

**IMPACT OF TECHNOLOGY TRANSFER RELATED FACTORS ON THE PERFORMANCE OF  
SMALL AND MEDIUM ENTERPRISES (SMES) IN SRI LANKA :  
A STUDY ON THE SRI LANKAN MANUFACTURING SECTOR**

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**Abstract**

This study investigates the critical factors influencing the effectiveness of technology transfer on the performance of Small and Medium Enterprises (SMEs) within Sri Lanka's manufacturing sector. Guided by a comprehensive theoretical framework, the research categorizes technology transfer into four key dimensions: Humanware (skills and knowledge), Orgaware (organizational structure and processes), Technoware (tools and equipment), and Inforware (information and documentation systems). The primary objective is to identify which of these elements most significantly contributes to enhancing SME performance, while also evaluating the moderating roles of government policies, competitive intensity, and firm size. A quantitative research approach was adopted, utilizing data collected from 145 SMEs operating across diverse manufacturing industries in Sri Lanka. The data was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the direct and moderating relationships between technology transfer components and SME performance, both operational and strategic. The findings reveal that all four components, Humanware, Orgaware, Technoware, and Inforware, positively and significantly influence SME performance, with Humanware and Technoware showing the strongest effects. Government policy support and competitive intensity were found to moderate these relationships, highlighting their role in facilitating or constraining the benefits of technology transfer. Firm size also emerged as a relevant contextual factor, affecting the degree to which technology transfer enhances performance outcomes. The study recommends that policymakers strengthen Humanware and Technoware capacities in SMEs through targeted initiatives such as training programs, technology grants, and infrastructure support. Enhancing the policy environment and competitive capabilities can further improve technology adoption, enabling SMEs to boost productivity, drive innovation, and achieve sustainable growth in a competitive, technology-driven market.

**Keywords:** Manufacturing Sector, Small and Medium Enterprises (SMEs), SME Performance, Technology Transfer.

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## Introduction

This study examines the impact of technology transfer on the performance of Sri Lanka's manufacturing SMEs. Technology transfer improves operational efficiency, product quality, and market reach but is often hindered by financial constraints, infrastructure gaps, and skill shortages. Despite their key role in economic growth, SMEs face major barriers to adopting new technologies.

By enabling the movement of skills, knowledge, and advanced technologies, technology transfer strengthens SME capabilities, drives innovation, and enhances competitiveness. Sectors like textiles and food processing, significant contributors to Sri Lanka's GDP, stand to benefit from effective adoption. The success of technology transfer depends on access to finance, skilled labor, infrastructure, and supportive policies. Persistent resource and operational challenges continue to limit SME modernization efforts.

This study investigates how technology transfer impacts SME performance and examines the contextual factors shaping this relationship. The findings aim to guide SMEs, policymakers, and industry leaders in fostering innovation, competitiveness, and broader economic development.

Technology transfer involves sharing skills, knowledge, technologies, and manufacturing methods among institutions like governments, universities, and businesses to make scientific advancements accessible and applicable. It enhances recipient performance and fosters new technological capacities. The process includes identifying suitable technologies, formalizing agreements, integrating them into operations, and providing training. For SMEs, technology transfer accelerates innovation, drives growth, and builds technical capabilities.

Several technologies significantly enhance SME efficiency and competitiveness. Cloud computing, Enterprise Resource Planning (ERP) systems, Artificial Intelligence (AI), Internet of Things (IoT), and collaboration tools enable SMEs to streamline operations, expand markets, and drive innovation (Nakandala & Turpin, n.d.; W N D, 2020). Technology transfer outcomes include improved productivity, access to new markets, and increased competitiveness. Mechanisms like licensing, joint ventures, academic partnerships, and government programs (Olayemi et al., 2022) further support economic growth (Weerasinghe et al., 2014a), crucial for modernization and global competitiveness.

SMEs account for about 75% of Sri Lanka's businesses, 45% of GDP, and 35% of employment (Yazeer & Sachithra, 2024). They operate across manufacturing, services, and agriculture, with key activities in textiles, food, tourism, IT, and agriculture. However, SMEs face barriers such as limited finance, high technology costs, regulatory burdens, and skills mismatches.

Financial constraints, skilled labor shortages (Kulathunga et al., 2020), weak IT infrastructure, and cultural resistance further hinder technology adoption. ICT offers significant opportunities for SMEs to automate, manage data, and expand via e-commerce, though adoption rates vary across sectors. Government initiatives like the National Digital Infrastructure Strategy (NDIS), ICTA programs, and Enterprise Sri Lanka aim to address these issues through training and financial aid (Wijenayake, 2021) to enhance SME competitiveness.

## Research Problem

Sri Lankan SMEs face challenges in adopting technology due to limited resources and weak regulatory frameworks. Gaps in understanding how Humanware-related Technology Transfer Factors (HTTF), Orgaware-related Technology Transfer Factors (OTTF), Technoware-related Technology Transfer Factors (TTTF), and Inforware-related Technology Transfer Factors (ITTF) influence performance, and how moderating factors like government policies, firm size, and competitive intensity affect outcomes, remain unaddressed. This study addresses these challenges, offering insights into sustainable SME growth (Mallinguh et al., 2020; Weerasinghe et al., 2014b).

Small and Medium Enterprises (SMEs) in Sri Lanka's manufacturing sector are key to economic growth but face major barriers to adopting new technologies due to financial constraints and limited human resources. Managerial challenges such as inadequate knowledge, weak infrastructure, and limited organizational capacity further hinder innovation and competitiveness. Policy-related issues, including restricted access to finance, weak regulations, and labor shortages, remain unresolved despite existing initiatives. This underscores the need to better understand external factors like firm size, competitive intensity, and government policy in shaping technology adoption. With rising competitive pressure, SMEs must embrace new technologies to stay viable. This study explores the impact of technology transfer on SME performance and examines how external conditions influence outcomes, offering strategies for sustainable growth and improved global competitiveness.

To address these issues, this study seeks to reach the following research objectives:

1. Identify the Key Factors Impacting the Effectiveness of Technology Transfer in Enhancing SME Performance in Sri Lanka. (This objective aims to identify and categorize which factors of technology transfer, such as the type of technology (orgaware, technoware, humanware, inforeware- related), the mode of transfer, and the existing support systems, critically influence the performance of SMEs.)
2. Evaluate the Influence of Government Policies on Technology Transfer to SMEs.
3. Determine the Impact of Competitive Intensity on the Effectiveness of Technology Transfer.
4. Investigate the Effects of Technology Transfer on the Operational and Strategic Performance of SMEs.

## Literature Review and Hypotheses Development

### *Factors Affecting Technology Transfer*

Various factors influence the successful adoption of technology by SMEs. These factors are commonly categorized under the Humanware, Orgaware, Technoware, and Inforeware model, which offers a comprehensive framework for understanding technology transfer processes. Humanware encompasses the skills, knowledge, and expertise of employees, which are essential for technology transfer. A lack of technical and managerial skills significantly hinders the effective adoption of new technologies (Kaluarachchi et al., 2019). Key factors include technical expertise (Kaluarachchi et al., 2019), technological literacy (Kulathunga et al., 2020), and training and development programs (Sunkpho & Trakulyingyong, n.d.), which address these gaps and prepare employees for managing new technologies. Moreover, knowledge transfer is critical for ensuring that employees can effectively apply technological advancements within their roles (Filatotchev et al., n.d.). Leadership and decision-making capabilities also play a crucial role in steering technology transfer initiatives, with entrepreneurial leaders demonstrating a greater inclination toward embracing innovation (Supervisor & Bjørke, n.d.).

Orgaware refers to the organizational structures, processes, and cultures that support technology adoption. Organizational readiness, including strategic alignment with business objectives (Kuruwitaarachchi et al., 2020) and a culture of innovation, facilitates smoother technology integration (Shukri et al., n.d.). Financial resources are vital for enabling technology investments, as firms require sufficient capital to adopt and maintain new technologies (W N D, 2020). Additionally, organizational culture that encourages innovation and change enhances the likelihood of successful technology transfer (Taylor, n.d.). Leadership within organizations also plays a central role in aligning technology initiatives with long-term strategic goals (Cabraal Wijesinghe, n.d.).

Technoware encompasses the technological infrastructure required for successful technology transfer. Research highlights the importance of technological compatibility (Kaluarachchi et al., 2019) and infrastructure (Yazeer & Sachithra, 2024) to facilitate the seamless integration of new systems. Security is another critical factor, as it ensures the protection of technological assets (Sunkpho & Trakulyingyong, n.d.). Additionally, maintenance and upgrade frequency (Kaluarachchi et al., 2019) is essential for sustaining the performance and relevance of adopted technologies. The perceived benefits of adopting new technologies, such as cost savings and operational efficiency, also influence decision-making (Fonseka et al., 2021), (Shukri et al., n.d.).

Inforeware involves the information systems that aid decision-making and improve operational efficiency. Data analytics capabilities enable SMEs to make informed strategic decisions (Sunkpho & Trakulyingyong, n.d.), while data security measures ensure the protection of sensitive information. Effective data management allows firms to efficiently organize and utilize information for better decision-making processes (Kuruwitaarachchi et al., 2020). Additionally, information-sharing practices promote collaboration and enhance organizational adaptability (Gamage et al., n.d.). These factors collectively enable SMEs to quickly adapt to market changes and strategically leverage technology transfer for improved performance.

### *Impact on SME Performance*

Technology transfer significantly enhances the performance of SMEs by improving critical business metrics. It drives revenue growth by enabling the adoption of innovative tools and practices that enhance productivity and operational capabilities (Shukri et al., n.d.). Moreover, it strengthens market share by providing SMEs with the competitive edge necessary to adapt to evolving market demands and expand their presence (Perera & Gunathunge, 2022). Additionally, technology transfer positively impacts customer satisfaction by improving service quality and responsiveness, ensuring that SMEs meet customer needs effectively (Das & Das, n.d.; Shafique et al., 2015). Furthermore, it boosts operational efficiency by streamlining processes and optimizing resource utilization, reducing costs, and enhancing overall productivity (Kaluarachchi et al., 2019). Collectively, these improvements position SMEs for sustained growth and competitiveness in both domestic and international markets.

**Additional Influencing Factors**

Beyond the core components, additional factors such as financial constraints, government policies, and organizational culture significantly affect technology transfer. Financial constraints often limit SME investments in technology, underscoring the need for accessible funding mechanisms (W N D, 2020). Government policies also play a pivotal role; supportive policies and incentives promote technology adoption, while weak regulatory frameworks can obstruct it (Akbar et al., 2022), (Olayemi et al., 2022). Furthermore, a culture of innovation and proactive leadership is critical for overcoming resistance to change and fostering successful technology transfer initiatives (Cabral Wijesinghe, n.d.) , (Njiraini et al., 2018).

**Key Moderating Factors in Technology Transfer**

The success of technology transfer in SMEs is significantly influenced by government policies, firm size, and competitive intensity. Government policies play a vital role in reducing barriers to innovation through supportive regulatory environments, subsidies, tax breaks, and infrastructure initiatives such as technology parks and training programs (W N D, 2020). These measures bridge gaps between research and industry, enabling smoother adoption of advanced technologies. However, weak legal frameworks can limit SMEs’ ability to compete in global markets (Olayemi et al., 2022), emphasizing the importance of strong government involvement in fostering public-private partnerships and creating innovation hubs.

Firm size also impacts the ability of SMEs to leverage technology transfer. Larger firms benefit from economies of scale, as higher turnover and larger workforces provide the financial and human resources needed for investments in infrastructure, training, and research and development (Ibrahim Gumel & Bin Bardai, 2023), (Jeganathan et al., 2021). On the other hand, smaller SMEs, despite resource constraints, demonstrate agility and adaptability when supported with targeted financial aid and technical assistance (Prasanna et al., 2019), allowing them to capitalize on technological and market changes.

Competitive intensity further shapes the effectiveness of technology transfer. While high competition and market saturation often push firms toward adopting innovative technologies (Huang, 2023), (Prasanna et al., 2021), excessive competition may hinder performance as firms struggle to keep pace with rapid advancements (David Brown & Earle, 2000). Factors like price competition, product differentiation, entrepreneurial orientation, and strong customer relationship management enable SMEs to stay competitive and foster growth in challenging markets (Fonseka et al., 2021), (Shafique et al., 2015).

The existing literature highlights a lack of quantitative studies on technology transfer in Sri Lankan SMEs, particularly across diverse industries. Critical factors such as firm size, government policies, and competitive intensity are often overlooked, leaving gaps in understanding their moderating effects on the technology transfer process. This study addresses these gaps by examining unexplored factors through a theoretical lens that has not been previously investigated, utilizing technology transfer components directly to provide deeper insights. Various factors influence the successful technology transfer in SMEs. These factors are commonly categorized under the Humanware, Orgaware, Technoware, and Inforware model, which offers a comprehensive framework for understanding technology transfer processes. (Indriartiningtias et al., 2020) Further research is essential to explore these dynamics comprehensively within the SME sector.

**Development of Hypotheses**

A set of hypotheses was formulated with reflective indicators, as shown in ”Table I”, to examine the relationships between key factors influencing technology transfer and their moderating effects.

**Table 01: Hypotheses for the Study**

H1	Humanware-related Technology Transfer Factors positively affect SME performance.
H2	Orgaware-related Technology Transfer Factors positively affect SME performance.
H3	Technoware-related Technology Transfer Factors positively affect SME performance.
H4	Inforware-related Technology Transfer Factors positively affect SME performance.

H5	Government policies condition the implications of (a) Humanware-related Technology Transfer Factors, (b) Orgaware-related Technology Transfer Factors, (c) Technoware-related Technology Transfer Factors, and (d) Inforeware-related Technology Transfer Factors on SME performance.
H6	Competitive intensity conditions the implications of (a) Humanware-related Technology Transfer Factors, (b) Orgaware-related Technology Transfer Factors, (c) Technoware-related Technology Transfer Factors, and (d) Inforeware-related Technology Transfer Factors on SME performance.
H7	Firm size conditions the implications of (a) Humanware-related Technology Transfer Factors, (b) Orgaware-related Technology Transfer Factors, (c) Technoware-related Technology Transfer Factors, and (d) Inforeware-related Technology Transfer Factors on SME performance.

**Research Methodology**

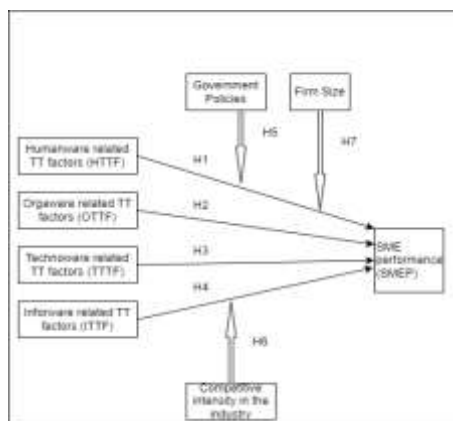
A comprehensive literature review was conducted to identify the potential factors influencing technology transfer in the manufacturing SME sector. The inclusion criteria outlined in “Table II”, were designed to ensure the relevance and quality of the selected sources for thorough analysis. The study primarily utilized 50 peer-reviewed journal articles and conference papers that met these criteria and were previously published, thereby ensuring the reliability of the literature reviewed.

**Table 02: Inclusion Criteria for the Study**

Characteristic	Inclusion Criteria
Type of Publication	Peer-reviewed Journal Articles, Conference Papers
Language	English
Time Period	From 2010 to 2024
Source	Google Scholar

**Conceptual Framework**

Addressing the identified knowledge gap in the literature review, a conceptual framework was developed, as illustrated in ”Fig. 1”, with a focus on the manufacturing SME sector in Sri Lanka. The framework highlights the most critical factors influencing technology transfer, analyzed through a theoretical lens specific to this sector. It comprises four independent variables and one dependent variable, along with three moderating variables that can either strengthen or weaken the positive relationship between the independent and dependent variables.



**Figure 01: Conceptual Framework**

**Operationalization of Constructs**

“Table III” presents the variable indicators and measurement model, detailing how each construct was operationalized and measured to ensure the reliability and validity of the study.

**Table 03: Variable Indicators and Measurement Model**

Variable	Indicators	References	Measurement Model
1.Humanware related, TT factors	Technical Expertise Technological Literacy Training and Development Knowledge Transfer	(Kaluarachchi et al., 2019) (Kulathunga et al., 2020) (Bandara et al., 2020) (Filatotchev et al., 2008)	Reflective
2. Orgaware related, TT factors	Financial Resources Strategic Alignment Organizational Readiness Organizational Culture	(Bandara et al., 2020) (Kuruwitaarachchi et al., 2020). (Suriyapperuma et al., 2015) (Bandara et al., 2020)	Reflective
3. Technoware-related, TT factors	Technological Compatibility Infrastructure Security Maintenance, and Upgrade Frequency	(Kaluarachchi et al., 2019) (Yazeer & Sachithra, 2024) (Kuruwitaarachchi et al., 2020). (Kaluarachchi et al., 2019)	Reflective
4. Inforware related TT factors	Data Analytics Capabilities Data Security Measures Data Management Information_Sharing Practices	(Sunkpho & Trakulyingyong, n.d.) (Onuorah et al., 2022) (Kulathunga et al., 2020) (Rajapakshe et al., 2020)	Reflective
5.SME Performance	Revenue Growth Market Share Customer Satisfaction Operational Efficiency	(Bandara et al., 2020) (Fonseka et al., 2021) (Weerasinghe et al., 2014) (Suriyapperuma et al., 2015)	Reflective
6. Government Policies	Regulatory Environment Incentives,for Technology Adoption Infrastructure Support Legal Framework	(Bandara et al., 2020) (Bandara et al., 2020) (Bandara et al., 2020) (Bandara et al., 2020)	Reflective
7.Firm Size	Number of Employees	(Bandara et al., 2020)	-
8.Competitive Intensity	Number of Competitors Market Saturation Price Competition Product Differentiation	(Yazeer & Sachithra, 2024) (Prasanna et al., 2021) (Fonseka et al., 2021) (Prasanna et al., 2021)	Reflective

**Research Design**

A review of literature reveals gaps in understanding technology transfer among Sri Lankan SMEs in the manufacturing sector, particularly a lack of quantitative studies across industries and regions beyond the Western Province. Limited exploration of moderating factors such as firm size, government policies, and competitive intensity further highlights the need for research. This study adopts a quantitative approach, utilizing convenience and snowball sampling techniques to gather diverse data. It identifies factors influencing technology transfer through a theoretical lens, incorporating unexplored dimensions of technology transfer components, and examines how moderating factors shape SME performance in Sri Lanka.

The sample size was determined based on Cohen’s (1992) guidelines for sample size determination (Hair et al., 2017). According to Cohen’s (1992) table, a minimum sample size of 137 data points was required to ensure sufficient statistical power for the analysis. The study aimed to achieve a statistical power of 80% to detect R<sup>2</sup> values of at least 0.1, with a 5% probability of error. This approach ensures robust and reliable insights into the factors influencing technology transfer in the manufacturing SME sector. A non-probability sampling technique was employed, specifically using convenience sampling and snowball sampling methods, to efficiently reach participants within the targeted SME population.

**Data Collection**

This study focuses on companies that have previously engaged in technology transfer initiatives. Data were collected from 145 participants across Sri Lanka. The data collection process involved distributing a structured questionnaire electronically in both English and Sinhala, as well as in person through printed surveys. The sampling period spanned one month, specifically October 2024, and included a pilot study to validate the questionnaire, ensuring its clarity and reliability.

**Data Analysis**

**Preliminary Data Analysis**

IBM SPSS was used to ensure the quality and reliability of the data. Pattern responses were removed to enhance accuracy, and boxplot analysis confirmed no influential outliers in the dataset. Normality tests using skewness and kurtosis revealed deviations from normality in some variables. However, since SMART PLS does not require normality, the dataset was deemed suitable for further analysis, making SMART PLS an appropriate tool for this study (Hair et al., 2019).

**Assessment of Reflective Measurement Model**

Before analyzing the structural model, the measurement model was assessed for reflective constructs to ensure the Internal Consistency and Reliability, Convergent Validity, and Discriminant Validity of the indicators. Composite Reliability and Cronbach’s Alpha values were tested to identify the Internal consistency reliability. Outer Loadings and Average Variance Extracted (AVE) values were examined to ensure the Convergent validity while Discriminant validity was evaluated using Cross Loadings, the Fornell-Larcker Criterion and Heterotrait-Monotrait Ratios (HTMT). As per the results of all the tests conducted, they demonstrated acceptable values, ensuring the validity and reliability of the indicators have been achieved (Hair et al., 2011).

**Assessment of Structural Model**

1) Hypotheses Testing of Base Model

The evaluation of the structural model follows the assessment of the reliability and validity of the measurement model. It examines the research questions based on the developed hypotheses. The results of the data analysis determine the acceptance or rejection of these hypotheses. In the testing of the base model, the analysis evaluated the relationship between Humanware-related Technology Transfer (TT) Factors, Orgaware-related TT factors, Technoware-related TT factors, and Inforware-related TT factors with the SME performance. As shown in the results below “Table IV”, the p-values are less than the threshold value of 0.05 while the t-values are higher than the threshold value of 1.96 for all the hypotheses (Hair et al., 2011).

**Table 04: Path Coefficients And Statistical Results:**

Hypothesis	Path	Path Coefficient	T values	P values	95% Confidence Interval
H1	HTTF → SMEP	0.496	6.121	0.00	[0.357, 0.668]
H2	OTTF → SMEP	0.344	3.716	0.00	[0.206, 0.552]
H3	TTTF → SMEP	0.490	6.591	0.00	[0.371, 0.651]
H4	ITTF → SMEP	0.530	11.041	0.00	[0.453, 0.642]

**Hypothesis Testing on Moderation Analysis**

The hypotheses related to moderating factors were tested through the following steps, as the data were analyzed in a categorical form. The analysis primarily evaluated two categories to assess path coefficients, p-values, and t-values. If both categories demonstrate statistical significance, a Multi-Group Analysis (MGA) was conducted to determine whether a significant difference existed between the two categories. If the MGA yielded a p-value less than 0.05, it indicated that the specific moderating variable had a significant moderating effect on the relationship under examination. Conversely, if only one of the two categories exhibited statistical significance, with a p-value less than 0.05, it could be concluded that the moderating effect is associated with that particular category. However, if both categories displayed p-values greater than 0.05, the Multi-Group Analysis would not be necessary, leading to the conclusion that no moderating effect was present.

**Results Discussion and Limitations**

Technology transfer plays a pivotal role in fostering the growth and competitiveness of small and medium enterprises (SMEs) in the manufacturing sector. This study validates the importance of four key dimensions, humanware, orgaware, technoware, and inforware, technology transfer factors in driving SME performance. By addressing critical aspects such as human capital development, organizational readiness, technological infrastructure, and data-driven strategies, these dimensions collectively contribute to operational efficiency, market expansion, and decision-making capabilities. The findings emphasize the need for targeted investments in

these areas to maximize the benefits of technology transfer and ensure sustainable SME development. The “Table V” provides a summary of the results of each hypothesis in this study.

**Table 05: Hypotheses and Acceptance Results**

Hypothesis	Description	Result
H1	Humanware-related Technology Transfer Factors positively affect SME performance.	Accepted
H2	Orgaware-related Technology Transfer Factors positively affect SME performance.	Accepted
H3	Technoware-related Technology Transfer Factors positively affect SME performance.	Accepted
H4	Inforware-related Technology Transfer Factors positively affect SME performance.	Accepted
H5	Government policies condition the implications of: (a) Humanware-related Technology Transfer Factors (b) Orgaware-related Technology Transfer Factors (c) Technoware-related Technology Transfer Factors (d) Inforware-related Technology Transfer Factors	Rejected Accepted Rejected Rejected
H6	Competitive intensity conditions the implications of: (a) Humanware-related Technology Transfer Factors (b) Orgaware-related Technology Transfer Factors (c) Technoware-related Technology Transfer Factors (d) Inforware-related Technology Transfer Factors	Rejected Accepted Rejected Accepted
H7	Firm size conditions the implications of: (a) Humanware-related Technology Transfer Factors (b) Orgaware-related Technology Transfer Factors (c) Technoware-related Technology Transfer Factors (d) Inforware-related Technology Transfer Factors	Rejected Accepted Rejected Rejected

The acceptance of Hypothesis H1 confirms the crucial role of Humanware-related Technology Transfer Factors in enhancing SME performance, with elements such as technical expertise, training, and knowledge transfer contributing to improvements in operational efficiency, revenue growth, and customer satisfaction. These findings highlight the need for continuous investment in human capital to support technology adoption and align with existing literature emphasizing the importance of skilled personnel and organizational learning. Hypothesis H2 supports the significance of organizational factors, such as readiness, strategic alignment, financial resources, and organizational culture, in enabling successful technology integration. A strong organizational framework

strengthens an SME's capacity to adopt technology, resulting in higher productivity, increased market share, and improved customer retention. The acceptance of Hypothesis H3 affirms that Technoware-related factors, including technological compatibility, infrastructure, and system maintenance, are essential for effectively leveraging advanced technologies, thereby boosting productivity and customer satisfaction. This aligns with prior research that stresses the necessity of adaptable and secure systems in fast-paced and evolving industries. Lastly, Hypothesis H4 highlights the importance of data-driven practices in the technology transfer process. Capabilities in data analytics, information sharing, and data security enhance decision-making and operational scalability, reinforcing the critical role of effective information management in fostering SME growth, innovation, and competitiveness.

The findings indicate that government policies, competitive intensity, and firm size play a moderating role in specific relationships between technology transfer factors and SME performance. The rejection of Hypotheses H5a, H5c, and H5d indicates that government policies do not significantly moderate the relationships between Humanware, Technoware, and Inforware-related Technology Transfer Factors and SME performance. This suggests that areas such as human resource development, technology adoption, and information management are more influenced by internal organizational efforts, like training, strategic planning, and data practices, than by external policy support. In contrast, the acceptance of Hypothesis H5b highlights that government policies do significantly moderate the relationship between Orgaware-related factors and SME performance. Supportive measures such as infrastructure development, financial assistance, and regulatory incentives enhance organizational readiness and strategic alignment, allowing SMEs to more effectively benefit from technology transfer initiatives.

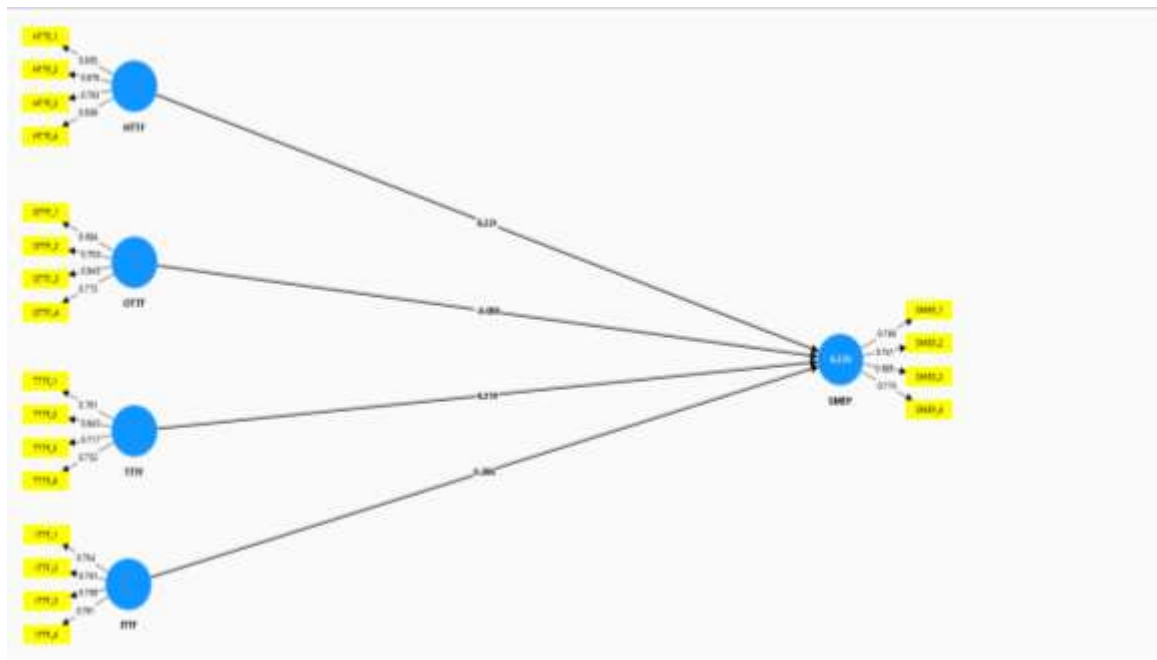
The rejection of Hypothesis H6a indicates that competitive intensity does not significantly moderate the relationship between Humanware-related Technology Transfer Factors and SME performance, suggesting that human resource capabilities remain effective regardless of market pressure. Similarly, the rejection of H6c shows that the impact of Technoware-related factors is largely independent of competitive intensity. In contrast, the acceptance of H6b highlights that competitive intensity significantly influences the relationship between Orgaware-related factors and SME performance, with SMEs that have strong organizational structures and strategies better able to adapt and sustain performance in competitive environments. Additionally, the acceptance of H6d confirms that competitive intensity significantly moderates the effect of Inforware-related factors, emphasizing the critical role of effective data management, analytics, and information-sharing in enabling SMEs to stay competitive in saturated and dynamic markets.

The rejection of Hypotheses H7a, H7c, and H7d indicates that firm size does not significantly moderate the relationships between Humanware-, Technoware-, and Inforware-related Technology Transfer Factors and SME performance. This suggests that human resource capabilities, technological infrastructure, and information management are equally important across SMEs of all sizes. In contrast, the acceptance of H7b reveals that firm size significantly moderates the impact of Orgaware-related factors. Larger SMEs, with greater financial and organizational resources, are better positioned to capitalize on these factors, leading to enhanced scalability and market expansion. These findings highlight that while some technology transfer components are universally impactful, others, like organizational capabilities, may yield greater benefits in larger firms.

Overall, the findings validate the direct impact of Humanware, Orgaware, Technoware, and Inforware-related Technology Transfer Factors on SME performance. However, the moderation effects of government policies, competitive intensity, and firm size vary significantly, underscoring the importance of tailoring strategies to specific organizational and contextual dynamics. These insights provide a robust foundation for improving technology transfer practices and enhancing SME performance in Sri Lanka's manufacturing sector.

This study, while comprehensive, has several limitations. It focuses on the manufacturing industry, with respondents primarily from the food and beverage and textile sectors, limiting the findings' generalizability to other industries. Geographical representation was also concentrated in the Western and Southern provinces, restricting relevance to SMEs in other regions. Although some evidence of a moderating effect of geographical location was observed, resource constraints hindered further analysis. Additionally, reliance on self-reported measures introduces potential response bias. Future studies should adopt mixed methods for more robust analysis. Despite these constraints, the study offers valuable insights into sustainable strategies to enhance technology transfer in Sri Lanka's SME sector.

“Fig:2” illustrates the base model of the study, outlining the key dimensions of technology transfer Humanware, Technoware, Orgaware, and Inforware and their hypothesized relationships with SME performance.



**Figure 02: Base Model of the Study**

**Conclusion and Recommendations**

This study offers valuable insights into how technology transfer factors affect SME performance in Sri Lanka’s manufacturing sector. By examining the direct effects of Humanware, Orgaware, Technoware, and Inforware technology transfer factors, along with the moderating roles of government policies, competitive intensity, and firm size, it meets its objectives and enhances understanding of technology transfer’s impact in the local context. The first objective of the study, identifying key factors impacting the effectiveness of technology transfer, was achieved by analyzing the four components, Humanware, Orgaware, Technoware, and Inforware, which were found to significantly enhance SME performance by improving operational efficiency, revenue growth, and customer satisfaction. The second objective, evaluating the influence of government policies, revealed that policies significantly moderated the relationship between Orgaware-related factors and SME performance, emphasizing the importance of policy support for organizational readiness and alignment. The third objective, assessing the impact of competitive intensity, showed that it significantly moderated the relationship between Orgaware and Inforware-related factors and SME performance, highlighting the need for strong organizational structures and data management in competitive environments. Finally, the fourth objective, investigating technology transfer’s effects on SME operational and strategic performance, demonstrated that effective technology transfer drives improvements in market share, operational efficiency, and customer satisfaction, reinforcing its critical role in supporting SME growth.

In conclusion, the study successfully met its objectives, offering practical and theoretical insights into technology transfer and its role in enhancing SME performance in Sri Lanka. These findings provide a foundation for policymakers and SME managers to develop targeted strategies that leverage technology transfer for sustainable growth.

This study recommends targeted incentives to support SME technology transfer, emphasizing collaboration among SMEs, industry associations, and technology providers to reduce costs and ensure seamless integration. Partnerships with educational institutions can build a skilled workforce, while adopting flexible strategies and leveraging data analytics can enhance decision-making and competitiveness, driving sustainable growth in the SME sector. Future research should expand beyond the manufacturing sector and include diverse geographical areas while considering external factors like global economic conditions. Mixed-method approaches and addressing data biases can enhance reliability, providing deeper insights and practical strategies to improve SME performance through effective technology adoption.

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