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Exploring the impact of Customization Strategy, Product Variety on Operational Performance in Automotive Manufacturing Industry

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A B S T R A C T

This research has three big contributions to car manufacturing companies in China. Firstly, it defines how an improvement in product variety impacts operational performance. Second, it explains the impact on operational performance of customization strategies practices. Thirdly, the thesis identifies the relative differences of impact by five types of customisations of the product variety on specific aspects of operating performance. It includes a comprehensive analysis of the literature associated with the effects of product variety and customisation as well as techniques for coping with trade-offs between product variety and operating performance. By adopting a quantitative research method, a survey of 12 car manufacturing sector companies from China was conducted. The objectives and questions of this research is clearly defined and outlines the difference the research is to bring to information. This also establishes theories that take into account the relationship between product variety, customisation and operational efficiency. The project focuses on data collection methods and a questionnaire is designed to be submitted to Chinese car manufacturing companies. This gives the empirical results of this study a detailed debate. Finally, the research is concluded by providing a summary of the results of the work and of the study's theoretical contributions. Effective mass customisation and customer-driven development will offer Chinese carmakers a variety of benefits. The basic results, therefore, have significant management consequences for Chinese car producers to pursue numerous strategies under different product design profiles.

1. INTRODUCTION

Mass customization is replacing large-scale production and a major movement is being driven for China's automotive makers to expand their offerings and provide consumers with more options and choices. But only rising the variety of products will only render competition worse. Rather, how the Chinese car factories operate and how they will enforce their operational performance to implement product variety are main issues. Chinese companies must define the potential effect of the product variety on operational performance, which might vary from the degree of customization, before deciding suitable solutions and strategies for the management of the product variety (Nahmens and Bindroo, 2011). Many Chinese automakers have in

particular started realizing that there is a compromise between product variety and operational performance (Pishdad and Taghiyareh, 2011). Numerous approaches for enhancing operating efficiency have been proposed to handle the effect of the product variety (Lyons et al., 2020). Nevertheless, differing customization levels involve diverse techniques and solutions which differently impact operational performance of the company (Zu'bi et al., 2012). This research seeks to assess the potential effect that product diversity may have on operational efficiency and to test a model designed to handle the effect that is eligible to customize the product (Al-Zu'bi et al., 2012). The findings include evidence that confirms and opposes prevailing beliefs on related issues of product-variety. The analysis (Pech and Vrchota, 2022) examined that the improvement in product variety was found to vary operational performance due to the mix of customisation and product variability. The effects of Variety Control Strategies (VCS) was evaluated with the results. The findings are viewed as a paradigm of operational performance architecture that promotes the management of product variety changes (i.e., the interaction between product variety improvement techniques and operational efficiency) (Salvador et al., 2002). This relationship is further studied by the degree of customization (for instance, high level or low level customisation) (Version, 2020). In order to address the challenges of product variety, multiple approaches such as cost control, differentiation and partnerships that can impact operational performance differently, are required for varying degrees of customization. But it remains unclear whether such a policy will affect operating success and whether policy and efficiency in Chinese car manufacturers will differ by degree of customisation. Thus, by undertaking empirical work it is helpful to resolve the difference between theory and reality. The findings in (Yu et al., 2014) help organizational decision-making by offering guidance to managers in Chinese car-making firms on how to make business functional architecture more accommodating for heterogeneous customer demands and responses. For China, rising manufacturing costs because of growing product variability and a comparatively small customization degree are a big challenge that needs to be solved (Omachonu et al., 2004). Chinese companies in the emerging markets still face various problems with a paradigm shift towards mass customisation, which presents quite a threat. This involves adhering to mass production, retaining high quality and low cost factors, or moving into mass customisation to meet the particular needs of the consumers. The researchers will therefore examine the effect of the customization strategy on operations and maintenance efficiency with the mediation role of the product variety in the car production industry with a view to solving this problem. This research can then help Chinese car manufacturers build variety flexible approaches to achieve global competitiveness and maintain a portfolio which is eligible to have effective and reliable operating performance at the level of the manufacturer's customisation. In particular, the research provides managers in car manufacturing companies in China with proof of the impacts on operational performance by an increasing product diversity, categorized using analysis across a five-stage framework from Pure Standardisation to Pure Customisation. Overall, the implications of increases in product variety on a comprehensive range of performance items that are usually required for the effective organization are provided to managers in China car manufacturing companies.

2. THEORETICAL FRAMEWORK

In order to fully understand the role of concept of research, the researcher is important to define core principles that are used in study. This is a conceptual framework that includes variables customization strategy, product variety and operational performance and their relations with dimensions that clarify and forecast how product variety has potential impact on operational performance, which may differ based on the degree of customisation offered.

2.1. Customization Strategy Dimensions

Pure Standardisation - This is the delivery of specific goods with pre-defined alternatives and designs that applies to pure specifications. Items are sold to all customers only and no discrepancies between different customers.

Segmented Standardisation - Segmented standardization includes the distribution of standard goods with predefined choices and configurations, where consumers may configure

product shipping, delivery times, or delivery places (Muhammad Turki Alshurideh et al., 2022a).

Customised Standardisation- Custom standardization includes production of various types of products manufactured on consumer orders using standard materials where a range of pre-defined options are open to customers; design takes place on the assembly level and fabrication is not customizable(Ahmad Ibrahim Aljumah et al., 2022a).

Tailored Customisation- It refers to the procurement by customer of various types of goods, in which a variety of previously specified specifications are provided to clients; modification is carried out during manufacturing processes but product specifications are not configured (Bawaneh et al., 2023; Fatima et al., 2023).

Pure Customisation- The customization is simply a matter of delivering a special, designed-for-order package that catches the customer's feedback at the beginning of the design process (Almasaeid et al., 2022).

2.2. Product Variety Dimensions

Fundamental- Fundamental variety is a metric that (Mohammed T. Nuseir et al., 2022) have established to calculate the distinct variant in various models in a variety such as body styles, driving train configurations (front or back) and unique country features, such as the left / right drive (AlDhaheri et al., 2023).

Intermediate- The measurement of intermediate variation described by (H. M. Alzoubi et al., 2022c) is essentially an index extracted from the addition of elements, including colors, wire harnesses and all of the elements, during the assembly stage of development which impact the product sequence and parts and material flow into the manufacturing line.

Peripheral- The peripheral variety represents basically the number of choices which may be mounted or modified during or after development without altering the fundamental structure of the component (Akour et al., 2023).

2.3. Operational Performance Dimensions

Cost- By late configuration and by postponement of the form, production costs can be augmented or lowered, a strategy designed to reduce inventory cost by postponing the downstream distribution of a product in the production chain. A larger variety of products can increase manufacturing costs by increasing the manufacturing process' complexity (I. Akour et al., 2022; A I Aljumah et al., 2022a; Hani Al-Kassem, 2021).

Variety- Variety makes the production, manufacture and management of these goods in industry more difficult. On the company level, higher operating and labour expenses, greater production costs are expected because of more complex procedures, products, regular adjustments and methods for quality control. A number of products need specific materials and technological assistance in the field (Louzi et al., 2022b), making management of efficient product support or service delivery for consumers more difficult.

Quality- Control of quality is a mechanism by which the organization seeks to preserve or enhance the product consistency (Alshurideh, M.T., Al Kurdi, B., Alzoubi, H.M., Sahawneh, N., Al-kassem, 2022). The findings show a higher consistency of the goods, reduced manufacturing prices and a quicker production and time to market with good operating efficiency (Alshawabkeh et al., 2021; M. El Khatib et al., 2022a).

Responsiveness- Varieties and executing decisions decide the sensitivity of a production business to demand vulnerability (Abudaqa et al., 2022; H M Alzoubi et al., 2020). Responsiveness helps businesses to minimize prices by correctly balancing production with demand which provides a distinctive business lead.

2.4. Operational Definition

2.4.1. Customisation Strategy

Customization strategy involves distribution of wide market goods and services that are customized to meet the needs of a particular customer (Khan et al., 2022). This is a marketing and manufacturing strategy that blends the versatility and personalized product customization to the low unit cost of mass production. Certain names are made-to-order or built-to-order to customize the inventory (Ahmed and Nabeel Al Amiri, 2022; Nadzri et al., 2023). This helps a consumer to develop those product characteristics while retaining cost-oriented solutions for mass-produced products. In certain cases, the product components are upgradable (M T Alshurideh et al., 2022). With this versatility, client can build a semi-custom final product by mixing and matching

options. Variety and customization tend to do with various definitions. Variety offers consumers the option but does not require the commodity to be specified (Nuseir and Aljumah, 2020). A highly flexible service will serve as a configuration proxy, but real customization calls for customer engagement (El Khatib et al., 2021). Nonetheless, addressing the variety of different market roles inevitably requires understanding the principles of customer engagement and configuration. Goods may be separated by stage in the design production chain, i.e. at the point of injection of the consumer feedback. In order to determine the configuration standard, defining the point of initial customer engagement is crucial (Al-Kassem, 2017; H. M. Alzoubi et al., 2022g; Mohammed T. Nuseir et al., 2022). The greater customization level and the degree of consumer involvement in the manufacture and supply of the product is necessary to evaluate the degree of customization earlier (M. Alshurideh et al., 2023).

2.4.2. Customisation Strategy dimensions

There are five dimensions for customisation strategy that include, Pure standardisation, Segmented standardisation, Customised standardisation, Tailored customisation and Pure customisation (Aityassine et al., 2022; El Khatib and Ahmed, 2020).

Pure standardisation - The model is based on a "dominant layout" aimed at a wide range of clients, products being produced to the widest possible scale and then shared with everyone. The customer must select or turn to another product without having any clear control on layout, development or even marketing policies (Aziz et al., 2023; Sakkthivel et al., 2022).

Segmented standardisation - Standardized in a small range of features are the products offered. To order to accommodate various model measurements but not on request of particular customers, a basic concept has been changed (H. M. Alzoubi et al., 2022e). For worst, the delivery process should be far more personalized. It occurs in the production cycle of big goods, for instance.

Customised standardisation (modularisation) - Goods from common parts are ordered and the assembly is customized to the particular use. The basic architecture is not modified and all the parts are manufactured massively for the aggregate market (El Khatib, 2015). Every purchaser gets its own settings. However, the possible configurations are limited by the number of components possible (e.g. automobile body with standardised material) (Al-Dmour et al., 2023; Aljumah et al., 2020; Khatib and Opulencia, 2015).

Tailored customisation - The business shows to a prospective consumer a new concept and it then adapts it to the desires or needs of the client. Customization works down to the production stage, not the concept stage (H. M. Alzoubi et al., 2022f).

Pure customisation - Once consumer expectations enter directly into the design process itself and the Product is designed for service, individualization reaches logical conclusion (Abudaqa et al., 2021; Al-Awamleh et al., 2022). The model, production, installation and distribution of all stages are highly personalized. The typical polarization between buyers and sellers has been an inclusive relationship in which both parties share in the decision-making of one another (A I Aljumah et al., 2022b; Muhammad Alshurideh et al., 2022; Mubeen et al., 2022).

(Mat Som and Kassem, 2013) analysed and highlighted four degrees of product customisation: pure customisation, tailored customisation, standardised customisation and non-customisation. A modern concept for particular consumers is supported with pure customisation. Changes to an existing specification are suited to tailored customisation. Standard configuration allows you to select from a certain range of template choices. Non-customization simply takes a current template as it is. The first three categories are those used by (Louzi et al., 2022a; Yasir et al., 2022). The fourth includes items that are not custom-made or normal products.

2.4.3. Product Variety

A vast number and selection of products are now sold in today's markets, as are intense global competition, accelerated innovative product growth, and versatile and scalable production processes (Amiri et al., 2020; El Khatib et al., 2019). Companies are expected to closely evaluate the levels of their product variety in order to create incentives that maximize market share and benefit. So far, the trend has been to raise goods and customize them more and more. Businesses is able to improve customer loyalty by adapting quickly to adjust tastes in style, feature, colour, scale,

packaging and accessories. The effect has been an increase in competitiveness (Aljumah et al., 2021a; Khatib et al., 2022). Manufacturers are argued that for lower unit costs of production, they prefer minimal process complexity and low product proliferation levels. The assumed concept of performance in marketing aims, however, at meeting specific customer requirements and at growing market share and development by means of broader product lines (Alshurideh et al., 2022; Nuseir, 2021). Industries will aim to balance the income benefits of the variety against its expense impact in order to optimize longer-term benefit (Al-Maroof et al., 2022a; Khatib et al., 2016). In addition, with increasingly evolving consumer demands, businesses can no longer benefit from manufacturing high quantities of traditional goods (H. M. Alzoubi et al., 2022a; Blooshi et al., 2023).

2.4.4. Product Variety dimensions

There are three dimensions for product variety that include Fundamental, Intermediate and Peripheral.

Fundamental - In the Chinese automotive study, several manufacturers used a technique to eliminate variations between radically different products in order to achieve economies of scale. They described this as a fundamental variety. The Design Mix is based on the number of vehicles and configurations multiplied by the amount of separate body shops and production lines on each site, and on the nature of the combination. At the development and design, at a fundamental variety stage (Mubeen et al., 2022).

Intermediate - The intermediate variance between these extremes is driven by the preference of customers. The variety of components results from an intermediate product selection partially influenced by the consumer's preference (e.g. exterior colour, motor configurations and transmissions) (Arshad et al., 2023; El Khatib and Ahmed, 2019). Component sophistication, however, also reflects the effect of increased variety on product specification (e.g. the number of principal wire bandages and the component specific across models) and the process supply (e.g. the number of assembly area component numbers and the number of assembly area suppliers) (Aljumah et al., 2023; H. M. Alzoubi et al., 2022d). Intermediate variety enhances the component size during manufacturing assembly, which impacts product ordering and the movement of components and materials.

Peripheral - The user should be given wide choice by providing a broad range of choices (i.e. end items) for simple designs (Al-Kassem et al., 2013; R. S. Al-Maroof et al., 2021b). They described this as a peripheral variety. The nature of the option and flexibility of the option are peripheral variety measurements because they vary from the main specification. The option contents are calculated by the percentage of vehicles constructed with various options aggregated for every model within the facility; while variation of alternative contents is reported in each configuration and in each configuration produced in the facility. A possible "choice bundling" limitation where such alternatives could not be selected freely, except as part of the kit. The producer is therefore pushed upon consumers to be technologically incompatible. O f examples, a convertible sunroof cannot be ordered. Peripheral variance is a kind of general variant in which Chinese producers will introduce variety at a late stage.

2.4.5. Operational Performance

Operational Performance is the performance of manufacturing firms based on calculated metrics such as cycle time, quality, variety management and regulatory compliance according to criteria of efficiency, effectiveness and environmental liability. The cost of management, diversification, quality assurance and responsiveness in the vehicle part production was greatly influenced by high customisation and product varieties (Haitham M. Alzoubi et al., 2020; Kurdi et al., 2022; Nuseir et al., 2021). Quality and rework issues will increase as the product variety expands and changes in engineering are induced by the product variety, resulting in more complicated tasks and expands in preparation which require more supervision (A. Al-Maroof et al., 2021; T M Ghazal et al., 2023a). Operational performance of manufacturing firms is strong, indicating that a high index or score on cost, variety, quality and responsiveness is usually sustained (M T Nuseir et al., 2022a). Such measures that assess the operating efficiency of the company in total measures are very helpful and valuable, because they help the organization recognize the specific field in which it fails and aim to enhance such aspects (H. M. Alzoubi et al., 2022b). Since a company with a good operational performance is

considered strong by clients, employees and customers, every company is actively seeking to enhance their performance (Varma et al., 2023).

2.4.6. Operational Performance dimensions

There are four dimensions of operational performance that include cost, variety, quality and responsiveness.

Cost – This tests how successful the organization can offer products or services. High product diversity raises prices and the sophistication of the manufacturing methods. In fact, there are substantial costs in conjunction with development and releasing to deliver a new product (H. Alzoubi et al., 2022; Alzoubi and Ahmed, 2019; El Khatib and Ahmed, 2018). The corollary is that with the rise in product diversity, operational efficiency is expected to decline as a result of higher direct labour and materials costs and overhead manufacturing costs. The calculation of three indices involved the commonality, variance point and set-up costs in order to identify the expense attributable to the product variety. The commonality Index accounts for the use of the uniform components, while the variance point involves the use of an inventory-reducible and time-bound distinction point and the set-up cost index calculate the output contribution of the set-up to total costs (M. Alzoubi et al., 2021; Nuseir and Elrefae, 2022). The method has been proven successful in mitigating negative cost impacts of product variety and mass customization by standardization or commonality and postponing contribution in relation to different variety requirements.

Variety – It tests that the organization can fulfil its heterogeneous consumer base's unique wishes. Design-for-diversity practices help car manufacturing companies in China to manage and mitigate adverse effects of variety in products on operational performance (Akour et al., 2021; El Khatib et al., 2020b). This improves organizational effectiveness by facilitating product quality, drawing on commonalities and promoting cross-functional and cross-border collaboration by streamlined product designs. When the size of components and number of product lines grows, direct labour costs and efficiency become exposed to increasingly diverse manufacturing parts to work with. If system capacities are not expanded, batch sizes can be limited and process improvements expanded to accommodate the broader spectrum of consumer requirements. The study of (R. S. Al-Maroof et al., 2021a) found that a major effect on operating efficiency is the mean available material for each vehicle (i.e. peripheral diversity), and components size (i.e. intermediate variety).

Quality – The definition of the quality is broad, with a variety of sub-dimensions, including the quality of operation such as what are the basic operating properties of the product or the service, the quality of conformance such as which product was manufactured or the service conducted according to the specification and the quality of reliability such as whether product functions without interruption or repair needs for a long time and whether service operation reliably executes its tasks over time (T M Ghazal et al., 2023c). Quality assurance is a mechanism by which the organization aims to guarantee the preservation or enhancement of product quality. Each phase in the manufacturing cycle includes quality checking. The companies also start testing raw materials, sampling them from the manufacturing line and checking the final product. Checking at the various manufacturing levels allows to assess whether a development problem occurs and how to fix it in future. For car manufacturing, quality assurance depends on how parts match and communicate to ensure the effective and efficient running of engines.

Responsiveness – It tests how easily the customer's desires can be fulfilled. Speed and reliability are the two basic features of responsiveness to demand. The speed of delivery typically means how quick operations will achieve a need after it has been established. Reliability of delivery refers to the willingness, when provided, to deliver goods or services (Muhammad Turki Alshurideh et al., 2022b; Haitham Alzoubi et al., 2020; Nuseir, 2020). A manufacturing firm should achieve a high degree of reliability while retaining long lead times. Typical distribution efficiency metrics include the number of orders issued in line with the expected period and the total late arrival. For manufacturing firms which are connected in a supply chain, delivery reliability is especially critical. The empirical study concluded that the improvement in the option quality increases overtime, rework and storage, while bundling

options with a couple of packages will minimize the reserve capacity needed. Furthermore, the variety of manufacturing components increases the scheduling complexity by determining when to stock and when to reorganize parts orders.

2.5. Car Manufacturing Companies in China

After 2008, the car industry in China is the largest vehicle device production market in the world. Since 2009, Chinese car production has been above European Union production or combined US and Japan (T M Ghazal et al., 2023b). The China Association of Car Manufacturers is the main trade organization representing the Chinese automotive industry. In China, there are 12 car manufacturing companies, of which "Big Four" are SAIC Motor, Dongfeng, FAW and Chang'an. Geely, Brilliance Automotive, BYD, Chery, the Guangzhou Automotive Company, Beijing Automotive Company, Great Wall and JAC are all Chinese automotive makers. However, many foreign manufacturing companies have collaborations with domestic producers.

While China has sold most of its vehicles within China, in 2011 there were 814,300 exports. China's domestic market offers a stable foundation to its automakers and Chinese economic policymakers intend to develop internationally competitive, highly lucrative, and reliable automotive companies over the years. In 2009, China produced 13.79 million cars, 8 million passenger cars and 3.41 million commercial vehicles and overcame the USA as the world's largest car manufacturer in volume (M. T. Alshurideh et al., 2023b; Alzoubi et al., 2019). Sales and production reached 18 million units in 2010, with 13.76 million passenger cars, each being the largest in history by any country. Overall Chinese car production hit 23,720 million in 2014, representing 26% of global automotive manufacturing. All of this is accomplished by mass production with fast capacity expansion. Yet Chinese companies in the emerging markets still face various problems with a paradigm shift towards mass customisation, which presents quite a threat. This involves adhering to mass production, retaining high quality and low cost factors, or moving into mass customisation to meet the particular needs of the consumers. The researchers will therefore examine the effect of the customization strategy on operations and maintenance efficiency with the mediation role of the product variety in the car production industry with a view to solving this problem.

3. LITERATURE REVIEW

3.1. Relationship between Customization Strategy and Product Variety

Variety and customization are separate philosophies even though they are related(Ahmad Ibrahim Aljumah et al., 2022b; M. El Khatib et al., 2021; Tariq et al., 2022b) expressed the distinction that the variety allows consumers the preference but does not require the product to be specified. A high-variety service can serve as customization proxy, but customer interaction with the product specification requires real customization. However, given the variety of different tasks allows the consumer engagement and customization ideas to be taken into account. Products are distinguished by the level of the customization that is at the point of injection of consumer data.

The word 'product variety' as used for a number of definitions, is vague. Types of customisation relate to the three dimensions of variety such as fundamental, intermediate and peripheral. The variety in products was calculated on a fundamental basis such as the number of core design models, on an intermediate basis such as the number of technological choices, sizes and colours depending on the core design and on a peripheral variety such as number of common choices and accessories independent of the core design. In the automotive sense for example, the fundamental variety uses to mix architectures, configurations, and body types, to include the number of subassemblies available, for example the number of engine / transmission variations, and to choose choices for peripheral variants without impacting key designs such as seats, the sun roof and electric mirrors. (Alzoubi, H MAlhamad et al., 2021; Harguem et al., 2022) shows that each automaker's customization has been listed as leading to pure standardization (PS) Segmented standardization, Customized standardi zation, tailored customization, or pure customization. The concept of PS has been described as providing standard products with predefined design options. SS was described as the provision of goods where clients may customize product labelling, distribution schedules, or locations for distribution. Product customisation happens at the selling level. With predefined

configurations and styles, the final product is standard. The concept of CS is the supply of different types of goods in which consumers are given a range of pre-defined choices. Using common parts, goods are assembled per customer order. At the assembly customization is achieved. TC was defined as provision of different product types in which a variety of pre-existing designs are available to customers. Products are generated by order of the consumer. The customization process is accomplished at the manufacturing level. PC has been described as providing a customized product concept, which incorporates consumer feedback at the beginning of the design phase. Products are for buying purposes. At the production point, customization is accomplished.

(Nuseir and Aljumah, 2020) suggested that variety of products and customization will differ in line with product management approach by the supplier. The attributes of each organization have been categorized into four types of customization. The nodes differentiated high product variety with high customisation, low product variety with high customisation, high product variety with low customisation and low product variety with low customisation. The most significant adverse impacts on operating efficiency with an improvement in product variability were high variety with low customization and low variety with low customization. This group is now accompanied by high variety with high customisation or low variety with high customisation. Mean values of all four samples show that low-customization groups are much more influential than high-customization samples by an improvement in product diversity.

The study observed, along with simple, intermediate and peripheral dimensions of the variance, that TC conditions displayed the highest levels of product variety. (El Khatib et al., 2020a; Farrukh et al., 2023; Tariq et al., 2022a) also found that increasing the variety of products available for low-customization styles improves more competition than for high customization forms with respect to customer loyalty, market share and the competitive edge. Nevertheless, changes in product variety often introduce higher prices for low customization styles than for high customization forms. In comparison, greater product variety in low customization types contributed to the use of varied control techniques such as the use of generic parts, postponement and versatility in production as opposed to high customization types.

Therefore, the findings suggest that in the case of a low degree of customization, an organization with a high level of established product variety usually has greater effect on increasing the product variety than a low-level of variety. Typically, higher styles of customisation will have a greater range of goods than lower styles of customisation, with a general improvement in variety from pure standardization to pure customization. Inattentively, the most high-quality product variety has been demonstrated by tailored customization. This can be demonstrated by the fact that the PC industries typically do not make good use of their varieties. The general opinion is that a high customization level provides greater product variety than a low customization level.

Based on the following information, the following hypothesis is formed:

H1: A high level of customisation has more product variety than a low level of customisation.

3.2. Relationship between Customisation Strategy and Operational Performance

The research shows that customization practices can offer both cost savings and product / service quality benefits for Chinese car manufacturers, which also improve operational efficiency. Some inspectors thought that the technique of customization increases the manufacturers' efficiency (I. Akour et al., 2022; Aljumah et al., 2021b; M. T. Alshurideh et al., 2023a); some argued that MC's variety and sophistication would threaten the company's profitability. In addition, customization approach includes elicitation methods, process versatility, advanced manufacturing technology, just-in-time supply chain and integrated logistics information system, which have specific roles to play in enhancing operational performance; In particular, in terms of cost and product / service efficiency the elicitation are highly critical to organizational success.

Mass customization is a method which uses IT, modular processes and organizational frameworks to provide a wide range of goods and services at a price similar to that of mass manufactured products, which meets the unique needs of individual consumers. The fact that customers actively engage in the value creating process in the

mass customisation is an important feature which differentiates from mass production. Each customer has a personal identity that provides details on the design, production and distribution of the product or service depending on their particular preferences. The point of consumer participation (i.e. de-coupling point) is a vital element in defining the specification of methods that should be used to produce mass customised products (RAMDAS, K. 2009). Consumer responsiveness (e.g. capacity for companies to deliver customer requirements within a reasonable period and times and expense to the customers) and operational preparation (e.g. information samples) are the key decision drivers in the framework of the product production process. (Nuseir and Aljumah, 2022) also proposed main factors affecting the achievement of mass customization that include consumer factors such as consumer participation and desire to pay a significant premium; product factors such as consumer exposure and adaptability; market factors such as market variety due to the nature of the competitive marketplace; industrial factors such as information and production technology growth; and organisational factors such as production / allocation flexibility and willingness to alter.

Customisation strategy requires the manufacturers to use sophisticated technology and methods to completely redesign the product and system. To be specific, (Chen, 2021) offers an easily understandable framework for the design of the production system to adapt cost-efficiently to each customer's needs. With the assistance of state-of-the-art information technology and managing customer relations, elicitation can assist manufacturers in deciding whether market demand is unique to them such as differentiation option, how much they want to pay for their customisation such as cost option and the input from previous buying experiences such as relation option. These knowledge will enable suppliers adjust their internal production processes and logistics and find the right customisation approaches and satisfy consumer requirements. In fact, prompt consumer knowledge exchange speeds up decision-making which also leads to reduced lead time. Based on that knowledge, manufacturers can best match the product to the needs of consumers, which not only decreases demand, but also increases quality of product and service.

One of the purposes of postponement and co-design is to plan the product and the process in order to delay completion until consumers have obtained their orders. Investigators have observed that waiting will reduce the expense of production (I. Akour et al., 2022; Aljumah et al., 2021b; M. T. Alshurideh et al., 2023a) also showed that the postponement and the company results were strongly and favourably linked. (Al-Maroof et al., 2022b; M T Nuseir et al., 2022b) argued that co-design is an important means of increasing construction quality and paving the way for many potentials to save costs. In turn, it will speed up the production process and boost the quality and design success of projects by considering partner ideas for product design. Through the implementation of versatility in design practices, the manufacturer not only can accumulate the output of pieces which reduces the cost for the package, but also remove semi-finished, much cheaper finished products. Some scholars suggest that this will cut costs without losing efficiency. In addition, consumers will sense the efforts of companies by enhancing the versatility of product and process design by being made more customized. Having improved output and development for their specifications, suppliers will also increase consumers' perceived quality level. In fact, with their specifications, the quality and development are higher. In fact, the inclusion of product design of consumer knowledge will help satisfy demand and goods, which improves goods / service compliance and efficiency.

Throughout China, TC appeared to be modularized to the full level, and PC, CS, SS and PS were used. The highest degree of postponement was also demonstrated by TC, followed by PC, CS, PS and SS. The highest score for cellular development was PC, CS, PS and SS. A high level of customization firm such as TC and PC will then concentrate more on customer interaction, differentiation and variety control, which can result in greater efficiency and operational performance consistency.

Based on the following information, the following hypothesis is formed:

H2: High types of customisation have a greater positive effect on operational performance than low types of customisation.

3.3. Relationship between Product Variety and Operational Performance

(Alzoubi, H MAlhamad et al., 2021; Harguem et al., 2022) indicates that variety in products have a huge positive effect on consumer quality, competitive benefit and market share. But even more so, in technical problems such as R&D expense and design/change costs for engineering, the product variety did have a major negative impact. Increasing a manufacturer's product variety faces a host of technological and design problems. Product variation adds added difficulty by requiring manufacturers to adjust processes in engineering. The costs for developing a product as each new feature will be produced and tested require investments in new product varieties. With growing product variety, the unit cost of an item often rises, mostly due to the growth in overheads. The effect on operating performance of product variety focuses on the negative consequences such as expense and difficulty. A product's architecture and complexity account for 70 percent of the final cost (Salvador et al., 2002) also stressed that, based on the number of products such as materials, components, packaging; activities such as design adjustment, timing of production; flows such as production position and distribution channel; and inventory such as raw materials, processing and finishing, the complexity costs of product variety varies from 10 percent to 40 percent of overall output. (Nuseir et al., 2020) suggested that the expense of scales declines with an increase in volume, typically decreasing by 15 to 25 percent every time volume doubles. The cost of production complexity such as construction, material storage, supplies, and other operating expenditures are included in the variety related costs. For most cases, with the rise for variance, prices typically escalate to a range of 20% to 35% per product, where variability doubles.

The high diversity of products raises costs and the difficulty of manufacturing processes. In addition, substantial development and start-up costs are involved in launching a new product (RAMDAS, K., 2009). As a result of higher direct labour and costs of materials, overhead production such as stock processing, quality control, computer technology or service use, distribution times and inventory volume, the anticipated effect is that the manufacturing efficiency of internal operations will decline as a result of increased product variety . The difficulty of manufacturing also contributes to the requirement that due to the variation in the amount of parts, more equipment, process areas and floor space are used. As a result of an increase in the number of components, product complexity increases as well. The diversity of processes for every product variant attributable to process alternatives is the variety and sophistication of the processes.

The adverse effects of product variety can be mitigated by producing flexible manufacturing programs. The cellular processing, for instance, makes it possible to manufacture a wide variety of products with an effective mass production by merging products or parts with identical manufacturing and design characteristics into families and setting aside processes or cells for their production. Therefore, as advanced technologies and sophisticated corporate control are used, the effect of the product variety can be reduced (Pishdad and Taghiyareh, 2011) regarded product complications as having a major influence in automotive part development on the costs of inspection, quality assurance and equipment maintenance. Problems with quality and rework will escalate with an expanded variety of products and technological change due to the variation of products contributing to more difficult activities and preparation changes that involve more monitoring effort.

(Gulseven and Ahmed, 2022; M. El Khatib et al., 2022b) also addressed the trade-offs in distinct products industries between product quality and product variety. Zhang, X., & Chen, R. (2006) noted that as products volume and the number of product lines rise, direct labor costs and efficiency may be affected by the growing amount of manufacturing staff operating with specific components. If system capacities are not expanded, lot sizes must be limited and procedure improvements made to accommodate the broader spectrum of consumer requirements. The study of (Salvador et al., 2002) suggested that the major effect on the labour efficiency is the mean opted material for each vehicle such as peripheral variety and the component complexity of the system such as intermediate variety. However there was no significant correlation with job efficiency or consistency in the model mix i.e. fundamental variety, since plants have a sufficiently high level of tooling for each stage of the model mix due to the

versatile manufacturing environment in the body shop. Furthermore, the variety of products improves product stability and manufacturing efficiency by incorporating new technologies, such as CAD, CAM and NC machines.

(Lee et al., 2023) came up with the concept of Design for Variety. In this DFV concept, the calculation of three indices involved the commonality, variance point and set-up costs in order to identify the expenses attributable to the product variety. The commonality Index accounts for the use of the uniform components, while the variance point involves the use of an inventory-reducible and time-bound distinction point and the set-up cost index calculate the output contribution of the set-up to total costs. The method has been proven successful in mitigating negative cost impacts of product variety by standardization or commonality and postponing contribution in relation to different variety requirements.

Based on the following information, the following hypothesis is formed:

H3: High variety of products can have a positive impact on both revenue and market share but may also have negative impact on operational performance regarding the cost.

3.4. Relationship among Customisation Strategy, Product Variety and Operational Performance

The researchers explored the connections between operational performance, the customization degree and the provided product variety. A rise in product diversity was found to affect operational performance significantly based on the combination of the customisation degree and the product diversity. (Al-Kassem, 2014; Lee et al., 2023) found that in accordance with the fundamental, intermediate and peripheral measurements, TC environments display the highest degree of product variety. A low degree of product customisation (in PS and SS environments) was found to have a more significant effect on operational performance than a high degree of customisation for a number of key functional attributes. These included the unit cost of the product, manufacturing cost, manufacturing lead time, manufacturing complexity and material cost. A low degree of product customization was found to have greater impact on operating performance in PS and SS environments than a high degree of customization for certain core functions. That include manufacturing unit costs, development costs, time to manufacture, and volume of development and material costs. The research has also shown that that the variety of goods in low customization forms improves competition more than high customization form in terms of customer loyalty, market share and competitive advantage. Increases in the variety of goods, however, often place larger costs on low customisation forms than on high customisation forms. In comparison, product ranges have expanded in low forms of customisation to result in the introduction of variety control strategies that includes use of standardised parts, postponement and versatility of production than in high-customisation styles. In addition, it has been observed that the predominant degree of customization is a more important determinant of the effect of a product variety improvement on a variety of main features like manufacturing costs, inventory costs, shipping costs, manufacturing complexities, production lead time and demand forecasts. In several dimensions of operational performance, HVLC has historically had a higher degree of adverse effects compared with LVLC. In other areas of operational performance (for example production and transit costs) a particular apparently faulty cluster, LVHC, has also had a greater adverse effect than HVHC. The effect was, however, smaller than for low configuration (HVLC, LVLC) clusters. In brief, growing the diversity in a concentrated plant or increasing variability in modular production by the innovation in process technologies to shift to the next stage in specialization. The HVLC will follow an inherently conflicting direction due to an unequal relationship between the degree of diversification and customisation.

According to (Gaytan et al., 2023; Taher M. Ghazal et al., 2023), the opportunity to customize the product, consumer preferences and the degree of competitiveness are the three most critical reasons driving the growth in product variety. For the first of these reasons, the reciprocal level of the product variations such as fundamental, intermediate and peripheral is also required to be higher than the low level of customization such as PS and SS with respect to customization. The degree of effect on the product variety in continuous processes is usually highly followed by the cost, responsiveness, quality and versatility styles of the flow shop and

project typology. Consequently, the effect of increasing product variety across the PS to PC framework may decrease. It is attributed to an improvement in operating efficiency in increasingly custom modular configurations and upstream decoupling point. The de-coupling point's downstream demand for a wide variety of goods is extremely volatile and upstream demand decreases with a reduction in the variety due to postponement. That is one of the most advantaged solutions to reducing the costs and uncertainties for products and enhancing operational efficiency lately (Nuseira and Aljumahb, 2020). This strategy has gained tremendous interest. Therefore, a high degree of customization using an upstream decoupling point creates less influences than a low customization on operating efficiency. Extremely high product variability can greatly expand expenses and market uncertainty, leading to adverse customer service and cancelation of purchasing decisions. Furthermore, certain businesses make too many products for other customers which may decrease production costs and raise business revenues by decreasing the variety of products for a certain brand. The degree of versatility and modularity of development will also help to reduce adverse impacts related to varieties (Al-Kassem et al., 2012; M. T. Alshurideh et al., 2023c; E. Khatib et al., 2021).

Therefore, high product variation with low customization showed the largest rise in production costs with an increase in the variety of products. It was followed by the high product variation with high customization, medium product variety with high customisation, and high variety with high customisation. In the case of the high product variation with low customisation cluster, the cost of product is largest followed by low variety low customisation, high variety high customisation and low variety and high customisation clusters. As the variability grows, HVLC development conditions are more affected than LVLC conditions. This is attributed to more complex construction and higher equipment, job and operating costs. HVLC firms, therefore, face a significant trade-off between production and material prices as the product variety grows. (Zu'bi et al., 2012) found that due to the longer set-up time required for the process type, HVLC demonstrated a greater improvement than LVLC in terms of output lead time. Therefore, the production complexity of HVLC and LVLC has increased similarly. Such manufacturers need to make careful decision when growing the variety of products for example, by concentrating on peripheral and not fundamental variety and need to consider the break-even point position. In comparison, the change in the product variety does not greatly affect HVHC and LVHC clusters. Overall, analysis indicates that the customization level is more critical than that of the existing product variety provided for evaluating the effect of product versatility on operational performance. Nevertheless, the size of the existing product variety also affects some aspects of operational efficiency, particularly with regard to the corresponding low level of customisation (I. A. Akour et al., 2022). The emphasis on the differentiation, diverse control strategies and consumer interactions is usually on a high degree of customization that leads to a high level of product variation, whereas the low level of customisation, with a small level of product diversity, focuses primarily on cost leadership.

Based on the following information, the following hypothesis is formed:

H4: High product variety on the basis of low customisation showing the highest negative impact on operational performance as a result of an unsettling variability and customisation.

3.5. Research Problem Statement

This research reveals the effects of a linear, combined qualitative and quantitative approach in which the researchers investigated how increases in product variety affect operational performance in the customization stage. The findings suggest that increasing the product variety of low-customization styles improves competition of the market more than in high-customization styles. The biggest negative impact on operational efficiency, however, was a high product variety and low customization as a result of an unsettling variability and customisation. The high product variation with low customization showed the largest rise in production costs with an increase in the variety of products. It was followed by the high product variation with high customization, medium product variety with high customisation, and high variety with high customisation. In the case of the high product variation with low customisation cluster, the cost of product is largest.

High variety of products may result in an increase in revenue but not automatically increase the profitability or productivity of a company. In fact, the variety of products can have a positive effect on both sales and market share but may also have adverse impacts on operational performance. For instance, higher product diversity can increase manufacturing costs by making the manufacturing process more complicated. Consequently, companies growing their product variety will consider the impact of the product variety on the efficiency of their operations and cost profile. Market demand is rising rapidly in developing markets. Overall Chinese car production hit 23,720 million in 2014, representing 26% of global automotive manufacturing. All of this is accomplished by mass production with fast capacity expansion. Yet Chinese companies in the emerging markets still face various problems with a paradigm shift towards mass customisation, which presents quite a threat. This involves adhering to mass production, retaining high quality and low cost factors, or moving into mass customisation to meet the particular needs of the consumers. The researchers will therefore examine the effect of the customization strategy on operations and maintenance efficiency with the mediation role of the product variety in the car production industry with a view to solving this problem.

3.6. Research Model

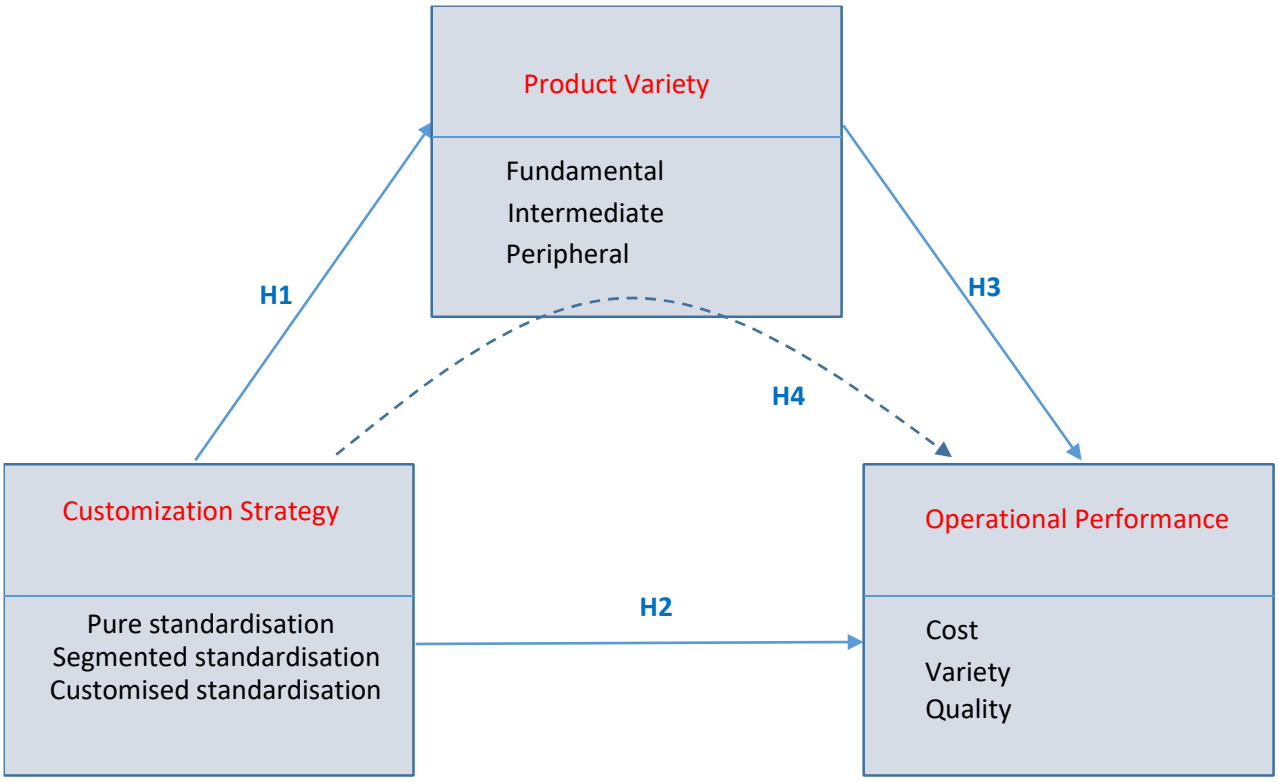

Figure (1)

3.7. Research Hypotheses

Hypothesis-1: There is an impact of Customization Strategy on Product Variety in car manufacturing industry

- Generally, high customization styles are supposed to be portraying more variety in products than low customization styles, and the model spectrum

typically is growing over the Pure Standardization to Pure Customization framework. It is generally believed that a high level of customisation has more product variety than a low level of customisation.

Hypothesis-2: There is an impact of Customization Strategy on Operational Performance in car manufacturing industry

- The findings reveal that high types of customization usually have a greater effect on operational efficiency than low types of customization. High customization has a positive impact on operational performance, as it increases product consistency and product responsiveness in a cost-effective way to satisfy specific consumer requirements.

Hypothesis-3: There is an impact of Product Variety on Operational Performance in car manufacturing industry

- High variety of products can have a positive impact on both revenue and market share but may also have negative impact on operational performance regarding the cost. For instance, higher product diversity can increase manufacturing costs by making the manufacturing process more complicated.

Hypothesis-4: There is an impact of Customization Strategy on Operational Performance through Product Variety in car manufacturing industry

- The findings suggest that increasing the product variety of low customization styles improves competition of the market more than in high customization styles. The biggest negative impact on operational performance, however, was a high product variety and low customization as a result of an unsettling variability and customisation.

4. METHODOLOGY

The literature review analysis suggest that the product variety has an effect on different aspects of operational performance. Nonetheless, the efficiency of a company function can be differently influenced by an increase in product variety. It is directly associated with the necessary or demanded degree of customization of the product. Therefore, the primary objectives of the research based on the resource based view of a firm are as follows:

- Analyse the influence of product variety on operational performance
- Examine such impacts on the degree of customisation and the variety of products offered

Research Questions

The following study questions were formulated after a detailed literature review to satisfy the established needs and objectives of the research:

1. How does an increase in product variety affect the operational performance of car manufacturing companies in China?
2. What is the impact of customisation strategy on operational performance of car manufacturing companies in China?
3. Will the increase in product variety affect the operational performance differently in car manufacturing companies in China on basis of the degree of product customization offered?

The research model will be studied and explored in detail by quantitative and empirical analysis. This model uses the descriptive and exploratory approach. It enables researchers to analyse a specific phenomenon in detail and create an appropriate questionnaire in order to gain professional advice and to understand the deeper problems in this topic of research. In this model, there are two independent variables and one dependent variable. The two independent variables are customisation strategy and product variety. The dependent variable is operational performance. In order to formulate theories and build a general hypothesis centred on those three variables, this report uses an inductive approach method. First, the researcher tests the variables in existing research publications to help understand

the variables. The researcher then collects secondary data for the study. In the case of secondary data, journal articles and company profiles were gathered. In order to comprehend the effect and relationship of one variable on other variables, the gathered data was then consolidated to average.

4.1. Customization Strategy Dimensions

Dimension	Measure
Pure Standardisation	"Dominant Model" with the largest potential consumer community
	Products manufactured in the widest possible scale
Segmented Standardisation	Products are included in a limited range of options
	The basic concept is changed to accommodate different dimensions of the component
	Need to modify the distribution process
Customised Standardisation	Goods from basic materials are ordered
	Customising the assembly
	All parts are manufactured in bulk for the overall market
Tailored Customisation	Development of a product submitted to a prospective customer
	Modification or tailoring to the desires and needs of the consumer
	Customization works in the manufacturing process
Pure Customisation	Customer expectations infiltrate the planning phase significantly
	The product is built for ordering
	Genuine relationship in decision taking between buyers and sellers

4.2. Product Variety Dimensions

Dimension	Measure
Fundamental	Complexity in Model Mix
	Amount of numerous physical stores and deployment lines
	Several various outlets, product types and prototypes
Intermediate	Complexity of parts
	Addition of components during production configuration
	Product sequencing
	Parts and resources move to the assembly line
Peripheral	Content selection and variety of choices
	Percentage of goods with various offerings mixed in each of these variants
	Variance in the quality of choices in every model

4.3. Operational Performance Dimensions

Dimension	Measure
Cost	How effective would the company provide goods and/or services
Variety	Will the organization satisfy their heterogeneous client base's unique demands
Quality	How great the product or service is
	Is the product and/or service as well as promoted

Responsiveness	How easily the customer's needs should be met

4.4. Population and Sample

The population of this study is car manufacturing companies all over the world.

The size of population: There are more than 60 car manufacturing companies in the world controlled by 14 major global corporations. Since we are unable to reach all the companies, then we will take a sample (the sample type is clustered: means that only companies in China)

The sample will be car manufacturing companies in China which are 12.

The primary data collection method is an empirical survey (or questionnaire).

The unit of analysis: The research involved developing and defining the research objectives, constructing key research questions and reviewing relevant literature. First, the researcher tests the variables in existing research publications to help understand the variables. The researcher then collects secondary data for the study. In the case of secondary data, journal articles and company profiles were gathered. In order to comprehend the effect and relationship of one variable on other variables, the gathered data was then consolidated to average. Due to the innovative nature of the research, there are readily available questionnaires on this aspect and are collected from all the related articles.

4.5. Data Collection

Surveys and close ended questionnaires are the tools used to gather data. Researchers can more accurately assess and interpret the data in surveys and questionnaires. The survey therefore must be carried out by the delivery of questionnaires to car manufacturing companies. The designed questionnaire for the survey is given below.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Disagree**
Customization strategy					
How much does your firm prefer mass production over mass customisation?	**1**	**2**	**3**	**4**	**5**
Does your firm provide products in which customers are offered predefined options?	**1**	**2**	**3**	**4**	**5**
How much does your firm's customers customise product delivery location or schedules?	**1**	**2**	**3**	**4**	**5**
How much does your firm prefer high level customisation over low level customisation to meet the needs of the business?	**1**	**2**	**3**	**4**	**5**
How much does your firm involve customer input at the start of the design process?	**1**	**2**	**3**	**4**	**5**
Do you think tailored customization is cost effective to your firm?	**1**	**2**	**3**	**4**	**5**
Product variety					
How much does the product variety of your firm affect the revenue potential of the entire line?	**1**	**2**	**3**	**4**	**5**

How reliant upon the core design are the various colours, sizes and technical options of your products?	**1**	**2**	**3**	**4**	**5**
How much independent of core design are the number of particular choices and accessories?	**1**	**2**	**3**	**4**	**5**
How much does the product variety of your firm respond to the changing preferences of customers?	**1**	**2**	**3**	**4**	**5**
How much does your firm prefer peripheral variety over intermediate variety?	**1**	**2**	**3**	**4**	**5**
How much does product variety positively influence quality management of your firm?	**1**	**2**	**3**	**4**	**5**
Operational performance					
Do you believe that adopting customisation strategy can give better performance on your firm's operations?	**1**	**2**	**3**	**4**	**5**
Does your firm face complexity with product variety?	**1**	**2**	**3**	**4**	**5**
How fast does your firm respond to your heterogeneous customer base?	**1**	**2**	**3**	**4**	**5**
How much is the capability to reduce manufacturing unit cost?	**1**	**2**	**3**	**4**	**5**
How much does your firm prefer product quality over manufacturing costs?	**1**	**2**	**3**	**4**	**5**
How much does your firm reduce the manufacturing lead time?	**1**	**2**	**3**	**4**	**5**

6. CONCLUSION AND RECOMMENDATIONS

In the beginning of the research, the researchers stated the problem whether car manufacturing companies in China should adhere to mass production, retaining high quality and low cost factors, or moving into mass customisation to meet the particular needs of the consumers. Overall Chinese car production hit 23,720 million, representing 26% of global automotive manufacturing. All of this is accomplished by mass production with fast capacity expansion. Yet Chinese companies in the emerging markets still face various problems with a paradigm shift towards mass customisation, which presents quite a threat. The researchers will therefore examine the effect of the customization strategy on operations and maintenance efficiency with the mediation role of the product variety in the car production industry with a view to solving this problem.

For Chinese car manufacturing companies, higher manufacturing costs because of greater product variety and a comparatively low degree of customization are a big issue that needs to be addressed. Most significant of all, the research adds to the literature by stating that according to customization rates the dynamic relationship between product variation and operational performance differs. According to the various decoupling points that includes consumer engagement points, each stage of customization has a different operating system, such as MTS, ATO, MTO and DTO. This research first analysed the effect of the product variety on operating efficiency in conjunction with the five customization forms

including PS, SS, CS, TC and PC. Then, the model was tested according to the customization point such as high and low customisation. Finally, this research specifically analysed the variation in strategies and operational performance by customization type and customization level. Such an approach will allow Chinese managers to understand the connections between product variety, customization, and variety related approaches and quality and how the variety control strategy has an impact on operational performance at the different rates of customization.

The results indicated variety in products have a huge positive effect on consumer quality, competitive benefit and market share. But even more so, in technical problems such as R&D expense and design/change costs for engineering, the product variety did have a major negative impact. Cost and non-cost dimensions of operational performance should be taken into account. The research indicates that China provides the dominant option in terms of supply, provided that variety is dominant in output, as the rise in costs associated with increasing variability outweighs the increase in costs in terms of demand mediation. For instance, the variance in the automobile body type of an automotive is influenced by major tooling investments.

As a result, car manufacturing companies in China with a scale efficient production will deliver a range of styles consistent with high cost of production, for example, fundamental and intermediate varieties. Thus, China will be better off by attempting to combine productive quantities in different regional markets into one facility to achieve scale-efficient growth, as manufacturing trends have shown that the rise in product variety has had the largest effect on cost. In order to lower output costs, Chinese firms could further concentrate on mediation-dominant variety such as peripheral variety. Manufacturing costs are positioned second in China, suggesting that Chinese carmakers with more scale efficient production are likely to offer relatively low customization and that manufacturing costs are strongly influenced by a growing variety of products. Moreover, the results show that car manufacturing companies in China had a greater effect on core operational performances that include unit cost of goods, manufacturing costs, inventory costs, and market negotiating costs as well as the cost of labour. China will therefore focus on consolidated production to reduce the high production costs that arise from high-demand dominant varieties such as fundamental varieties.

It also demonstrates a considerable capacity to minimize costs in terms of capital, output, delivery and inventory by implementing different techniques to control variety, and improve operational performance even in a high degree of customisation, for example, high mass customization. The findings show that customization activities will benefit Chinese car makers both as regards cost savings and improvements in quality of goods and services, thereby boosting operational performance. Some researchers claimed that customization strategy improves the efficiency of car manufacturers, others suggested that the variety and complexities of MC activities could jeopardize the company's progress. The research has also shown the significant and positive link between postponement and the operating success of the Chinese company. Co-design is a critical means of enhancing production performance and paving the way for other potential cost savings. Therefore, it will enhance the production process and boost project feasibility and design efficiency by considering Chinese business partners' recommendations for product design. Via the implementation of manufacturing efficiency methods, manufacturers not only can merge production of the components that reduces unit costs, but can replace semi-finished goods that are much cheaper. Some researchers say that these design strategies will lower costs without losing their efficiency. In turn, by increasing the versatility of product design and process management, consumers can sensate producers' efforts through receiving a higher degree of customisation.

Through the aid of advanced information technologies and customer interactions, elicitation allows manufacturers to recognize the degree to which user preferences are customized, how much they expect to pay for the customisation and the input from past buying encounters. This knowledge will allow manufacturers to change their internal manufacturing processes and logistics and find the right design approaches and satisfy consumer requirements. In fact, timely

exchange of information with consumers accelerates decision formation which also leads to a shorter lead time. On the basis of this knowledge, manufacturers can better tailor the product to the needs of consumers, not just reducing volume, but also increasing the product or service efficiency.

Through operating as the original equipment producers, the Chinese car manufacturers join the global supply chain and contend primarily by cost control. Experience and economic circumstances dictate that they have no development of expertise and skills to enable technological inventions. The majority are therefore clearly copying goods of international rivals, creating new uses of existing technology and designing for the local supply chain; and so they only innovate by customising for the market. In addition, the managers of Chinese companies are also paying particular attention to the way customisation-related costs are managed, because of their place on the global supply chain and the local market characteristics.

Therefore, the research can be concluded by stating that many Chinese car manufacturers have switched from mass production to mass customisation, some of which already have high-end, mass customised operations. Observing the findings of the literature review, it has been found that high customisation has a greater performance than low customisation because high customisation emphasises on customer relationships and product variety while low customization emphasises more on cost effectiveness and cost leadership.

Furthermore, it supports the concept that high output variety volumes such as fundamental and intermediate variety are dominantly correlated with a heavy manufacturing volume and low customization level. In order to minimize the detrimental effect of the product variety on operating performance, China must make a strategic step to a high degree of mass customisation such as Customised Standardisation. In fact, the key trend for the car manufacturing companies in China is to drive towards the mid position of Customised Standardisation, not towards Pure Customisation.

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