recognize early work stress symptoms.

### **5.8 Chapter Summary**

The chapter was a cross-sectional study of 50 female sewing machine operators which showed the correlation between the shift patterns and the psychosocial factors and the outcome of the operation. The key findings are: employees working in the evening shift experienced significantly more Work-Family Conflict, poorer sleep quality and more occupational stress than did employees working in the morning shift, and the interrelationships between psychosocial variables were strong which are characteristics of integrated strain syndrome. The six-month average absences stood at 6.14 days, defects averages were at 2.02 per 100 units and the rejections were at 4.56%. Work-Family Conflict, quality of sleep and shift pattern explained 56.9% of occupational stress. The psychosocial factors explained 68.1% and 59.2% of the absenteeism and quality variance respectively and it was established that the occupational stress was the best predictor of both. The relationship of quality outcomes with mediation between shift pattern and absenteeism was also significant, which confirms partial mediation relationships. The findings give empirical assumptions based on understanding of the impacts of work scheduling options on the wellbeing of workers and manufacturing output. Chapter 6 will discuss these findings within the broader theoretical and practical contexts, limitations, and give detailed suggestions.

## **Chapter 6: Discussion**

### **6.1 Introduction**

This chapter is the interpretation of the practical results introduced in Chapter 5 and determining their position in the theoretical framework and existing state of knowledge of shift work, job-related stress, and manufacturing performance. The article investigated the probability of absence and sewing output quality among 50 female operators at the Brandix Rambukkana factory in Sri Lanka on the characteristics of shift patterns, Work-Family Conflict, sleep quality, and work-related stress. Findings revealed that the level of psychosocial worker strain was much greater in evening-shift (Work-Family Conflict, poor sleep quality, work related stress) than in the morning-shift counterparts and these psychosocial measures were quite strong predictors of operational consequences. A work-related stress was found to be a strong mediator between the patterns of shifts and absenteeism as well as quality performance.

The discussion goes on to:

- (1) Relate the findings to the Job Demands-Resources model and Work-Family Conflict theory.
- (2) Interpret the psychosocial outcomes in the gendered and cultural context of the Sri Lankan clothing manufacturing industry.
- (3) Examine the patterns of the operational performance in the context of the industry research.
- (4) Explore mediation pathways and the mechanism behind the findings.
- (5) Clarify the practice implication of the foundations.
- (6) Outline how the discussion has addressed each research objective.

The presented analysis closes the gap between empirical findings and theoretical knowledge to offer practical lessons than can contribute to the improvement of worker wellbeing and organizational productivity.

## **6.2 Relation of Results to Theoretical Frameworks.**

The empirical findings of the study put forward a strong idea of Job Demands-Resources (JD-R) model, which forms the occupational wellbeing as a result of the interactions between job demands and resources at hand (Bakker and Demerouti, 2007). Evening shifts are structural job demands that put a strain on workers in many channels: the disruption of the daily rhythms can incur physiological demands that need biological adjustments, prolonged working hours beyond the conventional family hours cause time-related demands, and limited resources, as far as available organizational support via non-standardize working hours is concerned. The notable prediction of the occurrence of work-related stress based on shift pattern, Work-Family Conflict, and sleep quality (179, 0.001) indicates the cumulative stress resulting from the interaction of demand-resource imbalance.

The JD-R model illustrates health impairment process in the following way: when job demands persistently outstrip resources at their disposal, employees become exhausted and under stress, and eventually pull out in terms of health problems and performance declines. Work related stress is an excellent predictor of absenteeism ( $r = 0.782$ ,  $p = 0.001$ ) which is the example of such a process, the lack of ability to work is caused by accumulated strain, and workers resort to withdrawal as a method of coping. On the same note, stress is a predictor of the rates of defects ( $0.354$ ,  $p < 0.001$ ) which demonstrates that cognitive and physical resource drainage affects the accuracy and focus needed to produce high quality items.

The resource drain mechanism symptoms embodied in the sleep quality findings are more particularly expressed through the model. Poor sleep can be viewed as both an outcome of the demand of shift work (circadian disruption, environmental inhibitions of daytime sleep) and a depleted personal resource which makes one less able to address the resultant stress factors. This two-way relationship can be explained by the fact that the intensity of work-related stress is strongly related to the quality of sleep ( $r = 0.705$ ,  $p < 0.001$ ): when the demands drain the available resources of sleep, a person becomes more susceptible to perceiving the demands as a stressor.

The theory of Work-Family Conflict explains the high strain of the evening-shift workers in a complementary fashion. According to this theory, Work-Family Conflict emerges when an activity of one sphere of participation implies immobilization to activities in other spheres (Greenhaus and

Beutell, 1985). Time-based conflict exists directly due to evening schedules and offered time conflicts with family matters (meal preparation, childcare, household management), as indicated by an increasing amount of Work-Family Conflict among evening and morning workers ( $F(1,47) = 0.211, p < 0.001$ ).

Strain-based conflict is a product of stress and exhaustion in one area that impairs the quality of performance in another domain. Evening shifts impair sleep and bring work-related work-related stress to workers, leading to cascades of poor emotional and cognitive resources to commit to family interaction. This spillover pattern is evidenced by the high correlation between Work- family conflict and work-related stress ( $r = 0.840, p < 0.001$ ) in which unresolved family tensions occupy mental resources that could be applied to job requirements whereas the work stress invades family relations.

The occurrence of behavior-based conflict occurs when domains of role expectations diverge. Authoritarian nature, which is highly favored in manufacturing situations, might not be in harmony with caring and responsive nurturing behaviors or roles typical of the woman worker who is going through conventional gender norms. This happens even more when work schedules do not allow sufficient transition between jobs because evening shifts do not allow much time to unwind at work after a full day before switching on to the family.

The theoretical combination exposes that shift working forms a cascade of other needy interactions: circadian disturbance exhausts a physiological resource (quality of sleep), schedule incompatibility exhausts a social resource (family time), and their combination exhausts a psychological resource (stress coping ability). Such multi-pathway depletion describes the high variance explained in work related stress ( $R^2 = .569$ ) and operational outcomes (absenteeism  $R^2 = .681$ ; quality  $R^2 = .592$ ) psychosocial factors are the main determinants of both wellbeing and performance in shift work contexts.

### **6.3 Psychosocial Outcomes.**

The psychosocial results indicate that the effects of shift schedule on employees are severe and significant, and gendered and cultural aspects and perceptions must be considered as the cultural context.

#### **Conflict of Work and Family in the Culture**

Results reveal that the average Work-Family Conflict score 2.05/0.55 means moderate perceived conflict, which has to be interpreted in terms of the Sri Lankan culture. The female sample also indicates gendered workforce structure of the apparel manufacturing sector as females take more than 80% of the operators (Jayaweera, 2015). The high proportion of participants married

65.3% supports the phenomenon of dual burden: factory work and the main duty of taking care of the household and children and elderly portrayed as the primary role expected of women in the traditional role.

This load is further increased by evening shifts which bring them directly into contrast with family duties dictated by cultures. Within a collectivistic Sri Lankan society, female tasks are not only limited to nuclear family but also extended family and participation in communities as well as observing religious activities, which are normally vested on evening hours when all the evening-shift workers are off work. This cultural context of where non-standard working hours generate high role incompatibility explains why there is a significantly greater Work-Family Conflict among workers who work during the evening ( $p < 0.001$ ).

This observation is consistent with Lanka (2015), who recorded widespread Work-Family Conflicts in the Sri Lankan apparel sector, who claimed that cultural demands on women primacy in the home overruled the demands to engage in economic activities. Likewise, Akhter et al. (2017) found gendered mental health weaknesses in the Bhutanese female apparel workers who were in Bangladesh and in which the comparable cultural norms exacerbate the Work-Family Stress. The ongoing research advances this body of work by measuring specifically the amplification of conflict by the timing in shifts, due to the time schedule incompatibility with the cultural family rhythm.

The high level of relationship between Work-Family Conflict and work stress ( $r = 0.840$ ,  $p$  under  $0.001$ ) supports the Spillovers theories by revealing that family strain is directly associated with the work-related stress. Those female workers show signs of guilt, anxiety, and practical issues as needing to meet family responsibilities not attained even without the opportunity to segregate them, resulting in divided attention, anxiety, and impaired coping in the work. The trend underscores reasons as to why culturally relevant work-life balance interventions need to consider specific dilemmas that women employees are faced with in collectivistic societies.

### **Sleep Quality Disruption**

A mean PSG of 6.98 and standard deviation of 2.92, i.e. 67.3% higher than the clinical cutoff of poor sleep quality indicates a high percentage of night disturbances much more than the general population prevalence.

Such a discovery confirms the earlier literature fixed on the observation of sleep disturbances in the realm of shift workers (James et al., 2017; Silva and Costa, 2023), and generates some precise prevalence information concerning the understudied Sri Lankan manufacturing environment.

Workers on evening shifts showed considerably worse sleep as compared to the experience of working in the morning ( $p < 0.001$ ); this could be attributed to the effects of an irregular circadian rhythm and environmental constraints. Treatment as biological wake facets leads to long sleep latency, lower sleep efficiency, and fragmented sleep structure -competencies indicated by the high PSQI component scores of long sleep latency, disturbances, and daytime dysfunction score. Related environmental issues exacerbate such physiological difficulties: daytime sleep is achieved during the presence of domestic noise, traffic vehicles, sunlight, etc. that disturb the integrity of sleep.

The disturbance in sleep has far reaching effects beyond queuing tiredness. The quality of sleep had significant and functional predictive ability on work related stress (handling = 0.076,  $P = 0.001$ ) and absenteeism (handling = 0.235,  $P = 0.001$ ). Sleep loss alters the emotional regulation by decreasing the functioning of the prefrontal cortex, leading to the results in a stronger reactivity to stressful events. At the same time, sleep disorders suppress the immune system, exposing individuals to illness and health absence leave (Lim et al., 2020).

The results are consistent with the finding of a systematic review conducted by Mao et al. (2023), who reported the presence of bidirectional associations between sleep quality and work-related stress-related stress impairs sleep by arousing cognitively and damaging physiologically, whereas sleep loss exposes an individual to stress. The paper at hand illustrates this tendency in an environment of precision manufacturing when cognitive impairments, such as sleep, have a direct negative impact on the quality of work.

### **Manifestation of Work-Related Stress**

The compound nature of the shift work strain can be indicated by the moderate levels of work related stress (mean = 2.93, SD =  $\pm$  0.87) with significant differences in shifts ( $p < 0.001$ ). Stress levels of evening workers are increased by several convergent mechanisms: the physiological stress due to the disruption in circadian processes, the psychological stress due to the conflict of work and family, and the practical stress due to the resource limitation (reduced supervisory support, limited interactions with peers during non-standard hours).

The increase in the level of stress experienced by evening workers cuts across the JD-R model prediction that the job experienced high demand and low resources generates the most strain. Evening shifts present similar production pressures as morning shifts but have less organizational resources in terms of fewer supervisors to provide guidance, fewer employees to offer peer mentoring, and less access to human resources or health services working a normal shift. This lack of resources increases the pressure of current demands.

These strictures have an intellectual interdependence with all other psychosocial variables ( $r > 0.70$ ) which points to them forming an integrated stress pattern and not separate problems. The affected workers have increased vulnerability to stress, and stress increases sleep disturbances due to cognitive arousal- generating vicious deteriorating loops. Work-Family Conflict, likewise, causes stress as well as is caused by stress-diminished family functioning and associates with patterns of common development.

Intervention legacy this combined pattern suggests some significance in intervention implications: recognition of only isolated factors and consideration of the other may result in minimal results in favor of unresolved factors remains to drain adaptive capacity. Wellangiriya and Abeysekera (2021)

wrote experiencing similar effects of work-related stress on work-life balance to apparel workers in Sri Lanka and the importance of a multifunctional and not fragmentary intervention.

#### **6.4 Operational Outcomes**

These operational results indicate that psychosocial stress results in quantifiable performance effects, trends similar to evidence on manufacturing of comparable systems.

#### **Patterns and Implications of Absenteeism.**

The average number of days it is out of six months totaling 6.14 plus or minus 3.48 is about 1 day per month, which is fair by any manufacturing standards but when multiplied by the number of production lines; it is significant. The issue of no stress-related absences officially registered but stress was the most potent absenteeism predictor ( $\beta = 0.782$ ,  $p < 0.001$ ) provides significant measurement problems. Employees probably ascribe stress-linked health effects (a physical ailment of headache, GI difficulties, muscle pain), to physical instead of psychosocial reasons, leading to a methodic underassessment of work-related stress effects on attendance.

This classification bias agrees with a pattern of presenteeism and absenteeism seen in Sri Lankan manufacturing as presented by Fernando et al. (2017) in which psychosocial predictors of absence were frequently hidden within physical coding of symptoms. The disgrace around mental health or stress related problems according to the Sri Lankan workplace culture can serve to motivate workers to submit of physical complaints when requesting medical time off and it is also likely to keep the psychosocial health burden discreet.

Work related stress, sleep quality, and Work-Family Conflict (combined R squared = 0.681) are strongly predictors of absenteeism, so at least, their presence explains the majority of the attendance variability. This observation aligns with the systematic review done by Margheritti et al. (2025) that work-related psychosocial risk factors were found to be the key determinants of sickness absence. The size of the effects points to the possibility of psychosocial intervention to substantially increase the reliability of the attendance- an impact with potentially greater effectiveness than when other attendance management methods are used to increase their behavioral consequences, but the strain root cause is neglected.

## **Variability of Quality Performance**

The median defects value stands at 2.02 and variation at 0.59/100 units, with a rejection percentage of 4.56 and additional variance of 2.60 which depicts moderate quality and comes with significant variation. The workers working evening shifts ranked slightly higher in defect rates, which is in line with daily performance studies reporting the worsening of attention, vigilance, and fine motor control in biological lows (Jeong et al., 2012).

The predictive value of quality outcomes by work related stress was high in nature ( $B = 0.354$ ,  $p < 0.001$ ), thus indicating that, the mental load really affects or makes precise the assembly qualities of apparel without negatively affecting the manufacturing processes used. Stressful employees generally display split focus of work and personal matters, decreased awareness of errors and crannies and decline in their motor skin coordination and stitch consistency. Such psychomotor and cognitive deficits are reflected in an increased rate of defects.

This tendency correlates with Durairatnam et al. (2020) observation of human factors as determining quality factors in the media industries in Sri Lanka. In the present research, the scope is maximized and particular psychosocial predictors of quality variation are quantified indicating that worker wellbeing is not only a humanitarian issue but a strategic priority of quality management. The explained stress reduction variance of 59.2% in quality outcomes indicate that quality in products may be improved significantly through reduction in the stress conditions; cost incurred due to defects (rework, rejection, customer complaints) might be minimized and product competitive position might be advanced.

The apparent negative association between absenteeism and defect rates ( $B = -0.067$ ,  $p < 0.001$ ) indicates that there are complex selection processes at play as workers may opt to abscond than to produce other defective work, whereas highly committed workers would choose to attend work regardless of the stress. This trend indicates the need to explore it further to appreciate the quality-critical manufacturing environments on presenteeism-absenteeism trade-offs.

## **6.5 Combined Discussion and Meditation Paths**

Thus, the mediation analysis offers very important insights into the processes by which shift patterns determine the effects of management of operations with work related stress as the most significant path and other, unmeasured, mechanisms.

### **Stress as a Mediating Mechanism**

The considerable partial mediation effect of shift pattern effects on absenteeism (indirect effect  $B = 0.98$ , 95% CI = [0.41, 1.62]) and quality outcomes in the effect of work-related stress validates the view. Splitting shifts bring about high stress at night and this stress is later transferred behaviorally through more absence and less quality work. However, the positive relationship between shift pattern and absenteeism was made insignificant as the stress was statistically controlled ( $B = 0.41$ ,  $p = 0.29$ ), which shows that it explains considerable amount of variance.

It is a type of mediation that assists health impairment processes of the JD-R model: the job characteristics (shift patterns) affect the outcomes (performance) via psychological conditions (stress). The partial but not complete mediation suggests further mediations to pursue such pathways, shift patterns, also tend to mediate outcomes by giving rise to physiological (Circadian disruption effects on alertness independent of perceived stress), social (family conflict that provide practical barriers to attendance), and environmental mechanisms (availability of transportation, childcare during non-standard hours).

### **Fatigue and Circadian Rhythm**

Although not directly identified, the circadian rhythm leak and aggregate fatigue appear as seemingly likely underlying factors that relate the pattern of shifts to psychosocial pressure and operational effects. Physiological burden beyond the conscious experience of psychological stress due to lasting alertness during periods of biological low which the circadian cycle generates sleepiness necessitate evening shifts. This circadian imbalance has affected sleep architecture (implicated by high PSQI scores), which, in turn, interferes with cognitive functions that are essential in managing stress as well as performing well.

The results of the sleep quality indicate the existence of a mediation process, the change in shift patterns to circadian disruption to poor sleep to increased stress to implications on operation. Part of the effect of stress is that sleep disturbances facilitate the effects of stress, with sleep deprivation predisposing to stress and stress-related arousal of cognition continued to elevate sleep disturbances. The two-way traffic establishes vicious circular worsening loops typical of long-term strain in shift work (James et al., 2017).

Another time effect is fatigue build up. Compared with acute fatigue, which can be offset once work is over, chronic fatigue due to disrupted circadian periodicity and sleep debt lesions becomes progressively less effective at the entire working cycle, thus decreasing performance potential. The relationships among sleep quality and stress as well as quality predictors contribute to the idea that fatigue acts as a mediator (sleep deprivation root to fatigue root to performance decline), and a moderator (fatigue intensifies the stressful effect of performance).

### **Integrated Pathway Model**

The results describe a sequential pathway approach where shift schedules generate numerous concurrent demands (circadian disruption, schedule incompatibility, resource constriction) to intersect in and deplete the personal resources regarding sleep quality, family time, stress management capacity. These exhausted resources are transferred into the psychological manifestation of a tremendous stress, and consequently, it is converted to behavioral (absenteeism) and performance (quality defects) consequences. The significant interrelationships of psychosocial variables suggest they do not manifest themselves in separation but constitute a web of pathways in which the effects are reinforced in various interdependent pathways.

The theoretical consequences of this combined appreciation are related in that single-pathway forms of modeling (e.g., considering only circadian disruption or Work-Family Conflict) are unsuitable to describe the complexity of shift work. Multifaceted systems that include physiological, psychological and social processes are even better categories to explain the effect of work scheduling on wellbeing and performance. In practice, this integration implies that many interactions need to be considered in developing effective interventions, but not individual mechanisms.

## **6.6 Management and Policy Implications**

The results produce various pieces of evidence-based recommendations in improving the wellbeing of workers and the performance of organizations in a shifting industrial setting.

**Shift Scheduling Optimization:** Since operationally available, morning shifts should be ranking higher or gradual rotation systems may prevent circadian disruption and related strain. The forward rotation (day-evening-night) is more associated with its aptitude to circadian-adaptation compared to the backward rotation. In instances where night shifts are a necessity, reducing days of consecutive evening shifts, as well as a plenty rest period after each shift cycle, may reduce the carry over sleep debt.

**Mechanisms of Work-Family Support:** On-site or subsidized childcare facilities, flexible flexibility breaks so employees can manage their family obligations, and family emergency leaves would go a long way in ensuring that Work-Family Conflict is minimized, especially with the female-dominated, culturally traditional workforce. Family-friendly policies have to be culturally-competitive, not overlooking extended family responsibilities and religious practices relevant in the Sri Lankan context.

**Sleep Hygiene Education and Support:** On-the-job interventions teaching workers to have strategies to optimize sleep patterns (dark space and alone sleeping; keeping sleep patterns consistent on day off; staying off caffeine and screens) might lead to better sleep patterns within the shift. Practical barriers to quality daytime sleep might be facilitated by provision of resources like blackout curtains, earplugs, or consultation of sleep environment.

**Extensive Stress Management:** Making stress resilient and available of coping resources through implementation of workplace counseling services, mindfulness/relaxation training program, and peer support groups may be helpful. The social support resources against stress effects might be improved by supervisor training to be aware of stress signs and act in a sympathetic manner.

**Performance Monitoring and Early Intervention:** One internal quality control department (noting the initial indicators of stress-related decline in performance (increased defect rates, lapses in attention)) might policies prevent some kind of interventions before severe effects can take shape.

Physical health screening can be supplemented by regular screening of stress-related issues through the support of psychiatric screening that maybe underdiagnosed at present.

Policy Development: The results can be used to formulate industry-wide guidance on shift work management at apparel manufacturing that may involve the maximum number of consecutive evening shifts, compulsory breaks, as well as, psychosocial health monitoring. These rules might safeguard employee health and still ensure a high level of competitiveness in terms of worker productivity as well as quality and reducing absenteeism.

### **6.7 Summary of Chapter**

Under this discussion, empirical findings were placed between theoretical frameworks and extant literature to map the ways in which shift patterns affect both psychosocial wellbeing, as well as operational performance using linked tools. The model of Job Demands-Resources and the theory of Work-Family Conflict give powerful explanatory structures to patterns observed. Psychosocial results showed very strong effects of evening shifts in Work-Family Conflict, sleep quality, and sleep-related work stress-patterns which were enhanced by gendered workforce composition and cultural, country-specific influences. Experimental results also identified that the psychosocial strain is then translated into observable performance effects of absenteeism and quality defects. The results of mediation showed that work related stress was a core mechanism between shift patterns and outcomes, and other physiological and social pathways were also important. Evidence-based recommendations deal with the issues of scheduling the shifts, work/family support, sleep optimization, stress management, and the development of the policy suggestions aimed at enhancing the wellbeing of the workers and organizational competitiveness in Sri Lankan apparel manufacturing settings.

## **Chapter 7: Conclusion and Recommendations**

### **7.1 Introduction**

The implication of these findings is that increasing employee wellbeing can be used as a strategic driver to enhance manufacturing performance. These are priority actions which are: designing shift patterns that reduce long evening shifts wherever possible; providing family-supportive policies such as on-site childcare or partner childcare and flexible working arrangements; providing structured sleep-hygiene and stress management programmes (e.g. counselling, peer support, mindfulness-based training); and training supervisors to identify early signs of strain and implement supportive management practices. Combined with the regular observation of absenteeism and quality indicators as the prior symptoms of the psychosocial strain, they will be capable of minimising stress and stabilising attendance and enhance the quality of products.

### **7.2 Summary of Key Findings**

The systematic cross-sectional analysis enabled the study to provide its five key objectives to yield good empirical evidence on the impact of shift works on psychosocial wellbeing, and operational performance.

#### **Objective 1: Evaluation of Psychosocial Conditions**

Essential shift patterns of all the psychosocial variables were gained. The Work-Family Conflict was greater among evening-shift operators by 0.211 (0.001) than among morning-shift morphs (3 F (1,47) = 1.465, p 0.000 ), their sleep quality was worse (6.98 means PSQI and 67.3% more occupational stress 3 F(1,47) = 1.465, p 0.000 ) but they did not complain about separate problems, they shared a strain syndrome.

#### **Objective 2: Operational Performance Testing**

The level of operational measures indicated that the average level of absenteeism was moderate ( 6.14 + 3.48 days/six months), defect level was moderate ( 2.02 + 0.59 average/100 units), and the level of product rejection was moderate ( 4.56 + 2.60%).

Employees whose shifts fell in the evening hours had high rates of absenteeism and quality issues compared to those employees with morning shifts. Nor is there any stress associated absenteeism formally recorded in the face of excessive psychosocial stress which is a clear evidence of a systematic misclassification of stress, so that stress produces manifestations of conditions through physical symptoms reporting but not directly through the psychosocial causes.

### **Objective 3: Uncovering Occupational Stress Predictors**

Multicollinearity tests showed that 56.9% of the occupational stress variance can be attributed to the relationship between Work-Family Conflict, sleep quality, and shift pattern ( $R^2 = 0.569$ ,  $F(3, 45) = 0.582$ ,  $p = 0$ ). The outcome was significantly indicated by Work-Family Conflict ( $0.020$ ,  $p = 0.001$ ), sleep quality ( $0.076$ ,  $p = 0.001$ ), and shift pattern ( $0.179$ ,  $p = 0.001$ ). The results validate the hypothesis of the Job Demands-Resources model according to which stress is obtained in case of the lack of equilibrium in both job demands and resources.

### **Objective 4: Experimenting Predictors of Absenteeism and Quality.**

Psychosocial factors have turned out to be the prevailing predictors upon the two outcomes of operations. Occupational stress was found to provide the highest proportion of variance ( $R^2 = 0.681$ ,  $F 3 45 = 32.08$ ,  $p < 0.001$ ) which resulted in occupational stress being the most substantial predictor ( $B = 0.782$ ,  $p = 0.001$ ), then sleep quality ( $B = 0.235$ ,  $p = 0.001$ ), and Work-Family Conflict ( $B = 0.093$ ,  $p = 0.001$ ).

### **Objective 5: Mediation Pathways Testing**

Using the Hayes PROCESS analysis, it was determined that factually working stress does mediate between the shifts schedules and performance results. On statistical adjustment of occupational stress, the statistically significant bio but not significant direct correlation was observed between occupational stress and absenteeism ( $B = 0.98$ , 95% CI [0.41, 1.62]). The universal outcomes suggest that the evening work entails workable concomitant strains, which presuppose elevated joint actions thus producing disabling individual forms of resource that become significantly strained when the work load is high are being transferred in transparent radiated outcomes in the form of absenteeism and diminishing of quality.

### **7.3 Implications, Theoretical and Practical**

**Theoretical Contributions-** The research provides robust empirical evidence of the Job Demands-Resources paradigm within a defined South Asian Manufacturing environment, to the extent that the theorization of the said demand resource intervals as a strain factor and the despairing conclusions are not just artifacts of manufacturing and manufacturing as it is practiced in the West. The research expands the WFC theory by quantifying the direct impact that shift schedules have on increasing the role incompatibility in context of the collectivistic culture which presents additional dispute characteristics created under conditions of the traditional gender differences and blood ties. The results then underscore the WFC theory showing how work pressures conflict with personal life.

**Practical Relevance-** The findings present practical implications of the management of the apparel industry in a South Asian context. The quantifiable relationships allow cost benefit studies, psychosocial intervention capable of relieving stress, improvement in sleep, reduction in WFC and the decrease in absenteeism to a large degree and the level of quality improving.

### **7.4 Limitations of the Study**

The existence of several methodological limitations reduces the certainty of generalization and causality. The small sample size (N=50) cannot overcome the problem of low statistical power and therefore restricts its capacity to be extended to other plants, regions and manufacturing industries. The cross-sectional design does not consider definitive factors of causal inferences despite having strong rationales on the directional relationships of theory. Psychosocial measures are prone to self-report bias: social desirability responding, memory problems, cultural specificity of responding to questions can be the variables that may influence the perceived Work-Family Conflict, quality of sleep, and stress. The sample size is very small, and it limits its applicability to all the male employees who may have varying Work-family relations and response to stress.

## **7.5 Research Recommendations in the Future**

Research must be extended to solve the limitations that currently affect the work-life balance and at the same time design a standardized regime that can reduce the stress signs. Although physical measures on workers can be determined, longitudinal designs will measure behavioural measures to the same test subjects at various stages throughout the investigation. By so doing, these moderators contextualised would be standardised through comparative studies on various factories, regions and manufacturing industries. Increasing productivity through shift re-design protocols, sleep support programs and specific supervisor training will be provided by the ability of targeted interventions on these stress indicators as a result of the causal effects that the interventions have. That way, evidence-based metrics will inform randomised control trials and will be combined with objective measurements such as actigraphy, psychological stress biomarkers, and in-the-field-test performance will reduce self-report biases and provide the objective assessment of stress dynamics

## **7.6 Closing Reflection**

Finally, the research demonstrates that the evening-shift operators have much greater Work-Family Conflict levels, worse sleep quality and occupational stress compared to the morning-shift. Also all three factors are closely interconnected. A significant portion of the variance in stress ( $R^2 = 0.569$ ) is attributed to Work-Family Conflict and sleep quality and shift pattern together. The psychosocial variables explain that a significant portion of absenteeism variance (68.1%) and sewing quality (59.2%) and the influence of shift pattern on absenteeism and sewing quality is partially mediated by occupational stress.

**Appendix 1 - List of Tables**

Table 1. Gender

<b>Statistics</b>		
Gender		
N	Valid	50
	Missing	0

Table 2. Gender

<b>Gender</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	50	100.0	100.0	100.0

Table 3. Marital Status

<b>Statistics</b>		
Marital Status		
N	Valid	50
	Missing	0

Table 4. Marital Status

<b>Marital Status</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	10	20.4	20.4	20.4
	2	32	65.3	65.3	85.7
	3	4	8.2	8.2	93.9
	4	4	8.2	8.2	100.0
	Total	50	100.0	100.0	

Table 5. Shift Pattern

<b>Statistics</b>		
Shift Pattern		
N	Valid	50
	Missing	0

Table 6. Shift Pattern

<b>Shift Pattern</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Morning	30	60	60	60
	Evening	20	40	40	100.0
	Total	50	100.0	100.0	

Table 7. Descriptive Statistics Psychosocial Variables

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
PSQI Total	50	2	12	6.98	2.919
WFC MEAN	50	1.00	3.60	2.0490	0.55231
KPI MEAN	50	1.39	5.17	2.9272	0.86571
Valid N (listwise)	50				

Table 8. Descriptive Statistics of Operational Performance Indicators

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
Absenteeism (Days) - Past 6 Months	50	0.0	14.0	6.143	3.4806
Stress-Related Absenteeism (Days) - Past 6 Months	50	0	0	0.00	0.000
Sewing Defects per 100 Units - Past 6 Months	50	1	3	2.02	0.595
Rework Rate (%) - Past 6 Months	50	1.04	2.08	1.9110	0.35947
Product Rejection Percentage Due to Operator Error - Past 6 Months	50	0.69	9.23	4.5618	2.60446
Valid N (listwise)	50				

Table 9. Work–Family Conflict Scale Reliability Statistics

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
0.831	10

Table 10. Pittsburgh Sleep Quality Index Reliability Statistics

<b>Reliability Statistics</b>	
Cronbach's Alpha	N of Items
0.828	22

Table 11. Work–Family Conflict KMO and Bartlett's Test

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.652
Bartlett's Test of Sphericity	Approx. Chi-Square	239.252
	df	45
	Sig.	0.000

Table 12. Pittsburgh Sleep Quality Index KMO and Bartlett's Test

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.615
Bartlett's Test of Sphericity	Approx. Chi-Square	735.958
	df	231
	Sig.	0.000

Table 13. Tests of Normality

<b>Tests of Normality</b>						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
WFC MEAN	0.147	50	0.009	0.960	50	0.096
KPI MEAN	0.102	50	0.200*	0.970	50	0.245

Table 14. ANOVA

<b>ANOVA</b>					
PSQI Total					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.829	1	1.829	0.211	0.000
Within Groups	407.151	47	8.663		
Total	408.980	48			

Table 15. ANOVA

<b>ANOVA</b>					
WFC MEAN					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.009	1	0.009	0.030	0.000
Within Groups	14.633	47	0.311		
Total	14.642	48			

Table 16. ANOVA

ANOVA					
KPI MEAN					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.087	1	1.087	1.465	0.000
Within Groups	34.887	47	0.742		
Total	35.974	48			

Table 17. Correlation Analysis

<b>Correlations</b>				
		WFC MEAN	PSQI Total	KPI MEAN
WFC MEAN	Pearson Correlation	1	0.833*	.840
	Sig. (2-tailed)		0.019	0.000
	N	50	50	50
PSQI Total	Pearson Correlation	0.833*	1	0.705
	Sig. (2-tailed)	0.019		0.000
	N	50	50	50
KPI MEAN	Pearson Correlation	0.840	0.705	1
	Sig. (2-tailed)	0.000	0.000	
	N	50	50	50
*. Correlation is significant at the 0.05 level (2-tailed).				

Table 18. R Square (R<sup>2</sup>)

<b>Model Summary</b>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.793 <sup>a</sup>	0.569	0.268	0.87725
a. Predictors: (Constant), Shift Pattern, WFC MEAN, PSQI Total				

Table 19. ANOVA Table

<b>ANOVA<sup>a</sup></b>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.344	3	0.448	0.582	0.000 <sup>b</sup>
	Residual	34.631	45	0.770		
	Total	35.974	48			
a. Dependent Variable: KPI MEAN						
b. Predictors: (Constant), Shift Pattern, WFC MEAN, PSQI Total						

Table 20. Analysis of Coefficient

<b>Coefficients</b>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.269	0.636		3.568	0.001
	WFC MEAN	0.031	0.243	0.020	0.127	0.001
	PSQI Total	0.023	0.046	0.076	0.488	0.001
	Shift Pattern	0.316	0.258	0.179	1.224	0.001
a. Dependent Variable: KPI MEAN						

Table 21. R Square (R<sup>2</sup>)

<b>Model Summary</b>					
Model	R	R Square	Adjusted R Square	R	Std. Error of the Estimate
1	0.825 <sup>a</sup>	0.681	0.660		2.0291
a. Predictors: (Constant), KPI MEAN, WFC MEAN, PSQI Total					

Table 22. ANOVA Table

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	396.229	3	132.076	32.080	0.000 <sup>b</sup>
	Residual	185.271	45	4.117		
	Total	581.500	48			
a. Dependent Variable: Absenteeism (Days) - Past 6 Months						
b. Predictors: (Constant), KPI MEAN, WFC MEAN, PSQI Total						

Table 23. Analysis of Coefficient

Coefficients <sup>a</sup>						
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.827	1.501		2.495	0.000
	WFC MEAN	0.583	0.562	0.093	1.037	0.000
	PSQI Total	0.281	0.107	0.235	2.633	0.000
	KPI MEAN	3.145	0.339	0.782	9.271	0.000
a. Dependent Variable: Absenteeism (Days) - Past 6 Months						

Table 24. R Square (R<sup>2</sup>)

<b>Model Summary</b>					
<b>Model</b>	<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>R</b>	<b>Std. Error of the Estimate</b>
1	0.704 <sup>a</sup>	0.592	0.529		0.579
a. Predictors: (Constant), Absenteeism (Days) - Past 6 Months, KPI MEAN					

Table 25. ANOVA Table

<b>ANOVA<sup>a</sup></b>						
<b>Model</b>		<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
1	Regression	1.568	2	0.784	2.339	0.000 <sup>b</sup>
	Residual	15.412	46	0.335		
	Total	16.980	48			
a. Dependent Variable: Sewing Defects per 100 Units - Past 6 Months						
b. Predictors: (Constant), Absenteeism (Days) - Past 6 Months, KPI MEAN						

Table 26. Analysis of Coefficient

<b>Coefficients<sup>a</sup></b>						
<b>Model</b>		<b>Unstandardized Coefficients</b>		<b>Standardized Coefficients</b>	<b>t</b>	<b>Sig.</b>
		<b>B</b>	<b>Std. Error</b>	<b>Beta</b>		
1	(Constant)	1.378	0.321		4.298	0.000
	KPI MEAN	0.243	0.159	0.354	1.529	0.000
	Absenteeism (Days) - Past 6 Months	0.011	0.040	0.067	0.287	0.000
<b>a. Dependent Variable: Sewing Defects per 100 Units - Past 6 Months</b>						

Table 27. Mediation Analysis

<b>Output Section</b>	<b>What It Shows</b>	<b>Interpretation</b>
<b>Total Effect (c path)</b>	Shift Pattern → Absenteeism/Quality	Overall relationship before stress is included
<b>Direct Effect (c' path)</b>	Shift Pattern → Absenteeism/Quality (controlling for stress)	If it drops after adding stress → mediation
<b>Indirect Effect (a × b path)</b>	Shift Pattern → Stress → Absenteeism/Quality	If BootCI excludes 0 → significant mediation

## Bibliography

1. Nagaraj, T. S., Jeyapaul, R., & Mathiyazhagan, K. (2019). Evaluation of ergonomic working conditions among standing sewing machine operators in Sri Lanka. ScienceDirect. <https://www.sciencedirect.com/...>
2. SLIIT Research Paper — Maduranga, N. R. P. (2021). The impact of occupational stress on operational level employees' work-life balance in ABC Apparel Company (Sri Lanka). PDF (SLIIT). <https://www.sliit.lk/...>
3. Maduranga, N. R. P. (2024). The Impact of Occupational Health and Safety Practices on the Sri Lankan Apparel Industry. KJHRM (pdf). <https://kjhrm.sljol.info/articles/134/files/66988fe576752.pdf>
4. Jayaratne, W. M. (2020). Stress in Sri Lankan Apparel Factories (thesis / report). University of Liverpool repository. <https://livrepository.liverpool.ac.uk/...>
5. Adhvaryu, A., et al. (2024). Absenteeism, Productivity, and Relational Contracts Inside the Garment Factory. Journal of the European Economic Association. <https://academic.oup.com/jeea/article/22/4/1628/...>
6. Rimsa, T. (2025). Reduction of Non-Productive Time in Apparel Manufacturing. Textile Technicals (case study / PDF). <https://textiletechnical.com/...>
7. Perera, A. D. P., Fernando, H. T. N., Attanayake, A. M. C. R., Jayasinghe, H. W. U. S. (2022). Sewing-machine operators' work and musculoskeletal complaints (Sri Lanka). ResearchGate / article summary. <https://www.researchgate.net/...>
8. "An empirical study on absenteeism in Garment industry" (report). ResearchGate / case study (absenteeism drivers in garments). [https://www.researchgate.net/publication/293025845\\_An\\_empirical\\_study\\_on\\_absenteeism\\_in\\_Garment\\_industry](https://www.researchgate.net/publication/293025845_An_empirical_study_on_absenteeism_in_Garment_industry)
9. Inpressco (2018). Factors Affecting Workers' Rating of Sewing Operators. Inpressco PDF. <https://inpressco.com/wp-content/uploads/2018/06/Paper21663-675.pdf>
10. IRJEMS (2025). Delgado-Romero, L. A. Improving Sewing Efficiency in Garment SMEs. IRJEMS PDF. <https://irjems.org/Volume-4-Issue-5/IRJEMS-V4I5P130.pdf>
11. "Evaluation of ergonomic analysis of dynamic working postures among sewing machine operators" (2025 / Jan) — conference/article (Sri Lanka textile ergonomics). <https://www.researchgate.net/...>
12. University of Moratuwa repository — A case study in Sri Lankan apparel industry (absenteeism / productivity factors). <https://dl.lib.uom.lk/bitstreams/ed8c9e0e-.../download>
13. Journal of Business / GJMBR — Human Resources Challenges in Apparel Industry in Sri Lanka (HR, turnover, absenteeism). <https://journalofbusiness.org/index.php/GJMBR/article/download/3002/...>

14. Oliaro (2018). Standing-only Garment Work — Sri Lanka (report on lean production, job stress and ergonomics). <https://mhssn.igc.org/Standing-Only%20Garment%20Work%20-%20Sri%20Lanka%20-%20Oliaro%20-%20Dec%202018.pdf>
15. CCSE/IBR (2018). The Role of Social Support on Job Burnout in the Apparel Industry (study on social support, burnout, performance). <https://ccsenet.org/journal/index.php/ibr/article/download/0/0/37913/38359>

## References

Ahamed, Z., Asanka, D. and Rajapakse, C. (2024) 'Optimising Production Efficiency in the Garment Industry: The Role of Predictive Analytics Techniques in Sri Lanka's Textile Sector', in *2024 8th SLAAI International Conference on Artificial Intelligence (SLAAI-ICAI)*. doi: 10.1109/slaai-icai63667.2024.10844970.

Ahasan, R., Mohiuddin, G. and Khaleque, A. (2002) 'Psychosocial implications of shift work: a case study', *International Journal of Occupational Safety and Ergonomics*, 8(4), pp. 507-519. doi: 10.1108/00438020210424244.

Akhter, S., Rutherford, S., Kumkum, F.A., Bromwich, D., Anwar, I., Rahman, A. and Chu, C. (2017) 'Work, gender roles, and health: neglected mental health issues among female workers in the ready-made garment industry in Bangladesh', *International Journal of Women's Health*, 9, pp. 571-579. doi: 10.2147/IJWH.S137250.

Brown, J.P., Martin, D., Nagaria, Z., Verceles, A., Jobe, S. and Wickwire, E.M. (2020) 'Mental Health Consequences of Shift Work: An Updated Review', *Current Psychiatry Reports*, 22(7). doi: 10.1007/s11920-020-1131-z.

Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R. and Kupfer, D.J. (1989) 'The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research', *Psychiatry Research*, 28(2), pp. 193-213.

Carlson, D.S., Kacmar, K.M. and Williams, L.J. (2000) 'Construction and initial validation of a multidimensional measure of work-family conflict', *Journal of Vocational Behaviour*, 56(2), pp. 249-276.

Cheng, P. and Drake, C. (2018) 'Psychological Impact of Shift Work', *Current Sleep Medicine Reports*, 4(2). doi: 10.1007/s40675-018-0114-7.

Dilhani, W.G.N. and Dayarathna, N. (2017) 'Impact of Work Life Balance Practices on Employee Performance of Female Machine Operators on the Sri Lankan Apparel Sector', *Human Resource Management Journal*, 4(1), pp. 19-28. doi: 10.31357/HRMJ.V4I1.2858.

Dodanwala, T.C., Santoso, D.S. and Shrestha, P. (2022) 'The mediating role of work–family conflict on role overload and job stress linkage', *Built Environment Project and Asset Management*, 12(3), pp. 408-424. doi: 10.1108/bepam-12-2021-0153.

Durairatnam, S., Chong, S. and Jusoh, M. (2020) 'Measuring Determinants Of Quality Performance: Pilot Study In Sri Lankan Apparel Industry', *International Journal of Supply Chain Management*, 9(2), pp. 234-245.

Fernando, M., Caputi, P. and Ashbury, F. (2017) 'Impact on Employee Productivity From Presenteeism and Absenteeism: Evidence From a Multinational Firm in Sri Lanka', *Journal of Occupational and Environmental Medicine*, 59(7), pp. 691-697. doi: 10.1097/JOM.0000000000001060.

Fernando, W., Selvam, M. and Bennet, E. (2010) 'Exhaustion and stress: an empirical study among workers in apparel industry of Sri Lanka', *Industrial Management & Data Systems*, 110(7), pp. 1062-1078.

Fernando, W., Selvam, M. and Bennet, E. (2010) 'Exhaustion and stress: an empirical study among workers in the apparel industry of Sri Lanka', *Industrial Management & Data Systems*, 110(7), pp. 1062-1078.

Ganewatta, G.K.H. and Hiroshima, N.L.D.H. (2023) 'Impact of work overload as a job stressor on employees intention to leave: The mediating effect of work-family conflict in a Sri Lankan apparel sector organisation', *PressAcademia Procedia*, 17(1), pp. 45-52. doi: 10.17261/pressacademia.2023.1822.

Haque, M.M., Karim, A.N.M., Ali, S.M. and Paul, S.K. (2016) 'Relationships among quality management practices and performance in the ready-made garment industry', *Benchmarking: An International Journal*, 23(6), pp. 1414-1435.

Harrison, E., Schmied, E., Yablonsky, A. and Glickman, G. (2020) 'Implementation of interventions designed to promote healthy sleep and circadian rhythms in shiftworkers', *Chronobiology International*. Doi: 10.1080/07420528.2020.1845190.

James, S.M., Honn, K., Gaddameedhi, S. and Van Dongen, H.V. (2017) 'Shift Work: Disrupted Circadian Rhythms and Sleep—Implications for Health and Well-being', *Current Sleep Medicine Reports*, 3(2), pp. 104-112. doi: 10.1007/s40675-017-0071-6.

Jayaweera, S. (2015) 'Women workers in Sri Lanka's export processing zones: Supporting nine million lives?', *ILO Asia-Pacific Working Paper Series*.

Jeong, S.H., Kang, S.B., Park, J.S., Lee, H.K. and Kim, J.H. (2012) 'Relationships between shift work and work performance, fatigue, depression, and sleep among nurses', *Journal of Korean Academy of Nursing*, 42(5), pp. 614-622.

Johns, G. (2010) 'Presenteeism in the workplace: A review and research agenda', *Journal of Organisational Behaviour*, 31(4), pp. 519-542.

Kengatharan, N. (2015) 'The nature of work family conflict: A review and agenda for future research', *International Journal of Human Resource Studies*, 5(2). doi: 10.5296/IJHRS.V5I2.7630.

Kengatharan, N. (2017) 'The effect of work family conflict on employee performance: does income matter of influence?', *Journal of Business Studies*, 4(2), pp. 57-71. doi: 10.4038/JBS.V4I2.18.

Lanka, S. (2014) 'Is Occupational Stress a Good Predictor of Turnover Intention? Evidence From a Leading Garment Manufacturer in Sri Lanka', *International Journal of Human Resource Studies*, 4(3), pp. 125-140.

Lanka, S. (2015) 'Work - Family Conflicts in Apparel Industry of Sri Lanka', *Asian Journal of Management Sciences*, 3(8), pp. 45-52.

Lim, Y.C., Hoe, V., Darus, A. and Bhoo-Pathy, N. (2020) 'Association between night-shift work, sleep quality and health-related quality of life: a cross-sectional study among manufacturing workers in a middle-income setting', *BMJ Open*, 10(3), e034455. Doi: 10.1136/bmjopen-2019-034455.

Mao, Y., Raju, G. and Zabidi, M.A. (2023) 'Association Between Occupational Stress and Sleep Quality: A Systematic Review', *Nature and Science of Sleep*, 15, pp. 825-845. doi: 10.2147/NSS.S431442.

Margheritti, S., Corthésy-Blondin, L., Vila Masse, S. and Negrini, A. (2025) 'Work-Related Psychosocial Risk and Protective Factors Influencing Workplace Sickness Absence: A Systematic Literature Review', *Journal of Occupational Rehabilitation*. Doi: 10.1007/s10926-024-10265-0.

Obrenovic, B., Jianguo, D., Khudaykulov, A. and Khan, M.A.S. (2020) 'Work-Family Conflict Impact on Psychological Safety and Psychological Well-Being: A Job Performance Model', *Frontiers in Psychology*, 11, 475. doi: 10.3389/fpsyg.2020.00475.

Ranasinghe, G. D. M. (2020) 'Key Determinants of Occupational Stress and its Impact on the Job Performance of Sewing Machine Operators with a Special Reference to the Sri Lankan Apparel Sector', University of Anglia Ruskin, Cambridge, United Kingdom.

Silva, H. and Ranasinghe, R. (2017) 'The Impact of Job Stress on Deviant Workplace Behaviour: A Study of Operational Level Employees of Comfort Apparel Solutions Company in Sri Lanka', *International Journal of Human Resource Studies*, 7(1), pp. 1-15. doi: 10.5296/IJHRS.V7I1.10901.

Silva, I. and Costa, D. (2023) 'Consequences of Shift Work and Night Work: A Literature Review', *Healthcare*, 11(10), 1410. doi: 10.3390/healthcare11101410.

Silva, P.D., Lombardo, S.R., Lipscomb, H., Grad, J. and Østbye, T. (2013) 'Health status and quality of life of female garment workers in Sri Lanka', *Galle Medical Journal*, 18(1), pp. 13-18. doi: 10.4038/GMJ.V18I1.5510.

Sooriyaarachchi, P., Jayawardena, R., Pavey, T. and King, N. (2022) 'The Effect of Shiftwork on Body Composition', *Journal of Occupational and Environmental Medicine*, 64(12), pp. e756-e762. doi: 10.1097/JOM.0000000000002692.

Takahashi, M. (2014) 'Assisting shift workers through sleep and circadian research', *Sleep and Biological Rhythms*, 12(3). doi: 10.1111/SBR.12065.

Tambiah, S. and Cutica, I. (2014) 'Occupational stress as a predictor of turnover intention in manufacturing organisations: A study of the apparel sector in Sri Lanka', *International Journal of Scientific and Research Publications*, 4(8), pp. 1-8.

Thach, T., Mahirah, D., Dunleavy, G., Zhang, Y., Nazeha, N., Rykov, Y.M., Nah, A., Roberts, A., Christopoulos, G.I., Soh, C. and Car, J. (2020) 'Association between shift work and poor sleep quality in an Asian multi-ethnic working population: A cross-sectional study', *PLoS ONE*, 15(3), e0229693. Doi: 10.1371/journal.pone.0229693.

Wellangiriya, D.G. and Abeysekera, N. (2021) 'The Impact of Occupational Stress on Operational Level Employees' Work-Life Balance in ABC Apparel Company, Sri Lanka', *SLIIT Business Review*, 1(1), pp. 67-82. doi: 10.54389/hwim6204.

White, R.D., Patel, B.N. and Swain, J. (2018) 'The impact of supervision on work-related stress in manufacturing', *Journal of Manufacturing Technology Management*, 29(4), pp. 621-639.

Wöhrmann, A., Müller, G. and Ewert, K. (2020) 'Shift Work and Work-Family Conflict: A Systematic Review', *sozialpolitik.ch*. Doi: 10.18753/2297-8224-165.

World Medical Association (2013) 'World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects', *JAMA*, 310(20), pp. 2191-2194.