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Effect of Local Manufacturing Capacity on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM), Nnewi

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Abstract **Original Research Article**

The Nigerian automotive industry operates in a context of high import dependence, exchange rate volatility, and logistics bottlenecks, all of which undermine supply chain performance. This study examines the effect of Local Manufacturing Capacity (LMC) on the Supply Chain Performance (SCP) of Innoson Vehicle Manufacturing (IVM), Nnewi. LMC is operationalized through four proxies: Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, and Skilled Workforce Availability; while SCP is measured by Delivery Efficiency (Supply Reliability), Cost Efficiency, and Availability of Critical Components and Materials. A survey research design was employed, using a census sampling technique to collect data from all 150 accessible employees via a structured five-point Likert-scale questionnaire. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 3. Findings revealed that technology utilization and innovation significantly enhances supply chain performance (β = 0.397, $p = 0.046$), while production capability (β = -0.179, $p = 0.341$), local sourcing of inputs (β = 0.178, $p = 0.519$), and skilled workforce availability (β = 0.585, $p = 0.067$) show non-significant effects. The model explained 92.9% of variance in supply chain performance ($R^2 = 0.929$). The study recommends that IVM prioritize digital technology adoption, enhance production flexibility, strengthen local supplier development, and expand workforce training to optimize supply chain resilience and efficiency in Nigeria's automotive sector.

Keywords: Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, Skilled Workforce Availability, Supply Chain Performance.

Introduction

The global automotive landscape is a complex tapestry woven with threads of globalization, technological disruption, and growing calls for supply chain resilience. Historically, automotive manufacturers, especially those in top industrialized nations, have pursued a globally fragmented supply base to leverage economies of scale and cost efficiency, which is a key measure of Supply Chain Performance (SCP) (Delic & Eyers, 2020). However, the recent confluence of geopolitical shifts, trade wars, and, critically, the COVID-19 pandemic (Huang et al., 2023; Chen et al., 2025) exposed the systemic fragility inherent in these long, lean supply chains. Suddenly, risks such as supply disruption (e.g., supplier bankruptcy, component shortages) and time risks (e.g., procurement delays) severely impacted SCP, leading to delayed deliveries and increased costs (Huang et al., 2023). This realization has spurred a global paradigm shift, compelling firms to reassess their sourcing strategies and prioritize Local Manufacturing Capacity (LMC) as a strategic lever to enhance SCP.

In top economies, the push for enhanced Supply Chain Performance (SCP) is intrinsically linked to sophisticated manufacturing capabilities. SCP, defined by Ayantoyinbo (2018) as the cost-effective execution and control of product flow from raw materials to the final customer, is now viewed not merely as an output, but as a sustainable trajectory requiring ongoing adaptation (Wetsandornphong et al., 2025). The developed world has championed Local Manufacturing Capacity (LMC), which Dakić et al. (2024) define as the ability to produce vehicle components domestically, reducing import reliance. For instance, the US and China have heavily invested in domestic production and technology, recognizing that Production Capability and Technology Utilization and Innovation are critical drivers. In China, the "Made in China 2025" strategy, which focuses on localizing mineral and battery production, is a clear effort to bolster LMC to minimize logistical delays and enhance Cost Efficiency (Dakić et al., 2024). Similarly, in Europe, firms like BMW utilized advanced technologies, such as additive manufacturing, to reduce costs by 58% and time by 92% (Delic & Eyers, 2020), demonstrating how LMC proxies directly influence SCP metrics. These top countries recognize that Local Sourcing of Inputs significantly reduces geopolitical and logistics risks, enhancing the Availability of Critical Components (Schwarz, 2025). Furthermore, continuous investment in Skilled Workforce Availability underpins this success, as high-skilled labor drives R&D and quality control, crucial for delivery reliability (Sakuramoto et al., 2019).

The challenges of supply chain disruption are amplified in developing economies, particularly across Africa, where dependence on imported components is high (Ahmadi, 2025). The automotive sector in many African nations often relies on Complete Knock Down (CKD) assembly, which, while creating some jobs, leaves the supply chain profoundly vulnerable to global fluctuations and currency volatility, as noted in Iran's automotive sector (Ahmadi, 2025). Research in this region, such as in Nairobi (Korir et al., 2017) and Morocco (Raissouni & Hamiche, 2017), highlights the significant gap in Local Sourcing of Inputs and the consequential effect on SCP. For instance, Muraguri (2018) found that IT integration positively influenced SCP in Kenyan motor vehicle firms, suggesting technology adoption is a vital component of LMC. The issue of Skilled Workforce Availability also emerges as a key constraint. Sakuramoto et al. (2019) contrasted the high-skilled labor force in South Korea with the low-skilled labor in Brazil, showing how human capital availability is a crucial determinant of local competence, component reliability, and efficient delivery. The African narrative, therefore, is one where LMC is not just an efficiency choice but a strategic necessity for economic independence and supply chain security.

In Nigeria, Innoson Vehicle Manufacturing (IVM) represents a pioneering attempt to establish a truly local manufacturing capacity within the West African sub-region. IVM's commitment to indigenous production, as noted by Madichie and Nkamnebe (2025), is rooted in leveraging available resources and the traditional apprenticeship system to develop a Skilled Workforce Availability (Arukwe, 2023). The company's emphasis on local content is not merely a patriotic gesture; it is a strategic business decision to create a local supply chain and minimize reliance on international logistics, which are prone to delays from port congestion and foreign exchange instability (Ayantoyinbo, 2018; Arukwe, 2023). By focusing on LMC, IVM directly attempts to mitigate the time and financial risks associated with the traditional import-dependent model, thereby aiming for better Delivery Efficiency, Cost Efficiency, and Availability of Critical Components. This local context is a living laboratory where the effect of LMC on SCP can be directly studied. This study on the effect of local manufacturing capacity on the supply chain performance of Innoson Vehicle Manufacturing (IVM), Nnewi, is structured around the dynamic relationship between a central independent variable and its key outcome. The core focus is on Local Manufacturing Capacity (LMC), defined as the ability to produce critical components domestically, which serves to reduce import reliance and build essential supply chain resilience (Ahmadi, 2025). The inherent significance of LMC lies in its strategic potential to establish supply chain autonomy, shorten crucial lead times, and shield an indigenous firm like IVM from the volatility of international geopolitical and financial risks (Dakić et al., 2024).

To thoroughly examine this capacity, LMC is broken down into four distinct and measurable proxies, beginning with Production Capability. This first proxy is understood as the firm's inherent ability to efficiently transform inputs into outputs using standardized processes and technology (Mutuku & Senelwa, 2018), consistently meeting specification limits (Dobránsky et al., 2019). Its significance is foundational, directly enabling high Delivery Efficiency through accurate scheduling and lead-time management (Turovski, 2023), while ensuring product quality and overall operational performance (Li et al., 2022). The second proxy, Technology Utilization and Innovation, represents the adoption of advanced digital tools, such as AI, robotics, and digitalization, to enhance both production processes and products (Braidy et al., 2025), alongside the use of ICT platforms to streamline collaborative R&D (Stawiarska, 2020). This is a pivotal strategic force because it improves both Cost Efficiency and the Availability of Critical Components by providing real-time data for optimized logistics and inventory management (Rupnawar et al., 2024). Ultimately, digital innovation strengthens the company's supply chain position by enhancing managerial efficiency (Wang et al., 2024). Thirdly, the study examines Local Sourcing of Inputs, which is the strategic commitment to contracting suppliers domestically to shorten supply chains (Rion, 2023). This approach prioritizes proximity over global reach to reduce logistical complexity (Schwarz, 2025). The significance here is profound: it dramatically enhances the Availability of Critical Components and Delivery Efficiency by mitigating external risks like geopolitical shocks and port delays, cutting transportation costs, and facilitating closer supplier collaboration (Li et al., 2022; Raissouni & Hamiche, 2017).

Furthermore, this practice aligns with corporate sustainability goals by minimizing carbon emissions (Sengupta, 2024). The final proxy is Skilled Workforce Availability, which refers to the presence of trained, experienced, and competent personnel the human capital required to execute complex supply chain and manufacturing tasks effectively (Santa et al., 2022). This factor is critical because a skilled workforce mitigates operational risks and directly supports rigorous Quality Control, thereby boosting Delivery Efficiency and ensuring Cost Efficiency in the manufacturing process (Vinod et al., 2024). Skilled personnel are essential for successfully implementing strategic initiatives and adopting new technologies (Santa et al., 2022). Collectively, these four proxies are hypothesised to affect the Dependent Variable (DV): Supply Chain Performance (SCP), which is measured by three key outcomes: Delivery Efficiency (Supply Reliability), concerning the consistency and punctuality of deliveries; Cost Efficiency, focusing on minimizing costs across all supply chain activities; and the Availability of Critical Components and Materials, which reflects the continuous, timely provision of necessary production inputs without shortages.

Statement of the Problem

The Nigerian automotive manufacturing sector, exemplified by Innoson Vehicle Manufacturing (IVM), currently operates in an environment characterized by high import dependency for critical components, volatile foreign exchange rates, and severe port and infrastructural logistics challenges. These external factors introduce significant supply risks, time risks (procurement delays), and financial risks (cost overruns) which fundamentally threaten the firm's Supply Chain Performance (SCP), especially its Delivery Efficiency (Supply Reliability), Cost Efficiency, and the Availability of Critical Components and Materials (Huang et al., 2023; Ayantoyinbo, 2018).

Despite IVM's widely publicized mandate and strategic investments in Local Manufacturing Capacity (LMC) including developing production facilities, acquiring technology, and training local staff (Arukwe, 2023) there is a dearth of empirical evidence to systematically determine the extent to which these specific LMC proxies (Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, and Skilled Workforce Availability) actually translate into measurable improvements in the firm's SCP. Without this empirical validation, IVM and policymakers lack the strategic data necessary to allocate resources effectively, target specific areas for investment (e.g., in-house production vs. supplier development), and justify the national imperative of localization. The core problem, therefore, is the lack of clear, quantified evidence that IVM's focus on Local Manufacturing Capacity effectively mitigates the inherent supply chain risks and tangibly improves its Supply Chain Performance. This research is essential because it seeks to quantify and explain the effect of LMC on SCP within this unique Nigerian context, providing a critical empirical foundation for IVM's strategic decision-making and contributing a model for industrial development and supply chain resilience across the African continent. The main objective of this study is to investigate the effect of Local Manufacturing Capacity on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM), Nnewi. The specific objectives are:

1. To investigate the effect of production capability on the supply chain performance of IVM, Nnewi.
2. To assess the effect of technology utilization and innovation on the supply chain performance of IVM, Nnewi.
3. To evaluate the effect of local sourcing of inputs on the supply chain performance of IVM, Nnewi.
4. To determine the effect of skilled workforce availability on the supply chain performance of IVM, Nnewi.

The following null hypotheses are formulated to be tested at a 5% significance level:

H_{01}: Production Capability has no significant effect on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM).

H_{02}: Technology Utilization and Innovation has no significant effect on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM).

H_{03}: Local Sourcing of Inputs has no significant effect on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM).

H_{04}: Skilled Workforce Availability has no significant effect on the Supply Chain Performance of Innoson Vehicle Manufacturing (IVM).

Conceptual Explanations of Variables Dependent Variable: Supply Chain Performance

Supply Chain Performance (SCP) measures the overall effectiveness and efficiency of upstream-downstream coordination in planning, controlling, and executing the flow of products from raw materials to the final customer in a cost-effective manner (Ayantoyinbo, 2018; Huang et al., 2023). SCP evaluates efficiency and effectiveness using metrics like costs, customer response, reliability, and lead time (Lumwaji et al., 2023), and is defined as a trajectory achieved through ongoing adaptation and focused integration to balance efficiency and innovation (Wetsandornphong et al., 2025). In this study, Supply Chain Performance is measured by Delivery Efficiency (Supply Reliability), Cost Efficiency, and Availability of Critical Components and Materials.

Delivery Efficiency (Supply Reliability) is a time-based and reliability performance measure that quantifies the timeliness and consistency of component and finished product delivery (Ayantoyinbo, 2018; Delic & Eyers, 2020), encompassing order fulfillment where delays reduce SCP and erode firm reputation (Ayantoyinbo, 2018). It suffers from time risks like procurement delays in auto parts, causing cost overruns and partner dissatisfaction (Huang et al., 2023). Cost Efficiency evaluates the extent to which a firm's operational activities minimize the total supply chain, production, and procurement expenses (Delic & Eyers, 2020). This dimension links to financial risks, as inflation or operational risks from design changes can raise input prices and production costs, reducing overall efficiency (Huang et al., 2023), though supply chain capabilities directly enhance firm performance by lowering operational expenses through efficient resource sharing and Just-in-Time practices (Akour et al., 2022).

Availability of Critical Components and Materials assesses the steady flow and ease of access to essential parts required to maintain uninterrupted production, directly addressing supply risks where supplier failures or external disruptions propagate downstream failures, hindering production (Huang et al., 2023; Lumwaji et al., 2023). For a motor vehicle assembler, this involves integrating over 30,000 parts seamlessly to avoid shortages and delays (Lumwaji et al., 2023).

Independent Variable: Local Manufacturing Capacity

Local Manufacturing Capacity refers to the overall ability of a production system to generate output using resources, technology, and inputs within a specific geographic region (Mariel & Minner, 2015). For a firm like Innoson, this specifically refers to the ability to produce critical components domestically, which reduces reliance on imports and enhances supply chain resilience (Ahmadi, 2025). This capacity is a multidimensional construct encompassing the firm's production systems, human resources, and the adoption of advanced technology for domestic production (Liza et al., 2025). It is proxied by four dimensions:

Production Capability refers to the firm's inherent ability to efficiently transform inputs into outputs using standardized processes, technology, and coordination, consistently meeting specification limits (Dobránsky et al., 2019; Mutuku & Senelwa, 2018). It is the predicted ability of a firm to meet output targets amid uncertainties (Janmanee & Butdee, 2023). For IVM, this is its ability to efficiently manufacture products locally using its resources, processes (like assembly integration), and technologies, which directly influences Delivery Efficiency and Cost Efficiency through efficient scheduling and inventory control (Adebanjo et al., 2018; Vinod et al., 2024). Production Capability is fundamental for determining the quantity of goods to be manufactured to satisfy customer demand (Mose & Magutu, 2025).

Technology Utilization and Innovation involves the adoption of advanced tools like Artificial Intelligence (AI), robotics, and digitalization to enhance processes and products (Braidy et al., 2025). This includes using Information and Communications Technology (ICT) tools to streamline collaborative processes, enabling real-time data for better cost efficiency and component availability (Stawiarska, 2020; Vinod et al., 2024). Digital technology innovation, such as automation and robotics, enhances production line flexibility, shortens time to market, and reduces communication costs (Wang et al., 2024). For the supply chain, high technology utilization improves resilience and cuts lead times by fostering supplier-manufacturer alignment, as ITenabled coordination streamlines operations (Boubker, 2022; Huang et al., 2023).

Local Sourcing of Inputs is a strategy where a company procures goods from suppliers located within the same country or region, prioritizing proximity over global reach (Raissouni & Hamiche, 2017; Schwarz, 2025). This practice, exemplified by Innoson's emphasis on sourcing most of its raw materials locally (Arukwe, 2023), serves as a strategic tool to optimize logistics and purchasing costs by reducing transportationrelated expenses, lead times, and external geopolitical risks (Huang et al., 2023; Raissouni & Hamiche, 2017). Local sourcing enhances Availability of Critical Components and Delivery Efficiency by building supply chain resilience, avoiding port delays, and fostering close supplier collaboration (Rion, 2023; Sengupta, 2024).

Skilled Workforce Availability refers to the presence of trained, experienced, and competent technical, engineering, and managerial personnel capable of effectively executing supply chain and manufacturing tasks (Santa et al., 2022). It is a key element of human capital, which positively predicts agility, quality, and cost-effectiveness strategies (Santa et al., 2022). The availability of this expertise is crucial for achieving high Delivery Efficiency and Cost Efficiency through improved quality control, efficient operations, and reduced errors and cost overruns (Karimi et al., 2018; Vinod et al., 2024). Conversely, a shortage of skilled labor poses a significant risk to project outcomes and financial performance (Karimi et al., 2018).

Empirical Review Production Capability and Supply Chain Performance

Mose and Magutu (2025) examined the effect of capacity planning on supply chain performance of manufacturing firms. The study's objective was to find the effect of capacity planning (measured by demand forecasting, capacity expansion, equipment selection, real-time information, proper staffing, and proper scheduling) on supply chain performance (measured by indices like total average inventory, reduction in unit costs, and on-time delivery). Adopting a cross-sectional survey design with a positivism philosophy, the study was conducted among 518 manufacturing firms in Kenya, utilizing a sample of 457 well-filled questionnaires returned by Procurement/Supply chain directors or managers. Data analysis employed simple linear and multiple regression. The results revealed that the effect of capacity planning on supply chain performance was statistically significant at both variable and indicator levels. Specifically, demand forecasting, capacity expansion, and equipment selection were key determinants. The research implied that these indicators are fundamental for firms in determining the quantity of goods to manufacture to satisfy customer demand. A strength of the study was its use of a high response rate (88.2%) and the contextualization of its findings within the Resource-Based View (RBV) theory. A critique is the recommendation that future studies use other popular, possibly quantitative, measures for capacity planning and supply chain performance.

Dobránsky et al. (2019) assessed production process capability in the serial production of components for the automotive industry. The study evaluated process capability indices (Cp and Cpk) as proxies for production capability and process centering, using injection-molded polyamide 66 components with glass fiber reinforcement. Measurements were taken on three dimensional characteristics (Ø 39.85±0.15 mm, Ø 35.50±0.15 mm, Ø 30.00±0.10 mm) across eight mold cavities. The population comprised serially produced plastic parts for automotive suspension shock absorbers, with a sample size of 240 measurements (30 per cavity per dimension). Data were collected using a 0–200 mm caliper, and analysis involved capability indices, histograms, and Shewhart control charts. Findings revealed Cp values ranging from 2.990 to 22.827 and Cpk from 1.969 to 7.533, all exceeding 1.33, indicating excellent process capability and stability. The study recommended sustained statistical process control to maintain quality. Its strength lay in cavity-specific analysis, enhancing precision in multi-cavity molding evaluation. However, reliance on length measurements alone limited broader quality assessment.

Technology Utilization & Innovation and Supply Chain Performance

Boubker (2022) explored the effects of information technologies on automotive supply chain and firm performance: a plssem approach. The study examined how information technology integration (ITI) and supply chain information management (SCIM) influenced supply chain integration (SCI), supply chain performance (SCP), and firm performance in Morocco's automotive sector. Data were collected via questionnaires from 177 middle and top-level managers in automotive firms, analyzed using partial least squares structural equation modeling (PLS-SEM). Findings revealed that ITI and SCIM positively and significantly enhanced SCI, which in turn improved SCP and firm performance, while SCP directly boosted firm performance. Recommendations urged automotive supply chain managers to prioritize IT integration for competitiveness. The strength lay in its robust PLS-SEM application to a specific emerging market context. However, the critique notes its cross-sectional design limited causality inferences and focused solely on Morocco, reducing generalizability to other African contexts like Nigeria's local manufacturing.

Wang et al. (2024) explored the impact of digital technology innovation on the supply chain position micro evidence from the chinese new energy vehicle companies. The study examined how digital technological innovation heterogeneity affected companies' supply chain position and the pathways through which this effect played out. The researchers used a two way fixed effects model and causal stepwise regression analysis on global supply chain panel data from Chinese new energy vehicle companies. The sample was composed of 255 company year observations for 1051 companies from 2012 to 2022. The dependent variable was supply chain position (eigenvector centrality), the independent variable was digital technology innovation (number of digital technology patents), and the mediating variables were managerial efficiency and profitability. Findings showed that all three types of digital technology innovations (in design/development, production/manufacturing, and sales/after sales processes) significantly enhanced a company's supply chain position. Furthermore, the analysis determined that digital technology innovations improved supply chain position mainly by enhancing managerial efficiency and profitability. The study provided a reference for policymakers to promote the application of digital technology. A strength was the novel classification of digital technology innovation based on production processes. A critique is the focus on only Chinese New Energy Vehicle companies limits generalizability to other industries or regions.

Local Sourcing of Inputs and Supply Chain Performance

Raissouni and Hamiche (2017) explored the rate of local integration in the supply chain of the renault maroc company. The study's main question was whether the increase in the rate of local integration always reduced purchasing costs for multinationals. The researchers piloted a local integration project for Renault Maroc, using a case study methodology, focusing on the Body & Electrical perimeter parts, specifically radiator pipes. Data collection involved retrieving information from different departments on transport encryptions and current turnover analysis for comparison. Findings indicated that local integration did not always optimize purchasing costs for multinationals, particularly in non-industrialized countries, due to the lack of competitiveness of local suppliers and high investment costs needed for necessary technology and experience. The study recommended that subsidies from the Moroccan State, as outlined in the ecosystem convention, were necessary to encourage local suppliers to make necessary investments. A strength was the detailed, real-world application of the local sourcing procedure within a major multinational automotive company. A critique is that the focus on one project in a single country, Morocco, limits the generalizability of the findings regarding local sourcing in all developing countries.

Yadav et al. (2018) analyzed local sourcing and supplier development in global health analysis of the supply chain management system's local procurement in 4 countries. The study aimed to understand how local sourcing impacted supplier development and long-term market health. The proxies measured included revenue growth, asset growth, new contracts and access to capital, new products/services, and employee generation. The researchers developed a simple 3-part framework of potential impact and conducted a survey and interviews with a sample of 39 local suppliers from Ethiopia, Kenya, Mozambique, and Tanzania. The data collected did not use a control group but relied on before-and-after comparisons regarding the SCMS contract. Findings showed that local suppliers reported significant increases in new contracts (77%), new assets acquired (67%), and new employees hired (84.6%). The study offered preliminary guidance on how agencies could design effective local sourcing programs to create sustainable local markets. A strength was the focus on firm-specific managerial impacts and strategic implications. A critique is the lack of a control group limited the ability to definitively attribute growth solely to the SCMS contracts.

Skilled Workforce Availability and Supply Chain Performance

Santa et al. (2022) investigated the impact of human capital and supply chain competitive drivers on firm performance in a developing country. The study examined human capital (proxied by skilled workforce, training, and expertise), agility, quality, cost, and outsourcing strategies as predictors of business performance. Using structural equation modeling, the researchers surveyed 404 firms (167 SMEs, 237 large organizations) in Colombia's Valle del Cauca region via online questionnaires with Likert-scale items. Findings revealed human capital positively predicted agility, quality, and cost strategies across firm sizes, though outsourcing mediated agility only in SMEs and cost/quality in large organizations; human capital indirectly influenced performance via these drivers. The study recommended enhancing skilled workforce development and regional logistics partnerships. Its strength lay in comparative SMElarge organization analysis using robust SEM in an understudied emerging context. However, reliance on perceptual data limited objectivity, and regional specificity reduced generalizability.

Ambrogio et al. (2022) explored workforce and supply chain disruption as a digital and Magnanini et al. (2021) explored effect of workforce availability on manufacturing systems operations of job shops. The study assessed the impact of workforce availability (proxies: skills homogeneity/heterogeneity, unavailability, planning, workload; operation modes: manual, semimanual, semiautomatic, automatic) and production performance (KPIs: throughput, throughput variance, total number of performed operations) using a parametric discrete event simulation-based digital twin fed by real-time data. The population involved a job-shop system in the aeronautics sector producing hollow shafts; no specific sample size was detailed as simulation scenarios tested four cases varying skills and modes. Data collection integrated real production data via a structured data model encompassing operators, machines, parts, and buffers; analysis employed Siemens Tecnomatix Plant Simulation for KPI evaluation. Findings revealed homogeneous skills yielded higher throughput and operations performed but increased variance due to flexible task alternation, while heterogeneous skills reduced interference but lowered throughput unless optimized with production planning; semiautomatic modes amplified workforce effects on delays. Recommendations included joint optimization of planning and operator assignment using digital twins for medium-term service levels. The strength lay in its real-time data integration enabling precise stochastic modeling of human-machine interactions. However, the study overlooked fatigue-induced quality errors and long-term skill development, limiting generalizability beyond high-value aerospace job shops

Theoretical Framework

The Resource-Based View (RBV), propounded by Wernerfelt (1984), underpins this study on the effect of local manufacturing capacity on the supply chain performance of Innoson Vehicle Manufacturing (IVM), Nnewi. The theory posited that sustained competitive advantage stems from valuable, rare, inimitable, and non-substitutable (VRIN) resources configured into capabilities that enhance performance outcomes. RBV explained local manufacturing capacity as a bundle of internal resources, production capability enabling efficient output transformation (Mose & Magutu, 2025), technology utilization and innovation fostering process advancements (Chen et al., 2025), local sourcing of inputs reducing external dependencies (Dakić et al., 2024), and skilled workforce availability leveraging human capital for operational agility (Santa et al., 2022) that directly bolster supply chain performance metrics like delivery efficiency, cost efficiency, and component availability at Innoson Vehicle Manufacturing (IVM). For instance, IVM's localized assembly and sourcing mitigate import risks, aligning with RBV's emphasis on resource orchestration for resilience (Korir et al., 2017).

Strengths include its focus on firm-specific heterogeneity, empirically supported in automotive contexts where operational capabilities mediate performance (Huang et al., 2023). Weaknesses involve static assumptions overlooking dynamic environments, as critiqued by dynamic capabilities scholars (Teece et al., 1997), who argue RBV underestimates adaptation in volatile markets like Nigeria's. Alternative views, such as institutional theory, highlight external pressures like policy incentives driving localization (Adebanjo et al., 2018), while supply chain integration perspectives prioritize relational resources over internal ones (Wetsandornphong et al., 2025). This theory underpins the study and best explains it by framing IVM's local capacity as VRIN resources yielding superior supply chain outcomes, empirically linking proxies to performance amid import vulnerabilities, outperforming relational theories in emphasizing endogenous strengths.

Methodology

This study adopted a survey research design to examine the effect of local manufacturing capacity on the supply chain performance of Innoson Vehicle Manufacturing (IVM), Nnewi. Using a survey research design was significant for this study because it enabled the direct collection of practical insights from employees who are actively involved in IVM's production and supply chain processes. This approach allowed the researcher to capture real-time organizational realities, quantify perceptions across different departments, and objectively evaluate how local manufacturing capacity influences supply chain performance. Additionally, the design ensured uniform data collection, making it possible to compare responses reliably and analyze complex relationships among variables within a single operational context.

The population of this study consisted of 150 employees purposively selected from various departments in IVM. These included 12 senior managers, 20 middle managers, and 118 operational workers essential to manufacturing, logistics and procurement, engineering, and quality control functions. Given the relatively small and manageable population size, the researcher used all 150 accessible and consenting employees for analysis. This ensured that respondents possessed the experience and operational knowledge required to provide credible insights into the company's manufacturing capacity and supply chain performance.

Data were collected using a structured questionnaire designed on a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1). The instrument captured five constructs sequenced according to the study framework: Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, Skilled Workforce Availability, and Supply Chain Performance. Items for Production Capability were adapted from Mose and Magutu (2025) and Dobránsky et al. (2019); those for Technology Utilization and Innovation from Boubker (2022) and Chen et al. (2025). Local Sourcing of Inputs items were adopted from Raissouni and Hamiche (2017) and Masoumi et al. (2019), while Skilled Workforce Availability items were based on Santa et al. (2022) and Magnanini et al. (2021). Supply Chain Performance, measured through Delivery Efficiency (Supply Reliability), Cost Efficiency, and Availability of Critical Components and Materials was adapted from Ayantoyinbo (2018), Huang et al. (2023), and Lumwaji et al. (2023).

The reliability of the constructs was confirmed using Cronbach's Alpha, with all values exceeding the recommended 0.70 benchmark by Hair et al. (2014), indicating strong internal consistency. Specifically, the results showed high reliability across constructs: Production Capability (0.967), Technology Utilization and Innovation (0.979), Local Sourcing of Inputs (0.967), Skilled Workforce Availability (0.973), and Supply Chain Performance (0.957). These values demonstrate that the items consistently measured their intended constructs.

Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3 was employed for data analysis. PLS-SEM was selected due to its robustness in analyzing complex models with multiple latent variables and its ability to perform reliably with moderate sample sizes. Preliminary diagnostics including checks for missing data, outliers, normality, and multicollinearity were performed prior to hypothesis testing. The analysis involved the evaluation of the measurement model (reliability and validity) and the structural model (relationships among constructs).

Data Presentation, Analysis and Results

Out of the 150 distributed copies of questionnaires, 96 were returned and fully completed, resulting in a 64.0% response rate. This provided adequate representation of managerial and operational perspectives within IVM. Ethical considerations including voluntary participation, confidentiality, and informed consent were strictly upheld throughout the study.

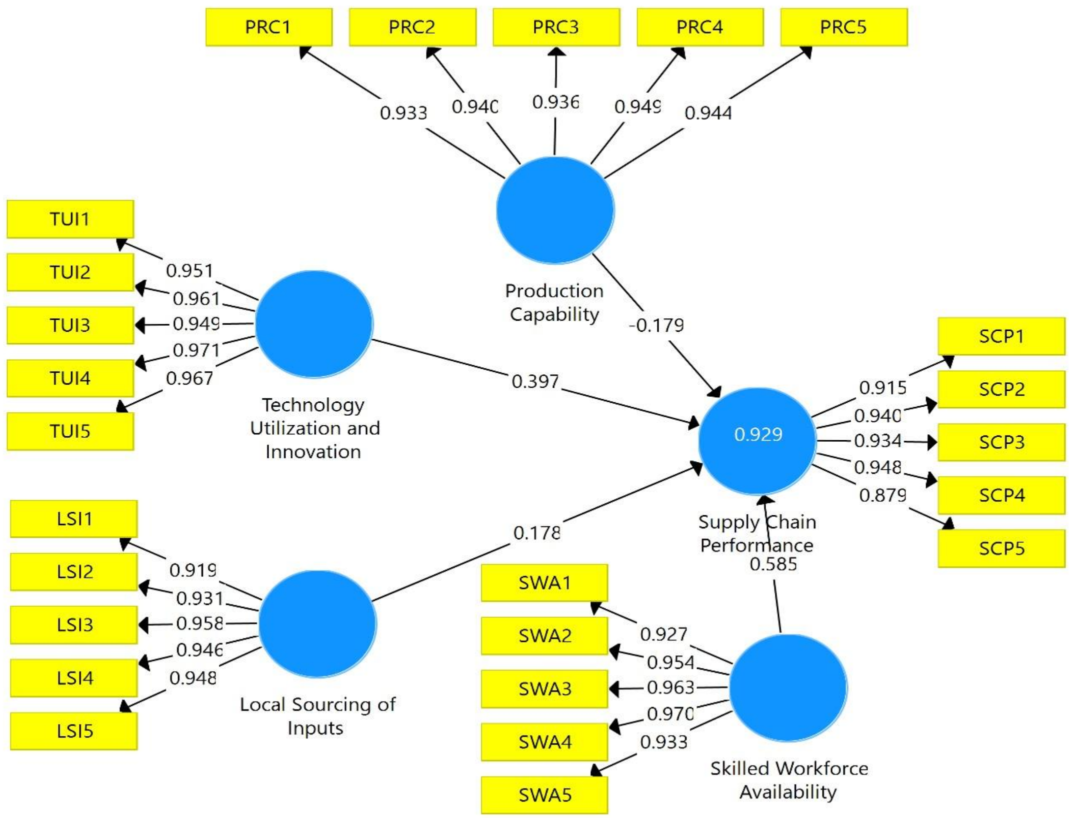

Figure 2: Measurement model of the study constructs and indicators. Source: SmartPLS Output, 2025.

Table 1: Factor Loadings

Items	Loadings	Items	Loadings
LSI1	0.919	SWA1	0.927
LSI2	0.931	SWA2	0.954
LSI3	0.958	SWA3	0.963
LSI4	0.946	SWA4	0.970
LSI5	0.948	SWA5	0.933
PRC1	0.933	SCP1	0.915
PRC2	0.940	SCP2	0.940
PRC3	0.936	SCP3	0.934

PRC4	0.949	SCP4	0.948
PRC5	0.944	SCP5	0.879
TUI1	0.951		
TUI2	0.961		
TUI3	0.949		
TUI4	0.971		
TUI5	0.967		

Source: SmartPLS Output, 2025.

Table 1 presents the factor loadings for the constructs used in this study, Local Sourcing of Inputs, Production Capability, Skilled Workforce Availability, Supply Chain Performance, and Technology Utilization and Innovation. All loadings exceeded the recommended 0.70 threshold suggested by Hair et al. (2022), confirming strong convergent validity across constructs. Loadings ranged from 0.879 to 0.971, indicating excellent item reliability and strong representation of each latent variable.

Local Sourcing of Inputs showed high loadings between 0.919 and 0.958, reflecting strong measurement accuracy. Production Capability also performed strongly, with loadings ranging from 0.933 to 0.949. Skilled Workforce Availability demonstrated exceptionally high loadings (0.927–0.970), highlighting its internal consistency. Technology Utilization and Innovation recorded some of the highest loadings in the model (0.949–0.971), confirming robust construct reliability. Supply Chain Performance exhibited strong indicators (0.879–0.948), with all items meeting validity standards.

In line with Fornell and Larcker (1981), these results affirm the robustness of the measurement model and demonstrate that all items adequately represent the dimensions of local manufacturing capacity and supply chain performance within Innoson Vehicle Manufacturing (IVM), Nnewi.

Table 2: Construct Reliability and Validity

Construct	**Cronbach's Alpha**	**rho_A**	**Composite Reliability**	**Average Variance Extracted (AVE)**
Production Capability	0.967	0.967	0.975	0.885
Technology Utilization & Innovation	0.979	0.980	0.983	0.921
Local Sourcing of Inputs	0.967	0.970	0.975	0.885
Skilled Workforce Availability	0.973	0.973	0.979	0.901
Supply Chain Performance	0.957	0.958	0.967	0.853

Source: SmartPLS Output, 2025.

Table 2 presents the construct reliability and validity results for the study variables. All constructs recorded Cronbach's Alpha and Composite Reliability values well above the recommended minimum threshold of 0.70, indicating excellent internal consistency (Hair et al., 2019). Furthermore, the Average Variance Extracted (AVE) values exceeded the benchmark of 0.50 for all constructs, demonstrating that each construct explains more than half of the variance in its measurement items. This establishes convergent validity as recommended by Fornell and Larcker (1981). The results confirm that the measurement model for local manufacturing capacity dimensions and supply chain performance is both reliable and valid, providing a solid foundation for structural model analysis.

Table 3: Heterotrait-Monotrait Ratio (HTMT)

Construct	Production Capability	Technology Utilization and Innovation	Local Sourcing of Inputs	Skilled Workforce	Supply Chain Performance
Production Capability					
Technology Utilization and Innovation		0.657	0.599		
Local Sourcing of Inputs			0.628	0.682	
Skilled Workforce		0.614	0.645	0.659	
Availability Supply Chain		0.629			0.687
Performance		0.610			

Source: SmartPLS Output, 2025.

Table 3 presents the Heterotrait-Monotrait Ratio (HTMT) results for the constructs in this study. All HTMT values were below the conservative threshold of 0.90 recommended by Henseler, Ringle, and Sarstedt (2015), confirming that the constructs are empirically distinct from one another. This establishes discriminant validity, indicating that production capability, technology utilization and innovation, local sourcing of inputs, and skilled workforce availability capture unique dimensions of local manufacturing capacity without excessive overlap. The results also validate the distinctiveness of supply chain performance as a dependent construct, measured across delivery efficiency (supply reliability), cost efficiency, and availability of critical components and materials.

Table 4: Inner VIF Values

Construct	Supply Chain Performance
Production Capability	1.071
Technology Utilization and Innovation	2.242
Local Sourcing of Inputs	1.813
Skilled Workforce Availability Supply Chain Performance	2.084

Source: SmartPLS Output, 2025.

Table 4 presents the inner Variance Inflation Factor (VIF) values for the predictors of supply chain performance in the structural model. According to Hair et al. (2022), inner VIF values below 5 indicate no critical multicollinearity issues. All VIF values in this study range from 1.071 to 2.242, well below the conservative threshold of 3.3 and the standard cutoff of 5. This confirms the absence of multicollinearity among the proxies of local manufacturing capacity (production capability, technology utilization and innovation, local sourcing of inputs, and skilled workforce availability), supporting the reliability of the path coefficient estimates in assessing their individual effects on supply chain performance at Innoson Vehicle Manufacturing (IVM), Nnewi.

Table 5: Effect Size (f^2)

Construct	Values
Production Capability	0.050 (small)
Technology Utilization and Innovation	0.241 (medium)
Local Sourcing of Inputs	0.038 (small)
Skilled Workforce Availability	0.319 (large)

Note: According to Cohen (1988), $f^2 = 0.02$ indicates a small effect, $f^2 = 0.15$ a medium effect, and $f^2 = 0.35$ a large effect.

Source: SmartPLS Output, 2025.

Table 5 presents the Cohen's f^2 effect size values for the structural relationships between the independent variables, Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, and Skilled Workforce Availability and the dependent variable, Supply Chain Performance, in this study. The results show that Skilled Workforce Availability has a large effect ($f^2 = 0.319$) on supply chain performance, indicating that human capital strength is a major driver of operational efficiency at Innoson Vehicle Manufacturing (IVM), Nnewi.

Technology Utilization and Innovation exhibits a medium effect ($f^2 = 0.241$), underscoring the importance of technological capabilities in improving delivery efficiency, reducing costs, and ensuring the availability of critical components. Production Capability demonstrates a small effect ($f^2 = 0.050$), suggesting that while functional manufacturing capacity contributes to performance, its impact is less pronounced compared to workforce skill and technological implementation. Local Sourcing of Inputs also shows a small effect ($f^2 = 0.038$), indicating that although local input sourcing contributes to supply chain outcomes, its influence is relatively minimal in the current manufacturing context of IVM.

Table 6: Coefficient of Determination (R^2 and Adjusted R^2)

Construct	R Square	R Square Adjusted
Supply Chain Performance	0.929	0.927

Source: SmartPLS Output, 2025.

Table 6 presents the coefficient of determination (R^2) and adjusted R^2 values for Supply Chain Performance, the dependent variable of this study. The R^2 value of 0.929 indicates that Production Capability, Technology Utilization and Innovation, Local Sourcing of Inputs, and Skilled Workforce Availability collectively explain 92.9% of the variance in Supply Chain Performance at Innoson Vehicle Manufacturing (IVM), Nnewi. The Adjusted R^2 value of 0.927, which accounts for model complexity, remains very close to the original R^2, confirming that the model is both parsimonious and robust. According to Hair et al. (2022), R^2 values above 0.75 represent substantial explanatory power, meaning the independent variables provide a strong predictive contribution to supply chain performance.

Table 7: Model Fit Summary

Fit Index	Saturated Model	Estimated Model
SRMR	0.033	0.033
d_ULS	0.350	0.350
d_G	1.838	1.838
Chi-Square	1460.273	1460.273
NFI	0.824	0.824

Source: SmartPLS Output, 2025.

Table 7 presents the model fit indices for both the Saturated and Estimated Models. The Standardized Root Mean Square Residual (SRMR) value of 0.033 is well below the recommended threshold of 0.08 (Hu & Bentler, 1999), indicating excellent model fit and confirming that the discrepancies between observed and predicted correlations are minimal. The d_ULS (0.350) and d_G (1.838) values reflect acceptable levels of discrepancy between empirical and model-implied covariances, suggesting that the estimated model represents the data structure adequately. The Chi-square value of 1460.273, although large as expected in PLS-SEM due to sample size sensitivity does not compromise model evaluation since chi-square is not a strict goodness-of-fit metric in variance-based SEM. The Normed Fit Index (NFI) of 0.824 exceeds the acceptable threshold of 0.80, further supporting a satisfactory model fit (Bentler & Bonett, 1980). Collectively, these indices confirm that the structural and measurement models are well specified and demonstrate a strong alignment between the hypothesized model and empirical data.

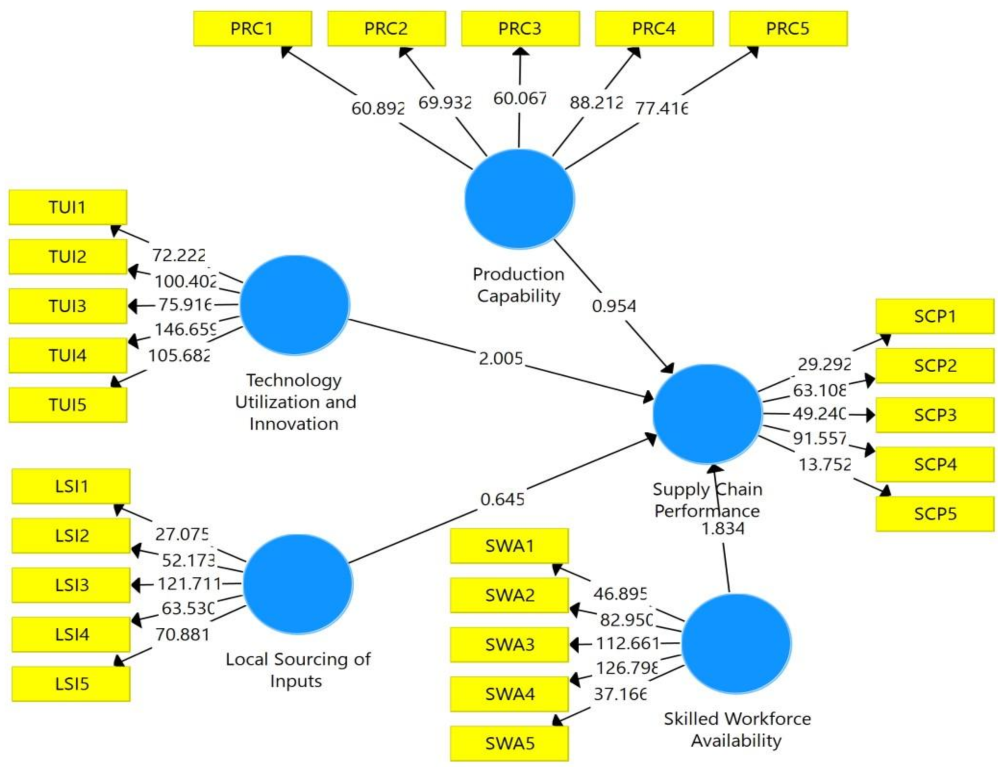

Fig. 3: Path Coefficients of the Regression Model Source: SmartPLS Output, 2025.

Table 5: Path Coefficients

Variables	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Decision
Production Capability	-0.179	0.954	0.341	Accepted
Technology Utilization and Innovation	0.397	2.005	0.046	Rejected
Local Sourcing of Inputs	0.178	0.645	0.519	Accepted
Skilled Workforce Availability	0.585	1.834	0.067	Accepted

Source: SmartPLS 3 Output (2025)

Discussion of Findings

H_{01}: Production Capability has no significant effect on Supply Chain Performance at Innoson Vehicle Manufacturing (IVM), Nnewi.

This hypothesis was accepted, with a path coefficient of -0.179, t-value of 0.954, and p-value of 0.341, indicating a non-significant negative effect. This suggests that enhancements in production capability defined as the firm's ability to efficiently transform inputs into outputs using standardized processes, technology, and coordination (Mutuku & Senelwa, 2018) do not significantly improve delivery efficiency (supply reliability), cost efficiency, or availability of critical components and materials. At IVM, over-reliance on existing assembly lines or equipment without adaptive scaling may lead to inefficiencies, such as idle capacity or misalignment with demand fluctuations, thereby weakening supply chain performance. In the context of local manufacturing, rigid production systems can increase lead times and inventory costs when component integration fails during peak demand.

This finding contrasts with Mose and Magutu (2025), who reported that capacity planning, including equipment selection and proper scheduling, significantly enhanced supply chain performance in Kenyan manufacturing firms through improved on-time delivery and reduced unit costs. Similarly, Dobránsky et al. (2019) found high process capability indices (Cp > 1.33) ensured consistent quality in automotive component production, supporting reliability. However, Vinod et al. (2024) noted that inefficient scheduling in Indian automotive firms led to production delays, negatively impacting cost efficiency and component availability, aligning with the current negative (though non-significant) effect. Janmanee and Butdee (2023) further highlighted that low production capability (<80%) in Thai rubber parts subcontractors triggered stock imbalances, reducing supply chain responsiveness.

H$_{02}$: Technology Utilization and Innovation has no significant effect on Supply Chain Performance at Innoson Vehicle Manufacturing (IVM), Nnewi.

The hypothesis was rejected, with a path coefficient of 0.397, t-value of 2.005, and pvalue of 0.046, showing a significant positive effect. This means that greater adoption of advanced tools such as AI, robotics, IoT, and digitalization (Braidy et al., 2025) enhances delivery efficiency, cost efficiency, and availability of critical components. At IVM, technologies like CAD software and automated assembly lines (Arukwe, 2023) enable real-time tracking, predictive maintenance, and process optimization, reducing lead times and waste while ensuring seamless component flow. In Nigeria's volatile automotive environment, technology utilization mitigates risks from disruptions, fostering resilience and competitiveness.

This result is consistent with Boubker (2022), who found that IT integration positively influenced supply chain performance in Moroccan automotive firms (β = 0.42, p < 0.01) by cutting lead times through supplier-manufacturer alignment. Similarly, Chen et al. (2025) reported that digital technology innovation improved ROE via supply chain resilience in Chinese auto parts firms, with IoT automation enhancing efficiency during chip shortages. In contrast, Stawiarska (2020) noted that low ICT expenditure limited innovation profits in internal-focused firms like Volkswagen, suggesting that IVM's positive effect may stem from targeted open innovation via supplier collaboration. Wang et al. (2024) further confirmed that digital patents in production/manufacturing processes strengthened supply chain position through managerial efficiency gains in Chinese new energy vehicle firms.

H$_{03}$: Local Sourcing of Inputs has no significant effect on Supply Chain Performance at Innoson Vehicle Manufacturing (IVM), Nnewi.

The hypothesis was accepted, as the path coefficient of 0.178, t-value of 0.645, and pvalue of 0.519 indicate a non-significant relationship. Although the coefficient is positive, the effect is too weak to conclude that increasing local sourcing leads to meaningful improvements in delivery efficiency, cost efficiency, or the availability of critical components at IVM.

This result suggests that while local sourcing can theoretically reduce logistics distance and support domestic industry, these advantages are not yet translating into measurable supply chain performance gains for IVM. Possible reasons include:

- Limited technological capability and inadequate production capacity among local suppliers, which may hinder consistent quality and timely delivery (Raissouni & Hamiche, 2017).
- High investment requirements and weak competitiveness in non-industrialized regions, making local inputs less reliable or more costly than imports.

- Infrastructural challenges that undermine the potential benefits of sourcing domestically.
- Unpredictable demand volumes, reducing suppliers' ability to scale efficiently, as highlighted in Yadav et al. (2018).

This finding contrasts with Li et al. (2022) and Masoumi et al. (2019), who reported that local sourcing improved environmental performance, resource efficiency, and supplier collaboration in automotive supply chains. However, your result is more aligned with evidence from Renault Maroc (Raissouni & Hamiche, 2017), where local integration did not reduce purchasing costs or improve operational efficiency due to insufficient supplier readiness.

The non-significant effect indicates that local sourcing at IVM has not yet matured into a strategic advantage, and substantial supplier development, quality improvement initiatives, and technology upgrading may be required before its benefits can be fully realized.

H_{04}: Skilled Workforce Availability has no significant effect on Supply Chain Performance at Innoson Vehicle Manufacturing (IVM), Nnewi.

The hypothesis was accepted at the 5% significance level because the relationship between Skilled Workforce Availability and Supply Chain Performance is not statistically significant ($\beta = 0.585$, $t = 1.834$, $p = 0.067$). Although the coefficient is positive and relatively large, the p-value indicates that the effect only approaches significance at the 10% level, meaning it is marginal rather than conclusive.

This result suggests that while a skilled workforce *appears* to improve delivery reliability, cost efficiency, and the availability of critical components, the effect is not strong enough to be statistically verified in IVM's current operational context. This implies that staff competencies though important may not be uniformly distributed or sufficiently developed across key production, engineering, and logistics functions to yield a consistently measurable impact on supply chain performance.

The finding contrasts with studies like Santa et al. (2022), where human capital significantly predicted agility, quality, and cost strategies in Colombian manufacturing firms. Similarly, Khawka et al. (2024) reported that skilled workforce engagement in Lean Six Sigma initiatives enhanced operational accuracy and delivery performance. These positive outcomes reflect environments with structured training and high workforce alignment, conditions that may not yet be fully established at IVM. The marginal significance in your result may reflect challenges noted by Magnanini et al. (2021), who observed that uneven skill distribution and role-specific competencies reduce throughput unless paired with optimized planning. Likewise, Jhawar et al. (2014) found that partial workforce training limited logistics performance improvements, indicating that incomplete skill development programs weaken potential gains.

Conclusion

This study concluded that technology utilization and innovation is the only SRM dimension that significantly improves supply chain performance at IVM, while skilled workforce availability shows a marginal but non-significant positive effect. Production capability and local sourcing of inputs do not contribute meaningfully, indicating that rigid production systems and weak local supplier capacity limit the benefits of local manufacturing. To improve performance;

1. Prioritize digital technologies such as IoT, CAD automation, and predictive analytics to enhance process efficiency and reduce delays.
2. Redesign production systems for flexibility with improved scheduling, equipment upgrades, and alignment with demand patterns.
3. Strengthen local suppliers through quality certification programs, technical support, and collaborative development initiatives.
4. Expand workforce skills via advanced training in automation, engineering, and supply chain management through the Innoson Kira Academy and institutional partnerships.

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QUESTIONNAIRE

S/N	Items	SD	D	U	A	SA
A. Production Capability (PRC)		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
PRC1	IVM's facilities are sufficient to meet local vehicle production targets.					
PRC2	Efficient assembly processes minimize waste and production bottlenecks at IVM.					
PRC3	IVM's capacity allows flexible, simultaneous production of multiple models.					
PRC4	IVM fully leverages technology to maximize the output of the Nnewi plant.					
PRC5	Routine equipment maintenance does not significantly disrupt IVM’s production schedule.					
B. Technology Utilization and Innovation (TUI)						
TUI1	Automation in IVM's assembly significantly improves production speed and accuracy.					
TUI2	IVM consistently invests in R&D to localize new vehicle component designs.					
TUI3	Advanced manufacturing software (CAD/CAM) is actively utilized in IVM's departments.					
TUI4	IVM employees receive regular training on the latest manufacturing technologies.					
TUI5	IVM's technological setup offers a competitive edge over vehicle importation.					
C. Local Sourcing of Inputs (LSI)						
LSI1	A high percentage of critical components are sourced from Nigerian suppliers.					
LSI2	Local suppliers consistently meet IVM's quality standards for key vehicle parts.					
LSI3	IVM actively engages in capacity building for local component manufacturers.					

LSI4	Sourcing locally significantly reduces IVM’s reliance on foreign exchange risks.					
LSI5	IVM has stable, long-term contracts with reliable local input suppliers.					
D. Skilled Workforce Availability (SWA)						
SWA1	IVM has sufficient technically skilled personnel to fully support vehicle production.					
SWA2	IVM's managerial and engineering staff possess required local manufacturing expertise.					
SWA3	IVM effectively retains skilled employees, reducing turnover in critical roles.					
SWA4	Employees are proficient using advanced equipment for IVM vehicle assembly.					
SWA5	In-house training programs adequately close any skills gap for local production.					
E. Supply Chain Performance (SCP)						
SCP1	Delivery timeliness consistently meets all internal and external deadlines.					
SCP2	Local sourcing has led to a significant reduction1 in total supply chain costs.					
SCP3	Critical components are always readily accessible to maintain steady production flow.					
SCP4	IVM's operational metrics demonstrate a highly efficient and lean supply chain.					
SCP5	IVM rarely experiences production stoppages due to essential parts stockouts.					