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Understanding the Relationship between Mechanical Innovation, Mechanical Efficiency, Customer Value Creation, and Business Performance: A Qualitative Inquiry

Vimala Venugopal Muthuswamy[1*], Mari Anand N[2]
[1] Department of Management, College of Business, King Faisal University, Al-Ahsa 31982, Saudi Arabia.
[2]Senior Lecturer, College of Economics and Business Administration, University of Technology and Applied Sciences-Salalah, Oman.

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ABSTRACT

Purpose: Examining organizational performance is important for gaining long-term market success and developing competitive advantage. Therefore, the purpose of this study was to explore the role of mechanical innovation, mechanical efficiency, and customer value creation in creating business performance. Design/ method/ approach: This research adopted an interpretive research paradigm through a grounded theory qualitative research design. Data were gathered from 40 professionals using convenience sampling. The collected data were analyzed through comparative analysis, supported by documentary triangulation. Findings: The results of the study revealed that mechanical innovation does not directly influence business performance. Rather, mechanical innovation develops a sequential process in which innovation enhances mechanical efficiency, creates customer value, and ultimately drives business performance. Originality: The study contributes to the literature by offering a process-based explanation whereby mechanical innovation improves business performance through mechanical efficiency and customer value creation.

Corresponding Author:

Vimala Venugopal Muthuswamy
Department of Management, College of Business, King Faisal University, Al-Ahsa 31982, Saudi Arabia
Email: fmuthuswamy@kfu.edu.sa

1. Introduction

Business performance is vital for all types of organizations, as it determines their ability to create value for stakeholders, maintain competitiveness, and ensure long-term survival. Business performance serves as a key indicator of managerial effectiveness, resource allocation, and strategic decision-making (Artha & Satriadhi, 2023). The term business performance refers to the extent to which organizations achieve their operational, financial, and strategic objectives. For mechanical organizations, the importance of business performance is further amplified, as their operations are capital-intensive by nature (Indriyani et al., 2025). Moreover, operations are dependent on engineering precision, supply chain volatility, technological disruption, and cyclical demand. Strong business performance in the context of mechanical organizations does not simply indicate financial outcomes; in fact, it reflects innovation capacity, product quality, and operational efficiency. Presently, global manufacturing markets are increasingly interconnected and technology-driven (Micheli, 2026). The ability of a mechanical organization to improve and sustain its performance directly affects its ability to grow, adapt, and compete in a demanding industrial landscape.

Mechanical innovation is very important for organizations operating in the manufacturing or mechanical sector because mechanical innovation enables the development of technologies, processes, and new products that enhance competitiveness, quality, and efficiency (Hoang & Nguyen, 2026). Mechanical innovation encompasses advancements in production techniques, automation, materials, and designs that enable a mechanical organization to respond effectively to evolving technological changes and customer demands (Olodu et al., 2026). For mechanical organizations, innovation is vital because it reduces operational costs, drives differentiation, and supports adaptability in increasingly competitive and dynamic markets. In context of mechanical organizations, innovation plays a vital role because technological advancement is essential to maintain product reliability, productivity, and precision.

Furthermore, mechanical innovation plays a significant role in improving business performance of mechanical organizations, since improvements in product design and engineering processes directly translate into stronger market positioning, higher quality output, and greater efficiency (Setiyo & Rochman, 2023). All these factors ultimately reinforce organizational ability to sustain long term growth and competitive advantage.

In the context of manufacturing organizations, efficiency is understood as the ratio between output generated and resources that are consumed. It is a measure of how effectively a mechanical firm is able to convert types of inputs, such as labor, energy, and materials, into finished products. The main concern of efficiency is to optimize existing resources, streamline workflows, reduce downtime, and minimize waste across production system, which is opposite to innovation (Fang et al., 2025). Organizations that neglect efficiency often face diminished competitiveness and rising costs, regardless of technological advancement. This is also true for mechanical organizations, where process design, maintenance practices, and machinery utilization determine whether resources are deployed wastefully or productively across increasingly complex mechanical production environments. As a result, mechanical efficiency functions as a driver of business performance by reducing costs and improving resource utilization, productivity, and profitability metrics (Handoyo et al., 2023). From this perspective, mechanical efficiency serves as a mechanism through which an organization translates operational capability into measurable performance outcomes (Seraj & Sundram, 2026).

Sustainable competitive advantage development is mainly dependent on creating value for customers. Organizations that are unable to provide meaningful value, regardless of technical sophistication and internal efficiency, often struggle to retain customer loyalty and market share (Wichitsathian & Ekkaphol, 2025). For mechanical organizations, industrial clients expect products to be reliable, technical support for high-quality products, responsiveness, and customization according to customer needs. The relationship between business performance and value creation is consequential and direct. Customers who perceive strong value are likely to accept premium pricing, recommend products to others, and return to purchase the product (Arteta Vivenzi & ORDOÑEZ BELLIDO, 2023). All of these factors strengthen profitability and revenue streams. These dynamic carries additional weight in the context of mechanical organizations, as industrial buyers are mostly engaged in long-term relationships with suppliers. Moreover, consistent value delivery determines market positioning and contract renewals (Gunawan et al., 2024). Therefore, customer value creation operates as a strategic function through which mechanical organizations convert customer satisfaction into sustainable business performance. Thus, this study aims to analyze the effects of customer value creation, mechanical efficiency, and mechanical innovation on improving business performance of mechanical organizations.

2. Literature Review

2.1 Mechanical Innovation and Organizational Transformation

Innovation is important for organizations to remain competitive in rapidly changing environments. The organization having well developed innovation capabilities have a very good chance to remain competitive (Reichert et al., 2020). Several medium and small sized organizations have adapted digital transformation in the form of industry 4.0. Such transformation is very important for manufacturing organizations to remain competitive. This innovation is mainly dependent on manufacturing organization's capabilities that are different from those that are needed for regular improvement in manufacturing firms (Lassen & Larsen, 2025). The conventional development of manufacturing system mainly focuses on efficiency, robustness, and resilience, that are needed in predictable and stable conditions. Scholars highlighted that innovation is more than technological advancement. It includes the methods of creating value by using entrepreneurial practices and business processes, and capability development (Vărzaru & Bocean, 2024). Organizations that invest in development of capabilities related to innovation can introduce new services and products and improve internal processes. Therefore, cost is reduced and operational efficiency is increased. Scholars suggested that organizations having different strategic resources such as assets that are inimitable, non-sustainable, rare, and valuable have the competitive advantage over the other firms. Scholars further revealed that it become difficult for other firms to meet the performance difference that a company have because of these resources (D'Oria et al., 2021).

Scholars mentioned that technological capability mainly focuses on collective resources, processes, skills, and knowledge that an organization possess to utilize and adopt different types of technology. Some scholars discussed that technological capability includes the physical and digital networks (such as devices, databases, communication apparatuses, cloud platforms, and servers) tools and networks that facilitate the assessment of large amount of data. These factors develop the foundation of organizational technological ability so they can handle different complex situations (Rashed et al., 2025). Mechanical innovation includes industry 4.0 technologies, cyber-physical systems, digital twins, intelligent manufacturing, predictive maintenance systems, robotics, and automation technologies

(López et al., 2026).

The industrial system is being transformed through digital twin technology through integration of physical assets with digital models, processing optimization, predictive analytics, enabling real-tome monitoring, particularly within the framework of Industry 4.0 (Bongomin et al., 2025). In context of industry 4.0, predictive maintenance is important for optimization of production processes. Whereas, popularity of predictive maintenance is growing among organizations because of its benefits and have economic impact on the organizational performance (Nagy et al., 2025). These technologies basically reshape production systems by facilitating data driven decision making, enhancing flexibility, reducing uncertainty, and improving visibility. This capability also suggests that organizations regularly, reconfigure, build, and integrate internal competencies in response to environmental changes (Wang et al., 2026). Therefore, mechanical innovation must be interpreted in the form of one-time investment rather than learning process of organization that continuously improves operational capabilities.

Successful innovation is based on routines of organizations that provide support to continuous improvement, learning, and experimentation rather than just adopting sophisticated equipment. Smart Connected technologies play important role to generate competitive advantage when organizations redesign operational processes around technological capabilities (Vărzaru & Bocean, 2024). Aligning efforts of innovation with business strategy is vital to develop sustainable advantage. Technological innovation, specifically adoption of AI, plays very important role in transforming operational innovation, highlighting the vital role dynamic capabilities to manage technological change. Literature also demonstrate that advanced manufacturing technologies improves responsiveness, process integration, machine intelligence, and production flexibility (Aboramadan et al., 2020), Organizational learning, innovation and firm performance. Studies showed that organizational outcomes that are learning oriented significantly improves organizational performance and innovation capability. Empirical research also mentioned that technology must be integrated with other factors to produce organizational performance. Whereas, organizations need complementary process integration, employee competencies, and managerial capabilities to exploit technological investments (Otioma, 2023b).

Scholars also indicated that organizations that adopt industry 4.0 technology experience higher operational benefits only in the case of technological implementation is accompanied with capability development and organizational change (Veile et al., 2020). Likewise, research by Valamede and Akkari (2020) also mentioned that lean management practices play significant role to strengthen effectiveness of digital manufacturing technologies. These results are in-line with the argument that mechanical innovation has role of organizational catalyst rather than a direct factor of business success. Mechanical Innovation introduces a number of technological possibilities, whereas organizational capabilities determine whether these possibilities generate outcomes that are measurable (Chychun et al., 2023). This concept is in line with past scholars who revealed that mechanical innovation is base of organizational transformation (Delloul, 2024).

2.2 Mechanical Efficiency and Mechanism for Capability Realization

Studies have described mechanical efficiency is the measure of how much power an organization output as compared to how much input it take (Ahmed & Siddiquee, 2022) Higher mechanical efficiency means that raw material within the organization is converted into useful products. Though innovation provides a number of technological opportunities, organizations can benefit from these opportunities through operational efficiency. Mechanical efficiency shows the capabilities of organizations to convert technological investments into productive operational outcomes. Capacity management is important aspect of strategic planning within the organization, focusing on resource optimization to achieve efficiency at maximum level. Literature also define efficiency as optimum use of resources to achieve maximum output by keeping waste at minimum level (Mashudi et al., 2023). Mechanical efficiency is organizational capability that is focused on multiple factors encompassing resource optimization, operational flexibility, quality improvement, process consistency, production stability and equipment reliability.

Studies illustrate that lean manufacturing play important role in maximizing the value for customers by minimizing production waste. The importance of lean manufacturing is discussed as organizational ability to provide products at the right price and right time with purpose to meet the needs of customers. Lean manufacturing also show that operational excellence is not only dependent on advanced technology, whereas it is dependent on how effectively organizations integrate technology with operational routines (Stojanović & Milovanović, 2020). Organizations can improve their operations by using 5s principles by maintaining, standardizing, cleaning, classifying, and organizing the different workstations with purpose to produce better quality products without any generation of waste linked with work environment. As a result, waste and errors are reduced that takes place during process of production. Thus, operation process will provide products that are homogeneous (Kaneku-Orbegozo et al., 2019).

Total productive maintenance has positive effect on cost efficiency, delivery, and quality through improved on-

time deliveries and inventory turns. Total productive maintenance shows the importance of continuous machine performance, equipment reliability, and proactive maintenance to enhance operational productivity. Predictive maintenance systems provide support have been supported by industrial internet of things and artificial intelligence technologies have further strengthened organizational capability to minimize machine failures before they take place (Ayalew & Belay, 2024). Predictive maintenance minimizes the impact of machine failure through detection of warning signs. Therefore, organizations are able to take corrective actions in time. Sufficiently, different algorithms of advanced predictive maintenance are able to judge the remaining timeline of malfunctioning components of machine and cause of malfunctions (Khalili et al., 2026).

Studies demonstrate that smart manufacturing systems are able to reduce downtime of equipment significantly while improving maintenance efficiency and reliability (Sathiri, 2026). Technologies related to industry 4.0 improve operational efficiency mainly through predictive decision making and enhanced process visibility. Literature further argues that efficiency plays important role towards organizational resilience because reliable systems improve organizational responsiveness and reduce production variability during environmental uncertainty. Organizations having highly efficient operational systems have the ability to respond to disruptions while keeping different standards consistent (Kong & Feng, 2025).

Therefore, mechanical efficiency play the role of capability realization mechanism by which innovation becomes meaningful operationally (Bhatti & Alqasa, 2025). Innovation. Technological potential is developed by innovation, whereas efficiency change this developed potential into improvements in resource utilization, quality consistency, reliability, and productivity (Frank et al., 2019). In different studies, participants emphasized a number of time that technological investments are considered valuable only after organizations are able to successfully minimize downtime, improve operational responsiveness, and stabilize production processes. Therefore, mechanical efficiency plays the role of Important bridge that connects innovation with development of organizational capability (Kafetzopoulos & Kafetzopoulos, 2026).

2.3 Market Conversion Mechanism and Customer Value Creation

Studies mentioned that operational efficiency improves organizational performance at the internal level, superior organizational outcomes can be achieved only when these operational improvements create customer value. Studies argued that customers evaluate organizations rarely on internal technological sophistication. Whereas organizations are mostly accessed as per the value that is received through services and products (Sharabati et al., 2024). Studies confirmed that perceived value of customers represents evaluation of customers regarding the benefits they receive to the cost they paid including psychological costs, efforts, time, and monetary value (Blut et al., 2024). Analysis of different studies also showed that perceived value is the important factor of purchase intentions, loyalty, and customer satisfaction in different industries. Therefore, operational capabilities of organizations become strategically important only when customers assume improvements in affordability, responsiveness, service reliability, and product quality (Al Najjar & Qandeel, 2025).

Studies identified different dimensions of customer value. One of the dimensions is functional value that discusses the perceived value, which is derived from alternative capacity for physical performance, utilitarian, and functional. On the other hand, emotional value shows the perceived utility which is derived from alternative capacity to arouse affective states and arousal feelings (Kato, 2021). These factors of operational efficiency are enhanced by maintaining consistent product quality, improving production precision, and reduction of defects. The economic value shows the perception of customers regarding cost savings and price fairness. Efficient operations of organizations minimize production costs by which organizations are allowed to provide products that are competitive in terms of pricing without compromising quality. The focus of relational value is on long term relationships, communication quality, responsiveness, and trust. Organizations having efficient operational systems show greater service consistency, quicker response times, and higher delivery reliability that later strengthen customer loyalty and trust (Pires et al., 2024).

Past studies confirmed the association between customer satisfaction and operational excellence. Scholars demonstrated that improved quality of product enhances customer satisfaction significantly that later enhances financial performance of organization (Zainurossalamia et al., 2022). Likewise, studies reported that customer satisfaction contributes significantly to market value, profitability, and customer retention. Literature also indicated that operational improvements are considered economically valuable when they are converted into superior customer experience. As a result of this perspective, the argument is reinforced that customer value plays the role of external market conversion mechanism that links operational capabilities of organization with business outcomes. Thus, customer value creation is perceived as important mechanism by which operational capabilities of organization effect market performance (Zehir et al., 2024).

2.4 Organizational Capabilities and Business Performance

Business performance of organizations is mostly measured through different financial indicators such as market share, return on investment, revenue growth, and profitability (Akpa et al., 2021). Literature argue that organizational performance is based on different factors namely organizational resilience, competitive advantage, innovation performance, customer performance, and operational performance. Studies proposed that financial outcomes of the organization are the consequences of the organizational success rather that beginning point of the organizational success. Different internal processes, collective learning, innovation, and customer satisfaction contributes significantly to the business performance (O'Higgins, 2023). Some studies emphasized that organizational performance is the outcome from integration of different capabilities of organizations rather than result of any isolated functional area (Quesado et al., 2022).

Scholars discussed the basic concept of core competencies, mentioning that emergence of sustainable advantage is based on integration of organizational learning, operational capabilities, and technological knowledge (Otioma, 2023a). Studies also revealed that technological investments cannot be the only catalyst of organizational performance. One of the key factor that improves organizational performance is operational excellence (Bag et al., 2021). Similarly, scholars also reported that customers who focused on operational capabilities, significantly strengthen the effect of industry 4.0 on the performance of organization (Ciano et al., 2021). Literature also support that resilient organizations anticipate resilience on the regular basis, learn from the experiences, and adapt operational processes. Mechanical efficiency also contributes to the resilience by enhancing operational stability and reliability, whereas innovation enables adaptation of organizations.

Therefore, business performance is improved through integration of organizational capabilities rather than through technological investments alone. Sustainability competitive advantage is achieved by the organizations when innovation enhance operational efficiency, customer value is improved through operational efficiency, and strategic and financial performance is improved through customer value (Huynh & Vo, 2023).

3. Methodology

3.1 Research Design

In the current study, grounded theory methodology and an interpretive research paradigm were used to develop an empirically grounded explanation of how mechanical efficiency and innovation integrate to create customer value and ultimately impact business performance. As compared to theory testing, a theory-building approach was considered more appropriate to understand the underlying mechanisms connecting operational excellence, customer outcomes, technological capabilities, and organizational success.

This theoretical approach helps the researcher to construct a theory directly from the organizational experience and move beyond descriptive accounts. Grounded theory enables the discovery of mechanisms, interactions, and latent processes, unlike traditional qualitative approaches, which seek to confirm existing assumptions to shape organizational phenomena. This method is specifically suitable because it identifies how engineers and managers enact, interpret, and continuously reconfigure efficiency and innovation practices within a dynamic business environment.

3.2 Sampling Process

Based on a grounded theory approach, the respondents were selected with the help of theoretical rather than statistical sampling methodology. As emerging categories required further refinement and exploration, sampling decisions evolved throughout the study. The researcher used a convenience sampling technique for the selection of respondents, based on their involvement in operational improvement initiatives and innovation. Respondents were recruited to challenge, elaborate, and validate emerging categories.

In current study forty professionals were interviewed, including production engineers, plant managers, operations directors, production engineers, innovation specialists, maintenance managers, customer relationship managers and quality assurance executives. Researchers of the study reached the theoretical saturation when new conceptual insight no longer generated by additional interviews and categories relationship became theoretically dense and sufficiently developed.

3.3 Process of Data Collection

Semi structured theoretical interviews were conducted for the collection of data. To explore the emerging relationships and concepts identification, theoretical interviews evolved throughout the process of study unlike conventional interviews based on priorly defined constructs, during analysis.

Duration of each interview was between 50 to 70 minutes focusing on the experience of respondents regarding innovation initiatives, customer-oriented operational practices, efficiency improvements, and organizational performance outcomes. Interview key included questions like

- For the improvement of operational efficiency which organizational conditions enable innovation?
- How do customers enjoy the results of operational improvement?
- How are organizational processes altered by mechanical innovation?
- Which organizational mechanism leads to business success through the enhancement of technological capability

Questions of interviews gradually focused on the understanding of contextual influences, intervening factors, causal conditions and strategic consequences, as categories emerged.

3.4 Triangulation of Data

Interview data supported documentary evidence to strengthen analytical credibility. Relevant documents of organization were reviewed. Sustainability report, annual report, project innovation documents, lean manufacturing report, maintenance record, strategic planning documents, operational performance dashboards. This process of documentary review enabled the triangulation of emerging concepts.

4. Analysis

4.1 Grounded Theory

Current study developed a significant grounded theory using open coding, constant comparative analysis, axial coding, focused coding, and selective coding procedures, to explain how organizations achieve sustainable business performance utilizing mechanical capabilities. Analysis revealed that the business performance is not directly impact by mechanical innovation, instead, innovation leads to the process of capability development in which operational efficiency considered as mechanism of capability realization and value creation function of customers as a mechanism of market conversion.

One core category and four interconnected categories collectively explained the under-investigation phenomena.

4.1.1 Category 1: For the Transformation of Organization Mechanical Innovation as a Catalyst

The first category captures how organizations use mechanical innovation to reshape operational systems and production capabilities.

Contrary to the conventional viewpoint about innovation as a technological event only, respondents emphasized that it is a process of transformation. Respondents emphasized that innovation is not only acquisition of advanced machinery only but also changes in maintenance practices, workflow structures, production routines, and process of decision-making.

According to a production manager:

“Our entire philosophy of production changed due to Innovation. We react to operational problems earlier, but now, we anticipate these issues before occurrence.

Respondents frequently referred to robotics, intelligent sensors, technological automation, predictive maintenance systems, and digitally integrated manufacturing systems as a system which transforms the process of operation.

According to an engineering director:

“Acquiring equipment itself is not an achievement, rather, achievement is the visibility we gained based on our production behavior and machine performance”

Thus, the results indicate that innovation improves the capabilities of organizations by increasing operational flexibility, technological adaptability, and process visibility. Furthermore, respondents described that innovation generates the operational improvement opportunities but does not automatically ensure performance improvement. Multiple managers highlighted the situation where heavy innovation investments lead to limited outcomes due to the deficient organizational competencies and processes to use and adapt technologies efficiently.

Thus, findings revealed that innovation is a catalyst for the success of organizations rather than a direct determinant of success.

4.1.2 Category 2: Realization of Capability of Innovation through Mechanical Efficiency

Second category demonstrates that through efficiency enhancement organizations convert innovation into operational efficiency.

Analysis revealed that successful innovation initiatives improve operational efficiency. According to the

respondents efficient and effective manifestation of technological capability leads to process efficiency.

A recurring pattern revealed throughout the interviews involved improved machine utilization, faster production cycles, reductions in downtime, and resource optimization enhancement.

A manager maintenance highlighted:

"When machine stoppage rate starts decreasing it demonstrates the real value of innovation. Productivity will improve automatically by the reduction of downtime"

According to a plant manager:

"Results generated by efficiency, but the tools provided by Innovation. We can achieved higher output level with the help of same resources due to minimization of operational interruptions."

Respondents also focused on the notion that efficiency improvements lead to predictability and operational stability.

According to manager quality assurance manager:

"Consistent quality improvement would be the outcome of consistent equipment operations. Thus, reliability will be created through efficiency in the system of production."

Consequently, efficiency was not defined by the respondents as cost reduction. Rather it was conceptualized as multidimension capability including productivity enhancement, quality consistency, process reliability, resource optimization, and operational responsiveness.

4.1.3 Category 3: Market Conversion Mechanism and Customer Value Creation

Most significant findings of the analysis is the role of creation customer value. It was repeatedly reported by the respondents that it is very difficult that the customer to recognize directly the sophistication of technology, rather organization is evaluated by the customers based on the benefits they receive by the service or product. Thus, strategic importance of operational improvement will be recognized when they create value for the customers and can be perceived by the customer.

According to manager customer relationship:

"Customers never question about the machines we used. Rather they ask whether our products can be delivered on time, what will be the reliable, and how efficiently we can respond to their issues."

In light of the analysis three dominant dimensions of value creation of customers revealed.

First one is the functional value dimension, it was emphasized by the respondents that mechanical efficiency improves quality, reliability and consistency of product

According to a respondent:

"With the help of better equipment, we can achieve the precision that will reduce defects significantly. Resultantly, customer confidence will improve in our products."

Second dimension is economic; it was explained by the participants that with the help of operational efficiency organizations can reduce costs and can offer products at low prices.

According to manager business development:

"By improving business efficiency production cost will reduce and help us to offer more product at low price, creating value without compromising the quality of product."

Third is the relational value, respondents focused on the significance of trust and responsiveness.

According to manager supply chain:

"Customers require and admire reliability. When product delivers on time and consistently with strong communication, means responsive, relationships will become stronger."

According to these findings customer value creation is a bridge between external market outcomes and internal organizational capabilities.

4.1.4 Category 4: Aligning Business Capability and Business Performance

This category demonstrates how organizations achieve superior business performance by aligning efficiency, innovation, and customer value creation. Respondents highlighted that the integration of multiple capabilities converges with business performance rather than isolated investments in technology.

According to chief executive officer:

"Organizational growth cannot be created by technology alone. Growth occurs when operations, innovation, and customer value work jointly."

According to respondents there are multiple performance outcomes linked with this defined alignment like revenue growth, competitive advantage and resilience.

According to commercial director:

"With the improvement of product reliability and reduced delivery times, high customer retention, leading to

higher revenues."

An executive explained:

"As we are offering better quality and our response time is very fast as compared to our competitors, our competitive position improved."

Managing director stated:

"During market disruptions efficient operations provided flexibility. Consequently, we can respond quickly as compared to the organizations having less efficient systems."

The findings suggested that performance of business is not a direct outcome of innovation. Instead, it emerges with the strategic integration of efficiency, innovation, and customer value. According to the emerging theory superior performance can be generated when the organizations are able to convert mechanical innovation successfully into operational efficiency and consequently translate efficiency into value for customers. This process can be labelled as "Value Conversion Process through Mechanical Capability."

4.1.5 Core Category: Conversion of Mechanical Capability into Value of Market and Customer

Connecting all subcategories a central explanatory core category emerged. Focusing on that competitive advantage could not be created by technological investments alone. Rather, it can be achieved with efficient and effective transformation of customers perceived and appreciated operational improvement.

Throughout the process of interviews, respondents rejected that innovation automatically could improve organizational performance. Instead, they emphasized that this process is sequential process in which initially the innovation improves operational processes and then operational improvements improves customer experiences, and consequently customer experiences add to business growth.

A senior executive operation described:

"Most of the times organizations expect immediate improvements in performance while investing heavily in technology. In real world, innovation changes the style of operational functions and customers benefit creations improves performance only."

According to another respondent:

"Customers never buy our product or machines. Customers buy value, quality, reliability, and responsiveness. Technology helps us to deliver those outcomes; therefore, it is a point of concern."

According to these narratives ultimate source of value is not innovation; rather, it leads to a transformation process that in turn improves customer-related and operational capabilities to develop. Resultantly, the main process of innovation conversion to performance can be summarized:

4.2 Triangulation of Findings and Documentary Evidence

Results derived from interviews of respondents were further validated by the analysis of documents, that provided a significant triangulation. These documents include annual reports, maintenance records, dashboards of sustainability performance, quality assurance and strategic planning reports, and corroborating the responses of the participants. For example, production logs and maintenance reports documented substantially reduced machine downtime, production interruptions, and equipment failures, following the implementation of automation technologies and predictive maintenance systems, supporting the claims of participants regarding the efficiency enhancement impacts of mechanical innovation. Similarly, reports on quality management demonstrate reduction in defect rates, improved process reliability and consistency, reinforcing observations of respondents regarding customer value creation and productivity enhancement. Strategic performance records annual reports further exhibited positive trends in market expansion, customer retention, revenue growth, and operational productivity, providing objective evidence about performance outcomes revealed during interviews. Furthermore, innovation project reports demonstrated significant investments in robotics, intelligent manufacturing technology, and systems of digital monitoring, confirming descriptions of participants regarding initiatives of technological transformation.

4.3 Emerging Process Grounded Theory Approach

It was revealed by grounded theory analysis that sequential and dynamic process by which external market outcomes achieved through internal technological capabilities.

The convergence of documentary evidence and interview data strengthened the trustworthiness and credibility of the findings by exhibiting that the emerging categories reflected the performance indicators and formal records of the organization and not solely based on perceptions of managers. This triangulation improved the credibility of grounded theory by providing multiple documentary evidence supporting value-capability conversion process and creation of business success.

Mechanical innovation initiated through the transformation of organization by the introduction of operational

possibilities and new technologies. Mechanical efficiency is consequently translated into operational effectiveness through technological capabilities. Value creation of customers then converted to operation effectiveness that turns to market benefit. Linear assumption regarding performance innovation relationships challenged by this analysis. Instead of operating through direct effects, innovation impact performance via a chain of customer-centered outcomes and interconnected processes of organization.

A new substantive theory emerged named as the findings therefore support the development of a new substantive theory, termed the Theory of Value Conversion through Mechanical Capability (TVCMC), proposing a sustainable business performance model achieved when mechanical innovation converts to operational efficiency and efficiency successively converts to business success.

5. Discussion

This study examined the association between Mechanical Innovation, mechanical efficiency, Customer Value Creation, and business Performance. The results of the study demonstrated that mechanical innovation play the role of catalyst to improve business performance. The respondent of study mentioned that innovation is one of important organizational processes that shapes decision making mechanisms, workflow structures, maintenance practices, and production philosophies. These findings also support the argument that organizations achieve sustainable competitiveness through configuration of operational processes and internal resources in response to changing business environment rather than only relying on acquisition of technology. The focus on digitally integrated manufacturing systems, predictive maintenance, and intelligent sensors also indicates that innovation improves technological adaptability, process visibility, and operational flexibility. These findings of the study are consistent with the past studies showing that manufacturing technologies improves responsiveness of the organization by using proactive operational management rather than reactive operational management. Whereas the results also show that technological investment is not sufficient to improve business performance. Respondents also highlighted that innovation provides meaningful outcomes when they are supported by adaptive managerial practices, employee capabilities, and organizational competencies. This response reinforces perspective of socio-technical systems that show that technological systems and organizational capabilities must be evolved for the to improve performance of organization. Thus, it is important to use mechanical innovation as factor that develop opportunities for the success of organization, whereas its effectiveness is mainly dependent on ability of organization to continuously refine, utilize, and integrate resources of technology (López et al., 2026).

Findings also show that organizations enjoy benefits of innovation when they are able to translate technological advancement into mechanical efficiency. They do not create values independently, innovation plays very important role in enhancing operational performance by improving optimization of available resources, accelerating production cycles, minimizing downtime, and improving utilization of equipment. The resource-based perspective also supports the arguments regarding different ways to generate technological resources. Respondents mentioned that organizations are able to generate value is generated by technological resources when organizational capabilities are applied an effective way. The respondents mentioned consistently that efficiency is enabled through innovation. On the other hand, efficiency determines improvement in operational performance and productivity. Findings also suggested that organizations should integrate different technological resources so they can achieve superior operational outcomes. Also, results show that mechanical efficiency goes beyond the traditional cost saving methods. Respondents of the study mentioned that organizational responsiveness, resource optimization, consistent product quality, operational stability and process reliability showing that it reflects a multifactor organizational capability. Participants also mentioned mechanical efficiency is one of multidimensional organizational capability that plays important role to minimize production cost. They also emphasized that efficiency is important for consistent product quality, greater responsiveness, operational stability, resource optimization, process reliability, and improved productivity. Furthermore, respondents also revealed that innovation provide real value to organizations only when it is able to improve mechanical efficiency, that later enable organizations to achieve improvement in operational reliability, quality, and productivity. These findings are aligned with results of Khalili et al. (2026).

The results also showed that value creation by customers plays a key role by which internal operational capabilities are converted into market success. Participants consistently mentioned that customers evaluate that organizational technology is sophisticated. Whereas, they examine the value of the product through responsive service, competitive pricing, reliability, timely delivery and product quality. It also shows that advancement is technology is not sufficient unless it develops benefits that can be perceived by customers directly. Participants also mentioned that there are three factors that are interlinked with customer value. These factors are rational value, economic value, and functional value. According to respondents of study, rational value is linked to dependable communication, responsiveness, and timely delivery that provide strength to long term relationships and customer trust. They revealed that economic value is

termed as factors that minimize production costs which enable organizations to offer products on the basis of competitive pricing without compromising quality. On the other hand, functional value was shown in improved product reliability, consistency, precision, and quality that resulted in enhanced mechanical efficiency. Participants demonstrated that these factors collectively develop improvement in internal operations that later is converted into tangible market advantage. Therefore, these results show that customer value creation play the role of bridge that develop connection between external performance outcomes and organizational capabilities. Thus, mechanical efficiency and innovation play very important role to achieve competitive advantage when their operational benefits are appreciated and recognized by the customers through superior value delivery.

The results also show that strategic alignment of customer value creation, mechanical efficiency, and innovation plays important role to achieve superior business performance. Alone technological advancement cannot play role to achieve superior business performance. Participants mentioned on a number of times that technology does not develop organizational growth, instead, customer value, operational efficiency, and innovation plays an important role as integrated system. According to participants, business performance is not the outcome of innovation, instead it is the outcome of a sequential capability building process. They also explained that mechanical innovation enhances operational efficiency by improving resource utilization, flexibility, reliability, and productivity. Later these efficiency gains are converted into customer value through greater responsiveness to the needs of customers, competitive pricing, timely delivery, and superior product quality. The respondents also highlighted that when customers appreciate and recognize these benefits, organizations mostly experience greater resilience, competitive positioning, increased revenues, and higher customer returns. From the perspective of respondents, sustainable business performance is achieved through the effective integration of customer value, operational efficiency, and innovation (Huynh & Vo, 2023).

The results of the study also show that conversion of mechanical capability into customer and market value as the basic explanatory process that embed all categories mentioned in above discussion. Participants mentioned on a number of times that technology cannot achieve competitive advantage alone. Respondents revealed that organizational value regarding innovation is dependent on transformation into improvement at the operational level that can be appreciated and perceived by customers. According to participants, business performance cannot be enhanced only through innovation. Whereas a sequential process is initiated by the technology where advancement of technology improves operational efficiency, which later enhances experience of customers through timely delivery, responsiveness, reliability and quality. These experiences of customers play important role in enhancing the growth of business. The respondents revealed further that organization is not evaluated by the customers on the basis of machine sophistication. Whereas the value is given by customers on the basis of different tangible benefits received by them. These tangible benefits include responsive service, competitive pricing, consistent reliability and superior quality. The results therefore show that sustainable competitive advantage takes place through conversion of mechanical capability into customer value and operational excellence that later translates into long term business success and superior organizational performance.

6. Limitations and Directions

This research has few limitations that should be addressed in future studies. This study employed qualitative research methodology, that provides contextual information but it becomes difficult to generalize the data. This research is based on the perception of professional and managers who are involved in operational and innovation processes, that may not fully capture the opinion of other stakeholders of organization. Future studies should use quantitative research methodology and validate theory of value conversion through mechanical capability. Study should use larger sample size with different countries and industries. Future studies are encouraged to use longitudinal research for the examination of customer value creation, mechanical efficiency, innovation and business performance over time. It will strengthen generalizability and empirical robustness of proposed theoretical framework. As this study is qualitative in nature, therefore it is proposed to develop a proper framework having multiple predicting and outcome variables for studies in future. Future studies may conduct comparative study in-terms of different sectors, industry and country for more valuable outcomes.

6.1 Theoretical and Managerial Implications

This research extends the body of knowledge by explaining the mechanism in which mechanical innovation contributes to business performance. The results demonstrate that innovation does not enhance organizational performance. Instead, its impact is created through customer value creation and mechanical efficiency. Therefore, the research provides a process based theoretical explanation that embeds internal operational capabilities with market outcomes. It enriches the understanding of value creation and capability development. In terms of managerial

contribution, research provides guidance to managers that they should consider technological innovation capability development investment rather. Managers should not consider it as direct source of competitive advantage. Furthermore, organizations must give priority to convert innovation into customer value, and operational value by improving resource utilization, responsiveness, quality, and reliability. These results can be used by the engineers and decision makers of the organizations for the strategy development of their organization. Moreover, researchers and scholars can use these results for their future research.

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References

Aboramadan, M., Albashiti, B., Alharazin, H., & Zaidoune, S. (2020). Organizational culture, innovation and performance: a study from a non-western context. *Journal of Management Development*, *39*(4), 437-451. https://doi.org/10.1108/JMD-06-2019-0253

Ahmed, M., & Siddiquee, M. A. (2022). Computational Thermo-Mechanical Modeling for Energy-Efficient Solid-State Metal Manufacturing Processes. *American Journal of Interdisciplinary Studies*, *3*(04), 579-618. https://doi.org/10.63125/ddg6mg97

Akpa, V. O., Asikhia, O. U., & Nneji, N. E. (2021). Organizational culture and organizational performance: A review of literature. *International journal of advances in engineering and management*, *3*(1), 361-372. https://doi.org/10.35629/5252-0301361372

Al Najjar, A. S., & Qandeel, M. S. (2025). Operational strategy, capabilities, and successfully accomplishing business strategy. *Journal of Applied Research in Technology & Engineering*, *6*(1), 1-11. https://doi.org/10.4995/jarte.2025.20708

Arteta Vivenzi, A. M., & ORDOÑEZ BELLIDO, L. (2023). Industry 5.0 and Customer Engagement: A Human-Centric Approach in the Product Life Cycle. https://hdl.handle.net/10589/227309

Artha, B., & Satriadhi, B. (2023). Performance of business: a review of the literature. *Jurnal Ekonomi LLDIKTI Wilayah*, *1*(3), 2. https://doi.org/10.54076/juket.v3i2.398

Ayalew, Y. G., & Belay, M. E. (2024). Enhancing total productive maintenance strategy for improved productivity and performance. *Systems Engineering: Design, Analysis, Programming, and Maintenance of Complex Systems*, 45. https://doi.org/10.5772/intechopen.114377

Bag, S., Telukdarie, A., Pretorius, J. C., & Gupta, S. (2021). Industry 4.0 and supply chain sustainability: framework and future research directions. *Benchmarking: An International Journal*, *28*(5), 1410-1450. https://doi.org/10.1108/BIJ-03-2018-0056

Bhatti, M. A., & Alqasa, K. M. A. (2025). Enhancing Business Performance through Operational Planning, Exploratory Innovation and Manufacturing Strategy. *Decision Making: Applications in Management and Engineering*, *8*(1), 458-477. https://doi.org/10.31181/dmame8120251384

Blut, M., Chaney, D., Lunardo, R., Mencarelli, R., & Grewal, D. (2024). Customer perceived value: A comprehensive meta-analysis. *Journal of Service Research*, *27*(4), 501-524. https://doi.org/10.1177/10946705231222295

Bongomin, O., Mwape, M. C., Mpofu, N. S., Bahunde, B. K., Kidega, R., Mpungu, I. L., Tumusiime, G., Owino, C. A., Goussongtogue, Y. M., & Yemane, A. (2025). Digital twin technology advancing industry 4.0 and industry 5.0 across sectors. *Results in Engineering*, *26*, 105583. https://doi.org/10.1016/j.rineng.2025.105583

Chychun, V., Grechanyk, O., Khliebnikova, T., Temchenko, O., & Kravchenko, H. (2023). Change management models and methods: implementing innovations, ensuring sustainability and engaging staff. *Economic Affairs*, *68*(4), 2249-2261. https://doi.org/10.46852/0424-2513.4.2023.33

Ciano, M. P., Dallasega, P., Orzes, G., & Rossi, T. (2021). One-to-one relationships between Industry 4.0 technologies and Lean Production techniques: a multiple case study. *International Journal of Production Research*, *59*(5), 1386-1410. https://doi.org/10.1080/00207543.2020.1821119

D'Oria, L., Crook, T. R., Ketchen Jr, D. J., Sirmon, D. G., & Wright, M. (2021). The evolution of resource-based inquiry: A review and meta-analytic integration of the strategic resources–actions–performance pathway. *Journal of Management*, *47*(6), 1383-1429. https://doi.org/10.1177/0149206321994182

Delloul, S. (2024). The impact of the transition from mechanical to organic structure on administrative effectiveness in the organization. *Recherchers economiques manageriales*, *18*(2), 380-403. https://asjp.cerist.dz/en/article/261457

Fang, Q., Despeisse, M., & Johansson, B. (2025). Review of resource efficiency assessments in manufacturing: An integration model for production information systems. *Cleaner Environmental Systems*, 100318. https://doi.org/10.1016/j.cesys.2025.100318

Frank, A. G., Dalenogare, L. S., & Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International journal of production economics*, *210*, 15-26. https://doi.org/10.1016/j.ijpe.2019.01.004

Gunawan, R. R., Siagian, H., Tarigan, Z. J. H., & Jie, F. (2024). The role of supplier-buyer relationship in enhancing business performance through supply chain management practice, total quality management implementation and product innovation. https://doi.org/10.5267/j.uscm.2024.5.022

Handoyo, S., Suharman, H., Ghani, E. K., & Soedarsono, S. (2023). A business strategy, operational efficiency, ownership structure, and manufacturing performance: The moderating role of market uncertainty and competition intensity and its implication on open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(2), 100039. https://doi.org/10.1016/j.joitmc.2023.100039

Hoang, P.-D., & Nguyen, T.-L. (2026). Toward sustainable development in mechanical engineering: an MCDM framework for technology management in Vietnam. *Cogent Business & Management*, *13*(1), 2632750. https://doi.org/10.1080/23311975.2026.2632750

Huynh, C. M., & Vo, L. K. (2023). The Effects of Dynamic Capabilities on Operational Performance: An Empirical Study from Manufacturing Enterprises in Vietnam. https://ideas.repec.org/p/pra/mprapa/119170.html

Indriyani, E. P., Suhariadi, F., Lestari, Y. D., Aldhi, I. F., Rahmawati, E., Hardaningtyas, D., & Abbas, A. (2025). Sustaining infrastructure firm performance through strategic orientation: Competitive advantage in dynamic environments. *Sustainability*, *17*(3), 1194. https://doi.org/10.3390/su17031194

Kafetzopoulos, P., & Kafetzopoulos, D. (2026). The influence of Industry 4.0 capabilities on organizational exploration and exploitation. *International Journal of Industrial Engineering and Operations Management*, 1-18. https://doi.org/10.1108/IJIEOM-10-2025-0263

Kaneku-Orbegozo, J., Martinez-Palomino, J., Sotelo-Raffo, F., & Ramos-Palomino, E. (2019). Applying Lean Manufacturing Principles to reduce waste and improve process in a manufacturer: A research study in Peru. In *IOP Conference Series: Materials science and engineering* (Vol. 689, pp. 012020). IOP Publishing. https://doi.org/10.1088/1757-899X/689/1/012020

Kato, T. (2021). Functional value vs emotional value: A comparative study of the values that contribute to a preference for a corporate brand. *International Journal of Information Management Data Insights*, *1*(2), 100024. https://doi.org/10.1016/j.jjimei.2021.100024

Khalili, Y., Ahmadi, M., & Keshavarz Moraveji, M. (2026). Predictive Maintenance for ESPs: Enhancing Reliability, Efficiency, and Sustainability in Oil & Gas Professionals. *International Journal of Reliability, Risk and Safety: Theory and Application*, *9*(1), 9-28. https://doi.org/10.22034/IJRRS.2026.9.1.2

Kong, T., & Feng, T. (2025). Enhancing supply chain resilience: the role of big data analytics capability and organizational ambidexterity. *Industrial management & data systems*, *125*(7), 2348-2370. https://doi.org/10.1108/IMDS-07-2024-0674

Lassen, A. H., & Larsen, M. S. S. (2025). Manufacturing innovation for Industry 4.0: an innovation capability perspective. *Journal of Manufacturing Technology Management*, *36*(9), 19-44. https://doi.org/10.1108/JMTM-09-2023-0414

López, E. J., Ruiz, J. E. P., Chávez, O. L., Muñoz, F., Velásquez, L. A. G., & Lugo, J. G. C. (2026). The Evolution of Mechatronics Engineering and Its Relationship with Industry 3.0, 4.0, and 5.0. *Technologies*, *14*(2), 81. https://doi.org/10.3390/technologies14020081

Mashudi, Sulistiowati, R., Handoyo, S., Mulyandari, E., & Hamzah, N. (2023). Innovative Strategies and Technologies in Waste Management in the Modern Era Integration of Sustainable Principles, Resource Efficiency, and Environmental Impact. *International Journal of Science and Society*, *5*(4), 87-100. https://ijsoc.goacademica.com/index.php/ijsoc/article/view/767

Micheli, P. (2026). Operations & supply chain management: principles and practice. *International Journal of Production Research*, *64*(1), 330-513. https://wrap.warwick.ac.uk/190737/

Nagy, M., Figura, M., Valaskova, K., & Lăzăroiu, G. (2025). Predictive maintenance algorithms, artificial intelligence digital twin technologies, and internet of robotic things in big data-driven industry 4.0 manufacturing systems. *Mathematics*, *13*(6), 981. https://doi.org/10.3390/math13060981

O'Higgins, D. (2023). Impacts of business architecture in the context of digital transformation: An empirical study using PLS-SEM approach. *arXiv preprint arXiv:2307.11895*. https://doi.org/10.48550/arXiv.2307.11895

Olodu, D. D., Ihenyen, O. I., & Erameh, A. (2026). Advancements and Emerging Trends in Mechanical Engineering Design and Manufacturing Processes: A Comprehensive Review. *Bilge International Journal of Science and Technology Research*, *10*(1), 161-198. https://doi.org/10.30516/bilgesci.1608837

Otioma, C. (2023a). Information and communications technology capabilities, innovation and economic performance in Africa: The role of framework conditions, entrepreneurial activity and firm learning. https://doi.org/10.26481/dis.20230302co

Otioma, C. (2023b). IT capability, organisational learning and innovation performance of firms in Kenya. *Journal of the knowledge economy*, *14*(3), 3489-3517. https://doi.org/10.1007/s13132-021-00886-8

Pires, P. B., Prisco, M., Delgado, C., & Santos, J. D. (2024). A conceptual approach to understanding the customer experience in e-commerce: An empirical study. *Journal of theoretical and applied electronic commerce research*, *19*(3), 1943-1983. https://doi.org/10.3390/jtaer19030096

Quesado, P., Marques, S., Silva, R., & Ribeiro, A. (2022). The balanced scorecard as a strategic management tool in the textile sector. *Administrative Sciences*, *12*(1), 38. https://doi.org/10.3390/admsci12010038

Rashed, M., Uddin, M. K., Islam, M. F., Faisal-E-Alam, M., Tushar, H., & Ahmed, M. E. (2025). Building resilient organizations: The role of technological capability, innovation leadership, and sustainability. *Global Journal of Flexible Systems Management*, *26*(4), 963-995. https://doi.org/10.1007/s40171-025-00471-x

Reichert, F. M., Janissek-Muniz, R., Heinze, M., Cainelli, A. d. S., & Zawislak, P. A. (2020). Innovation Capabilities and the role of Strategic Intelligence. https://aisel.aisnet.org/confirm2020/13

Sathiri, M. (2026). Predictive Maintenance Models for Smart Manufacturing Systems. *IJARCCE*, *11*(12). https://short-url.cc/1wij3

Seraj, A. H. A., & Sundram, V. P. K. (2026). Optimization of Mechanical Companies Production Performance through the Operations Management Models: Moderating Role of Technology Capability. *Reports in Mechanical Engineering*, *7*(1), 152-168. https://doi.org/10.31181/rme569

Setiyo, M., & Rochman, M. L. (2023). The role of mechanical engineering in the era of industry 4.0 and society 5.0. *Mechanical Engineering for Society and Industry*, *3*(2), 54-56. https://doi.org/10.31603/mesi.10786

Sharabati, A.-A. A., Ali, A. A. A., Allahham, M. I., Hussein, A. A., Alheet, A. F., & Mohammad, A. S. (2024). The impact of digital marketing on the performance of SMEs: An analytical study in light of modern digital transformations. *Sustainability*, *16*(19), 8667. https://doi.org/10.3390/su16198667

Stojanović, J., & Milovanović, G. (2020). The importance of lean manufacturing and six sigma concept for quality management of supply chain business processes. *Facta Universitatis, Series: Economics and Organization*, 285-297. https://doi.org/10.22190/FUEO200118021S

Valamede, L. S., & Akkari, A. C. S. (2020). Lean 4.0: A new holistic approach for the integration of lean manufacturing tools and digital technologies. https://doi.org/10.33889/IJMEMS.2020.5.5.066

Vărzaru, A. A., & Bocean, C. G. (2024). Digital transformation and innovation: The influence of digital technologies on turnover from innovation activities and types of innovation. *Systems*, *12*(9), 359. https://doi.org/10.3390/systems12090359

Veile, J. W., Kiel, D., Müller, J. M., & Voigt, K.-I. (2020). Lessons learned from Industry 4.0 implementation in the German manufacturing industry. *Journal of Manufacturing Technology Management*, *31*(5), 977-997. https://doi.org/10.1108/JMTM-08-2018-0270

Wang, K., Xu, X., Mao, P., Deng, X., & Cao, D. (2026). Digital transformation and organizational readiness: evidence from Chinese construction SMEs with a dynamic managerial capabilities lens. *Engineering, Construction and Architectural Management*, *33*(7), 5783-5819. https://doi.org/10.1108/ECAM-01-2025-0069

Wichitsathian, S., & Ekkaphol, S. (2025). The mediating role of sustainable competitive advantage: A comparative study of disaggregated vs. holistic models in green hotels. *Sustainability*, *17*(19), 8954. https://doi.org/10.3390/su17198954

Zainurossalamia, S. Z., Martiyanti, D., NoorlitariaAchmad, G., Lesmana, D., & Yudaruddin, R. (2022). Impact of operational activities on customer satisfaction in cafes and restaurants: A mediating role of infrastructural elements. *Innovative Marketing*, *18*(4), 13-24. https://doi.org/10.21511/im.18(4).2022.02

Zehir, C., Allaham, M. V., & Mamedov, Z. (2024). A bibliometric study on Turkey-Azerbaijan economic relations. *Yönetim ve Ekonomi Dergisi*, *31*(2), 227-246. https://tinyurl.com/3z8k9f8k