Product Modularity, Mass Customization Supply Chain Quality Integration and the Competitive Performance of Textile and Appraisal Sector of Indonesia: The Role of Open Book Accounting

Natnaporn Aeknarajindawat[1], Suramon Chancharoen[2]

[1,2]*Graduate School, Suan Sunandha Rajabhat University, Bangkok, Thailand*
[1]natnaporn.ae@ssru.ac.th
[2]suramon.ch@ssru.ac.th

Abstract **- The main purpose of the current study is to investigate the impact of product modularity, Mass customization, and supply chain integration on the competitive performance of the textile and appraisal sector of Indonesia. In addition to that, the study has also examined the moderating role of open book accounting in the relationship between product modularity and competitive performance and in the relationship between supply chain quality integration and competitive performance. The hypotheses have been developed using the existing theories and the objectives have been set for the study. The data was collected using survey method. Quantitative research approach was used to gather information from a sizeable population. A resourceful finding related to product modularity, supply chain quality management, and mass customization has been added to the existing literature. The previous empirical studies focused on the development of mass customization capability and no study has paid any attention on the role of open book accounting in the supply chain management. The research offers several guidelines for the managers to implement supply chain integration. It has been suggested that the managers should apply organizational and manufacturing design practices, which enhance the capability of mass customization for managing internal and external issues related to supply chain.**

Keywords: *Supply Chain, Accounting, Textile, Indonesia*

1. Background

Increased globalization of supply chains and productions have led to quality issues for the organizations [1, 2]. Any link in the supply chain of manufacturer, traditional practices of quality management including training, incentives can lead to quality problem. There can be a limited effect on the reductions of risks linked with quality through sharing best practices [3]. It has been argued by researchers that supply chain perspective should be taken into account by the quality management [2]. In order to focus on integration and coordination in the business processes, extensions are made in supply chain quality management to product-based and company-centric practices for improving the quality of processes, products, and services [4]. For delivering value to the customers in this dynamic and globalized supply chains, there is need for an integrated quality system by the manufactures to make decisions and align the activities with supply chain partners. Moreover, it is important to avail opportunities provided by the relation with the customers and suppliers [3]. The textile sector is one of the largest sectors of Indonesia and experiencing a steady exponential growth. According the Morder intelligence the textile industry of Indonesia is expecting to grow by 20 percent as shown in the figure (1)

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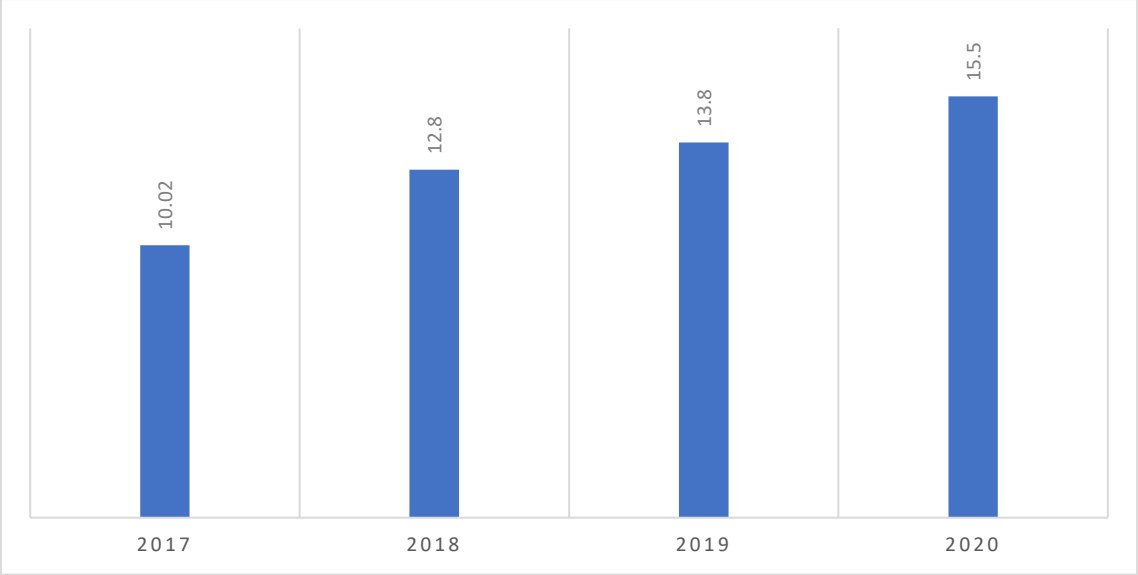

Figure 1. Indonesian Textile industry exports in USD
Source: Morder Intelligence

Quality management can be linked with supply chain integration to define supply chain quality integration (Dechprom & Jermsittiparsert, 2018). It is referred as the extent to which the internal functions of an organization, external partners of supply chain coordinate with each other strategically and operationally. This leads to the management of inter and intra organizational quality related relations and processes of communication to maintain high quality performance at low cost [4]. Both the internal and external integration are involved in supply chain quality integration and ultimately deals with both internal and external contexts of supply chain. It has been argued by researchers that performance outcomes are improved with increased collaboration with the supply chain partners on the management of quality related issues [2, 4].

Literature on supply chain integration reveals that the performance outcomes can be influenced through integration with the suppliers and customers [5]. Most of the empirical studies related to quality management have not identified the distinctive influences created by internal customer and supplier quality integration on the competitive performance [1]. Moreover, there are few studies providing empirical evidence on the way to establish an integrated system for improving supply chain quality.

The ability to offer a large number of products in a large market with customized demand without the issues of quality, delivery, and cost is referred as mass customization. There are four components of mass customization including cost efficiency, responsiveness, quality and volume customization [6]. Manufacturers become able to achieve numerous competitive priorities through mass customization. Moreover, it enables manufacturers to resolve the tradeoffs between costs and customization. It has been reported by researchers that mass customization can result in different performance outcomes including customer value, product innovation, organizational performance, operational performance in terms of quality, delivery, flexibility, and customer satisfaction. Establishing close relationships with the supply chain partners has become important. It is required to evaluate the ways of establishing supply chain relations within the contractual framework along with the management control mechanism and processes to align the activities for achieving success.

The process of decision-making and controlling is based on management accounting information, which is a basic source of information. Considerable value can be created through effective management accounting techniques for inter-organizational supply chains. This can be done by offering accurate and on time information regarding the activities for achieving success. In this way, decisions are facilitated across the organization. Moreover, management accounting techniques can provide information regarding the quality and efficiency of tasks, managers' performance to ensure the consistency of activities with the plans.

Establishing long-term collaboration with the supply chain partners include highly complicated process of negotiation. There is need to control the activities and mechanisms for planning their role in the supply chain relations. These issues are linked with the need and sharing of information. A suitable technique for providing this type of information can be claimed as management accounting. Moreover, suppliers, producers, assemblers have become integrated but there is need to consider the way in which management

accounting can be used to support the development and implementation of strategic to gain competitive advantage. The focus of this research is on the potential role of management information accounting in the management of supply chain. A reverse influence of supply chain activities can be seen on the management accounting practices and its uses. This research will analyze both the perspectives. The study aims at analyzing the factors enabling mass customization and product modularity I the integration of supply chain. Three research questions have been addressed by this study. The first is related to the influence of mass customization on internal, supplier and customer quality integration. The second is related to the influence of product modularity on internal, supplier and customer quality integration. The third is related to the influence of internal, supplier and customer quality integration on the competitive performance.

2. Hypothesis Development

2.1. Influence of Mass Customization on Supply Chain Quality Integration

Organizations who are mass customizer can respond to the increased level of competition and uncertainty in the environment. These are able to align their business with the requirements of customers [7]. Advanced channel management, production planning, inventory management, and lateral relations are built by such organizations through increased collaboration with the supply chain partners [8, 9]. A system is developed to elicit information from the environment and recognize the qualities of solution spaces by these organizations. The existing resources are combined and reused for establishing an integrated logistics system [7]. Therefore, the operational capabilities of manufacturer can be improved through mass customization [10]. It has been argued by researchers that organizations can achieve sustainable competitive advantage through mass customization [10]. Resources, abilities, and power is owned by the mass customizers to create an influence on the partners and become supply chain leaders [11]. Compliance with the partners in supply chain is increased by the supply chain leadership with a combined vision for the entire supply chain [1]. Therefore, leadership can be created by mass customizers with focus on quality [3]. Moreover, quality management strategies are developed including the internal operations, upstream and downstream supply chains [12]. The extent to which an organization establishes relation with the customers and supplies to develop inter organizational practices, strategies and procedures to meet the customer requirements is referred as supplier/customer quality integration [5]. Being the leaders of supply chain, mass customizers give great important to quality that result in a mutual understanding among the partners regarding quality issues to improve supplier/customer quality integration [13].

A manufacturer can keep a close communication through customization responsiveness with the suppliers with regard to the changes in design and quality concerns [10]. Moreover, a close relation is built by mass customizers with the customers to focus on the customer requirements along with expected feedback for product quality [14]. Manufacturers are able to work in collaboration with the customers because of customization to develop new products and improve quality. Therefore, a base is set by mass customization for learning from customers.

The extent to which an organization develops its practices, strategies, and procedures to fulfill the requirement of customers is referred as internal quality integration [4]. The process of mass customization is linked with the organizational designs that support cooperation, involvement of peers and cooperation [8]. Therefore, employees working in different departments are motivated to cooperate with each other regarding the decisions for management activities and quality. For resolving the problems of quality, cross-functional teams are formed [5]. The following hypothesis has been proposed in this regard:

H1a: Mass customization is significantly and positively related to supplier quality integration.

H1b: Mass customization is significantly and positively related to internal quality integration.

H1c: Mass customization is significantly and positively related to customer quality integration.

2.2. Influence of Product Modularity on Supply Chain Quality Integration

A manufacturer is enabled by product modularity enables to improve the transparency in its supply chain. This is because of the ability of modular designs to reduce the asymmetries of information in the supply chain [15]. The extent of product modularity creates an influence on the channel management of the manufacturer, planning and production techniques as well as decision making in supply chains. Effective decisions can be made by the manufacturer regarding the structure of logistics and production as well as supply chain processes. When standard modules are involved in a product, this creates effective product architecture and complexity is reduced in the supply chain to determine the components of quality. The production supply chain processes can be schedules and controlled efficiently by the manufacturer. Manufacturers are enabled by product modularity to incorporate quality standards while decision making about the designs of supply chain.

A manufacturer can design the supply chains to fulfill the quality needs in an efficient and effective manner through product modularity. Manufacturers are facilitated through supply chain designs to incorporate quality concerns in the selection of supply chain partners for developing long-term relations [5, 16]. The visibility of supply chains is increased as well and this supports the manufacturer to develop a tracking system across the supply chain. A tracking or tracing system can improve the quality integration of supply chain.

Moreover, a close relation should be maintained between the manufacturer and suppliers to decide about the specifications for ensuring combinability of modules [17]. The complex products are decomposed through product modularity into simple modules and product designs are divided into self-contained tasks. This supports the involvement of customers in the development of product and improving quality. Based on these arguments, the following research hypotheses have been developed:

H2a: Product modularity is significantly and positively related to supplier quality integration.

H2b: Product modularity is significantly and positively related to internal quality integration.

H2c: Product modularity is significantly and positively related to customer quality integration.

2.3. The influence of Supply Chain Quality Integration on Competitive Performance

The overall capabilities of a manufacturer are reflected through the competitive performance for achieving competitive advantage. Competitive performance has been defined by Miller and Roth [18] as the performance of a manufacturer regarding different objectives including quality, cost, innovation, and delivery. It has been found by researchers that the performance of a firm improves with the upstream quality management [12]. The transparency of supply chain is not just improved through supplier quality integration but it also aligns the goals and objectives among the suppliers and manufacturers for improving competitive performance [1]. More specifically, close communication and cooperation with the suppliers ensure that the importance of quality is understood by the suppliers [3]. The quality of materials and sourced components can be improved through certification and development of suppliers. Errors can be prevented through high quality components, which slows the speed causing internal unreliability, waste of time, low dependability, improvement of developing and cost savings [2]. A manufacturer is enabled to use resources and capabilities of suppliers by involving them in improving quality and developing new products. This can avoid the risk of mismatch between different components along with reduction of lead-time and cost in the development of new products [2].

Lateral communication regarding quality issues is facilitated through internal quality integration. It enables the coordination among the different departments for making quality decisions [3]. Therefore, fewer mistakes are incurred by the manufacturer and less confusion is created resulting in efficient processes with improved internal visibility [19]. Everyone in the process of manufacturing is pushed through cooperation and cross-functional interaction to take responsibility for quality that results in less variation and a smoother process. The manufacturing costs are reduced along with level of inventories. Within the same quality standard, functional departments work with cooperation that improves the development of new product and delivery. The functional barriers are broken down and employees from different departments work in coordination to deal with the conflicts in innovation, manufacturing delivery processes. This reduces costs and increases the quality and flexibility [5].

A manufacturer can have a good understanding about the customer requirements that result in lower design errors [12]. Customers are provided with products, which are reliable. Agreements can be made regarding quality requirements with frequent customer contact. Increased communication with the customers can reduce the uncertainties of market and gap in the perception of customers regarding. A manufacturer becomes able to use the skills and resources of customers in the development of new products, which improves the uniqueness and flexibility [20]. The traceability and visibility of products is improved through customer feedback regarding the delivery and quality performance. This reduces the negative influence of quality issues [1]. Moreover, it is ensured by participation in the quality improvement projects that products are developed, stores and distributed in suitable conditions avoiding the risk of quality issues. In this way, the following research hypotheses have been proposed.

H3a: Supplier quality integration is significantly and positively related to competitive performance.

H3b: Internal quality integration is significantly and positively related to competitive performance.

H3c: Customer quality integration is significantly and positively related to competitive performance

2.4. Open Book Accounting

Sharing of cost information about the related processes in every organization and across the supply chain is referred as open book accounting. It aims at the identification of non-value adding processes, which can be withdrawn without creating a negative influence on the customers. This is likely to improve customer service. Sharing

such information with the supply chain partners is an activity resulted from the development of lean thinking in management. It is based on the idea it is wasteful to use resources other than the creation of value. Sometimes, companies do not share such information because of trust issue or fear to lose competitive advantage. Moreover, there can be some technical issues. Open book accounting lead to the improvement through reduction in cost. The process cost information is shared by the customer and supplier because of the success in the identification of processes, which do not add value.
It is required to deal with several issues, which results in the achievement of benefits through opportunities open book accounting. Several issues have been identified by Kajüter and Kulmala [21] in their work based on the German and Finnish companies, which include the following:

- No extra benefits are experienced by the suppliers from openness and a win-win solution is not offered by the main contractors.
- It is thought by the suppliers to keep the privacy of accounting information
- Accurate cost information cannot be produced by network members and no sense is seen in sharing poor cost data
- Suppliers feel reluctant to reveal their cost structure for being exploited
- There are no capable resources own by suppliers from the main contractors to develop accounting systems
- It is not agreed by the network members about the process of implementing an open book practices.
- There is need for these factors to consider open book agreements in the process of implementation.

An interested study on SCMA and trust between the suppliers and supermarkets of UK has been provided by researcher. The relations developed by major retailers have been referred, which are operating the in supermarket sector of UK including Sainsbury, Tesco, Safeway, Marks and Spencer, Waitrose, and the Co-Op. some of the techniques in the guidelines have been considered but it warns the need for protection against indiscriminate demands and heavy handed accountability forms. When handled not with care, it can create lack of trust and manipulation of management accounting information.
H4a: The mass customization has significant positive impact the competitive performance.
H4b: The product modularity has significant positive impact the competitive performance.
H4c: The open book accounting moderate the relationship between the mass customization and the competitive performance.
H4d: The open book accounting moderate the relationship between the product modularity and the competitive performance

3. Methodology

This research study has employed the philosophy of positivism [22]. The relation between mass customization, supply chain quality integration, product modularity, and competitive performance as observable reality has been considered in this study. This aims at the creation of generalization of law. The hypotheses have been developed using the existing theories and the objectives have been set for the study. The data was collected using survey method. Quantitative research approach was used to gather information from a sizeable population. This allows the testing of the hypothesized relationships [22]. Questionnaire survey was used to collect data from the sample size. This research study employed positivist quantitative approach [22].
Based on the criterion of five-technique, the estimated sample size was 29000. Almost 495 respondents were drawn for sample. A questionnaire was formulated and survey was conducted from the respondents. Almost 380 questionnaires out of total were complete and processed for further analysis. The response rate came out to be 76%. Sampling technique employed was stratified sampling design. Moreover, the study used proportionate random sampling method. Random samples were drawn out of subgroups of the population. Using stratified random sampling, questionnaires were distributed. Table 2 depicts the response rate.

3.1. Measures

The four components of mass customization were used by five items including cost efficiency customization, high volume customization, customization quality, and customization responsiveness [20]. Three items related to the application of common modules and product platforms in the product designing were used to measure product modularity [20]. The criterion of Huo, et al. [4] was used for the measurement of supply chain quality integration. More specifically, seven items regarding the supplier communications, cooperative supplier relationships, supplier involvement in product design and improving quality, certification of suppliers were used to measure supplier quality integration. The measurement of internal quality was done through eight items related to the degree of collaboration among the functional departments and teamwork for solving quality issues. Five items were used including customer communication, customer cooperative relationships, customer

involvement, customer certification, and quality improvement. In questionnaire survey, seven-point likert scales was used to determine the constructs. The reference of Zhao, et al. [23] was used for the measurement of competitive performance. In order to determine the performance of manufacturer in terms of quality, delivery, flexibility, cost, and innovation as compared with the industry competitors, ten items were used. A likert scale based on five points was used to determine the competitive performance. About 45 measurement items and informants for every scale were included. This has been listed in Appendix A.

4. Results

Most of researchers in social sciences use SEM approach. It is very powerful technique, which can test several relations simultaneously [24]. A number of researchers have suggested the use of co-variance approach such as AMOS. However, PLS-SEM has become an advanced alternative to previous co-variance approaches because of its unique features and abilities. PLS-SEM technique is the widely adopted approach and it has gained huge recognition among the researchers. According to Urbach and Ahlemann [25], the SEM approach is quite suitable. Moreover, PLS is considered beneficial for when researcher aims at the prediction and explanation of the predictive relevance of the variables Hair, et al. [24]. This research has used PLS-SEM approach because of its flexibility for sample size and estimation of multiple regressions at a time. Moreover, reflective and formative constructs are involved in PLS-SEM approach. The technique is supported by Hair, et al. [24] because of the tendencies of PLS incorporated in PLS-SEM.

The estimation of measurement and structural model is involved in SEM-PLS method. This involves the measurement of its components and determination of degree of indicators loadings and the value of correlation between the related constructs. From a different perspective, the expected measurements by the survey items are determined in the outer model [26, 27].. The first is the assessment of measurement model and second is structural model, both the inner and the outer model has been determined through SEM approach.

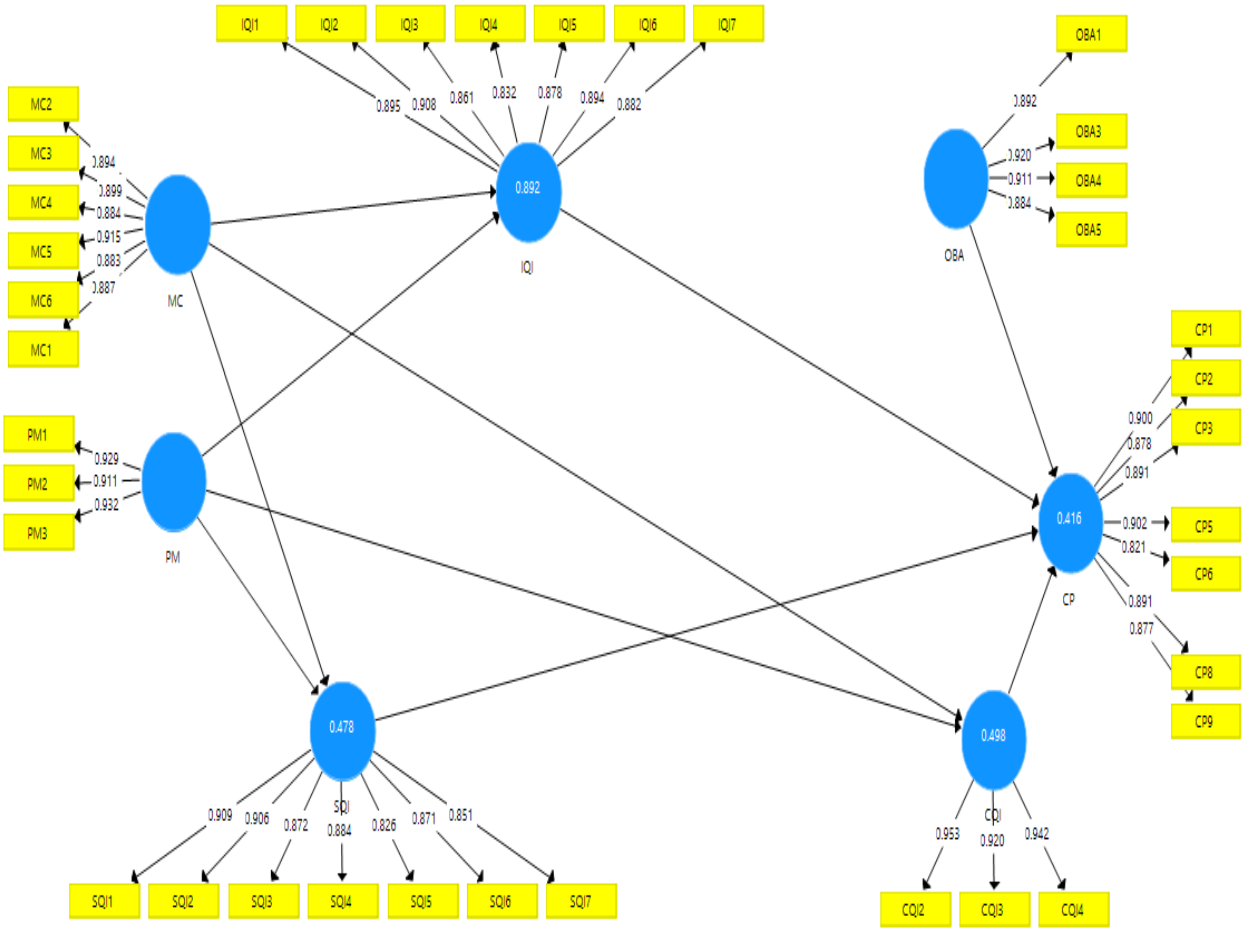

Figure 2. Measurement Model

Table 1. Outer loadings

	CP	CQI	IQI	MC	OBA	PM	SQI
CP1	0.900						
CP2	0.878						
CP3	0.891						
CP5	0.902						
CP6	0.821						
CP8	0.891						
CP9	0.877						
CQI2		0.953					
CQI3		0.920					
CQI4		0.942					
IQI1			0.895				
IQI2			0.908				
IQI3			0.861				
IQI4			0.832				
IQI5			0.878				
IQI6			0.894				
IQI7			0.882				
MC2				0.894			
MC3				0.899			
MC4				0.884			
MC5				0.915			
MC6				0.883			
OBA1					0.892		
OBA3					0.920		
OBA4					0.911		
OBA5					0.884		
PM1						0.929	
PM2						0.911	
PM3						0.932	
SQI1							0.909
SQI2							0.906
SQI3							0.872
SQI4							0.884
SQI5							0.826
SQI6							0.871
SQI7							0.851
MC1				0.887			

The validity and reliability of the research tool is determined in the assessment of inner model. A strong relation is expected to exist among the variables because of the changing nature of items. For the conformation of validity of measurement model, Confirmatory Factor Analysis has been used. The items have been estimated separately using formative, structural, and reflective modeling. A criterion has been suggested by Fornell and Larcker [28] to determine the validity, which is referred as discriminant validity. Several researchers have used discriminant validity. The discriminant validity estimates the relation between reflective variables and their related constructs. The association between the constructs, composite reliability, AVE (average variance explained), and Cronbach's Alpha value has been represented in Table 2. The range of the Cronbach's Alpha is

between 0.74-0.88 and the range of composite reliabilities is between 0.84-0.90. All these value are greater than the standard value of 0.70 [28]. The CFA (confirmatory factor analysis) and AVE has been used to determine convergent and discriminant validity [29]. The estimated values are above the standard value of 0.50 as shown in Table 2. Only one construct has the value lower than 0.50. Therefore, there is sufficient convergent validity [28]. The covariance between the constructs were estimated freely and every item was linked with the related construct in the CFA model.

Table 2. Reliability

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CP	**0.952**	**0.955**	**0.960**	**0.775**
CQI	**0.932**	**0.933**	**0.957**	**0.881**
IQI	**0.951**	**0.952**	**0.960**	**0.773**
MC	**0.950**	**0.951**	**0.960**	**0.799**
OBA	**0.924**	**0.926**	**0.946**	**0.814**
PM	**0.915**	**0.920**	**0.946**	**0.855**
SQI	**0.949**	**0.950**	**0.958**	**0.765**

Discriminant validity is the extent that the measurement concepts are unrelated or different from other measurement concept, following the empirical standards. However, an established discriminant validity indicates that a construct is recognizably different as compared to the other model constructs. In a reflective measurement model, discriminant validity is measured using two methods, namely cross-loading method, and Fornell and Larcker [28] criterion. According to the cross-loadings method, for a particular construct, the indicators' loading must be higher than its cross-loadings for the other constructs of the same model. However, if the cross-loadings for any construct is greater as compared to the loadings of the actual construct, then it shown that discriminant validity is not achieved and is violated for that construct.

Table 3. Discriminant Validity

	CP	CQI	IQI	MC	OBA	PM	SQI
CP	0.880						
CQI	0.586	0.939					
IQI	0.570	0.741	0.879				
MC	0.513	0.688	0.915	0.894			
OBA	0.555	0.661	0.623	0.605	0.902		
PM	0.547	0.679	0.916	0.878	0.588	0.924	

According to Hair, et al. [30], the structural model estimates the relationship between the constructs involved in a proposed model. It provides a useful interdependence between the constructs, such as the structural model shows the nature of association among the latent constructs. The existing relation among the constructs of the proposed model was then tested using structural equation modeling. However, the structural model involves the exogenous and a set of endogenous variables. The study estimated this model by observing the significance and the relevance of the structural relationships in the proposed model, the collinearity issues, as well as the R^2 value

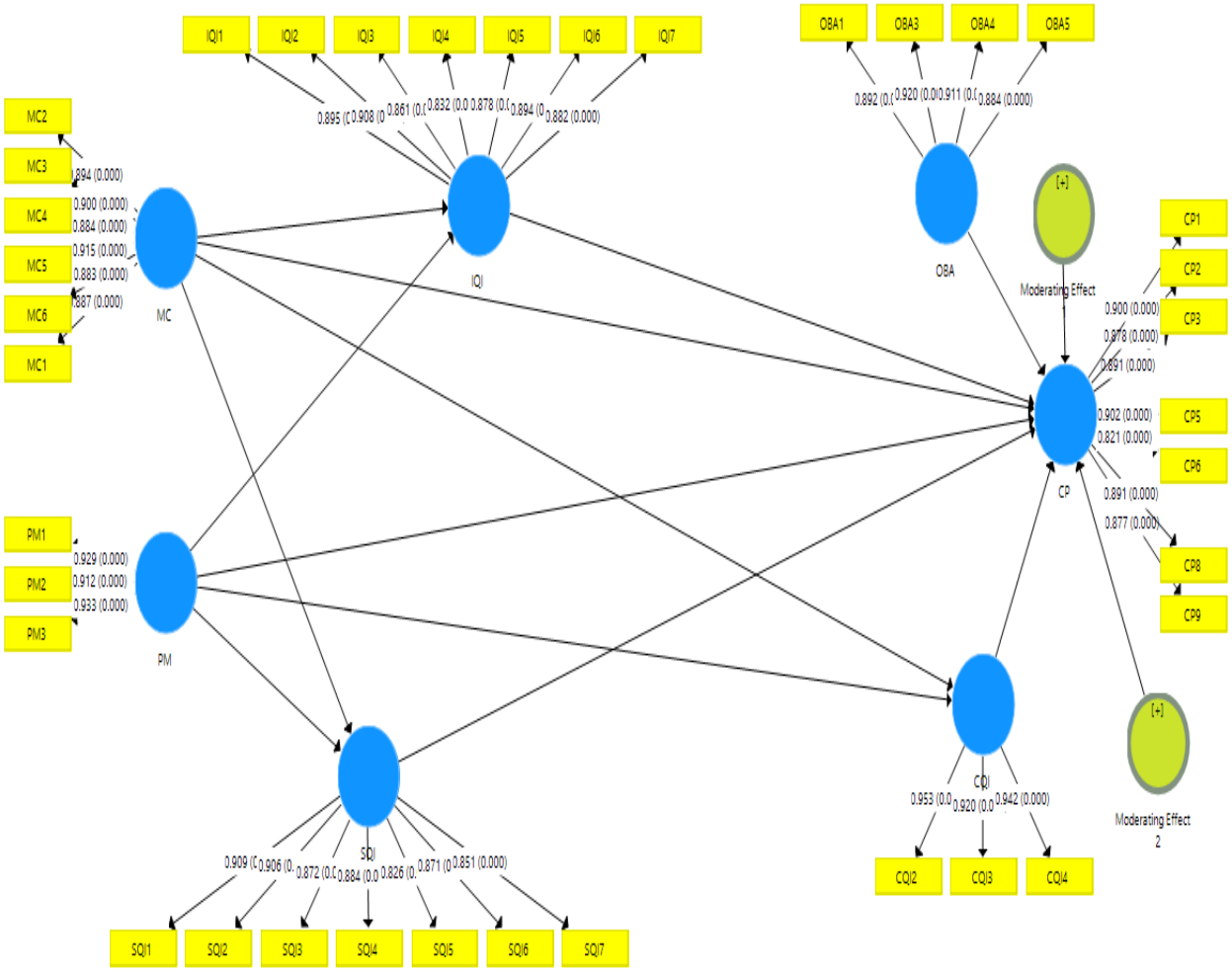

Figure 3. Structural Model

Table 4. Regression results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CQI -> CP	0.071	0.071	0.173	3.413	**0.000**
IQI -> CP	0.422	0.421	0.235	3.800	**0.000**
MC -> CP	0.362	0.371	0.174	3.074	**0.038**
MC -> CQI	0.404	0.400	0.120	3.375	**0.001**
MC -> IQI	0.486	0.484	0.067	4.241	**0.000**
MC -> SQI	0.553	0.551	0.097	5.711	**0.000**
Moderating Effect 1 -> CP	0.069	0.062	0.091	4.756	**0.000**
Moderating Effect 2 -> CP	0.294	0.297	0.102	3.889	**0.000**
OBA -> CP	0.189	0.192	0.128	3.481	**0.000**
PM -> CP	0.256	0.254	0.158	3.623	**0.000**
PM -> CQI	0.324	0.330	0.116	2.786	**0.005**
PM -> IQI	0.489	0.491	0.065	4.544	**0.000**
PM -> SQI	0.153	0.158	0.086	3.774	**0.000**
SQI -> CP	0.111	0.116	0.189	3.588	**0.000**

In view of Ringle, et al. [31], PLS-SEM can predict well and most studies use R^2 value for model estimation to assess the model's predictability to explain the variance in endogenous variable. The coefficient of determination or R^2 shows the combined effects of a set of exogenous variables on the model's endogenous variable. In addition, it also measures the regression function or goodness of fit by using items obtained through empirical analysis, ranging from 0-1. The R^2 value is usually assessed as 0.19, 0.33, and 0.67 as weak, moderate, and substantial variation in endogenous variables, respectively [32]. However, the acceptance and rejection of R^2 differs, based on the nature of the study. Thus, the higher R^2 represents that greater proportion of endogenous variance is explained by one or more exogenous variables [30].

Table 5. R-Square

	R Square
CP	0.416
CQI	0.498
IQI	0.892
SQI	0.478

5. Discussion and Conclusion

5.1. Discussion

The direct influence of mass customization on supplier quality integration has found to be significant. The purpose of mass customization is offer products designed as per the individual requirements on time and close to the mass production prices [33]. A manufacturer becomes able to develop production capabilities in terms of flexibility, productivity, quality, and delivery [10]. The research findings highlight the way in which effective supply chain quality management systems can be developed and quality issues can be resolved to improve the product design. This also emphasizes on the contributions of suppliers, customer, and internal quality integration to improve competitive performance.

The customer and supplier quality integration is improved through product modularity and mass customization. The influence is indirectly created through integration of internal quality and this improves the customer and supplier quality integration along with competitive performance. This improves the understanding of the relations between internal, supplier and customer quality integration. Moreover, it has been revealed through the study that customer and supplier quality integration is improved through product modularity and mass customization. An insight is provided b the research findings about the complicated relation between internal, customer and supplier quality integration and product modularity. The joint influences on supply chain quality management by product modularity and mass customers have been discussed as well.

5.2. Conclusion

A resourceful finding related to product modularity, supply chain quality management, and mass customization has been added to the existing literature. The previous empirical studies focused on the development of mass customization capability. There is a positive relation between supply chain quality integration and mass customization, which improves the understanding about the influences of mass customization. It has been found by researchers that traditional practices of quality management include process management, customer focus and cross-functional teams [6]. These are linked with the implementation of mass customization. The study suggests that mass customization supports the integration of manufacturer with customers and suppliers for managing quality. This improves the quality integration of supplier customer and internal system in various ways. The existing knowledge is expanded related to complicated relation between quality management and mass customization [6]. Another finding of the study is related to the positive relation between supply chain quality integration and product modularity, which improves the understanding about the influence of product modular on quality and supply chain management. The focus of most of the studies is on the influence of modularity on the internal manufacturing capabilities of a manufacturer [20]. The results of the study reflect that a manufacturer can integrate quality management with the customers, suppliers, and functional departments through product modularity [1]. The design and production capabilities of manufacturer are linked with the quality management in the internal and external supply chain context. This explains the relation between product modularity, mass customization, supply chain integration, and competitive performance. The existing knowledge and the impacts of supply chain quality management are improved [34].

5.3. Policy Implication

The research offers several guidelines for the managers to implement supply chain integration. It

has been suggested that the managers should apply organizational and manufacturing design practices, which enhance the capability of mass customization for managing internal and external issues related to supply chain. Moreover, production varieties can be reduced through application of product platforms and modular product designs. Supply chains can be simplified through use of common components and assemblies. This improves the supply chain visibility [1]. It is also suggested that managers should implement product modularity and mass customization to achieve a significant influence on supply chain integration.

References

[1] Flynn, X. Huang, and X. Zhao, "Supply chain management in emerging markets: Critical research issues," *Journal of Supply Chain Management*, vol. 51, pp. 3-5, 2015.

[2] Y. Yu and B. Huo, "Supply chain quality integration: relational antecedents and operational consequences," *Supply Chain Management: An International Journal*, vol. 23, pp. 188-206, 2018.

[3] A. Srinivasan and B. Kurey, "Creating a culture of quality," *Harvard Business Review*, vol. 92, pp. 23-25, 2014.

[4] H.-z. Huo, Z.-y. Zhou, B. Wang, J. Qin, W.-y. Liu, and Y. Gu, "Dramatic suppression of colorectal cancer cell growth by the dual mTORC1 and mTORC2 inhibitor AZD-2014," *Biochemical and biophysical research communications*, vol. 443, pp. 406-412, 2014.

[5] Flynn, B. Huo, and X. Zhao, "The impact of supply chain integration on performance: a contingency and configuration approach," *Journal of operations management*, vol. 28, pp. 58-71, 2010.

[6] M. M. Kristal, X. Huang, and A. V. Roth, "The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance," *Journal of Operations Management*, vol. 28, pp. 415-429, 2010.

[7] Zhang, H. Guo, B. Huo, X. Zhao, and J. Huang, "Linking supply chain quality integration with mass customization and product modularity," *International Journal of Production Economics*, vol. 207, pp. 227-235, 2019.

[8] A. Trentin, E. Perin, and C. Forza, "Product configurator impact on product quality," *International Journal of Production Economics*, vol. 135, pp. 850-859, 2012.

[9] T. Jitpaiboon and S. Sharma, "The influence of information technology utilization (ITU) on supply chain integration (SCI)," in *Mobile Applications and Knowledge Advancements in E-Business*, ed: IGI Global, 2013, pp. 186-210.

[10] S. Kortmann, C. Gelhard, C. Zimmermann, and F. T. Piller, "Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities," *Journal of Operations Management*, vol. 32, pp. 475-490, 2014.

[11] M. Bogers, R. Hadar, and A. Bilberg, "Additive manufacturing for consumer-centric business models: Implications for supply chains in consumer goods manufacturing," *Technological Forecasting and Social Change*, vol. 102, pp. 225-239, 2016.

[12] J. Hong, Y. Zhang, and M. Ding, "Sustainable supply chain management practices, supply chain dynamic capabilities, and enterprise performance," *Journal of Cleaner Production*, vol. 172, pp. 3508-3519, 2018.

[13] S. T. Foster, "Towards an understanding of supply chain quality management," *Journal of operations management*, vol. 26, pp. 461-467, 2008.

[14] F. S. Fogliatto, G. J. Da Silveira, and D. Borenstein, "The mass customization decade: An updated review of the literature," *International Journal of production economics*, vol. 138, pp. 14-25, 2012.

[15] C. Y. Baldwin, "Bottlenecks, modules and dynamic architectural capabilities," *Harvard Business School Finance Working Paper*, 2015.

[16] M. Hussain, A. Awasthi, and M. K. Tiwari, "Interpretive structural modeling-analytic network process integrated framework for evaluating sustainable supply chain management alternatives," *Applied Mathematical Modelling*, vol. 40, pp. 3671-3687, 2016.

[17] Zhang, Guo, Huo, Zhao, and Huang, "Linking supply chain quality integration with mass customization and product modularity," *International Journal of Production Economics*, vol. 207, pp. 227-235, 2019.

[18] J. G. Miller and A. V. Roth, "A taxonomy of manufacturing strategies," *Management Science*, vol. 40, pp. 285-304, 1994.

[19] D. Peng, F. Wu, and G. Chen, "Pay as how well you do: A quality based incentive mechanism for crowdsensing," in *Proceedings of the 16th ACM International Symposium on Mobile Ad Hoc Networking and Computing*, 2015, pp. 177-186.

[20] Zhang, C.-P. Chuu, J.-K. Huang, C.-H. Chen, M.-L. Tsai, Y.-H. Chang, C.-T. Liang, Y.-Z. Chen, Y.-L. Chueh, and J.-H. He, "Ultrahigh-gain photodetectors based on atomically thin graphene-MoS 2 heterostructures," *Scientific reports*, vol. 4, p. 3826, 2014.

[21] P. Kajüter and H. I. Kulmala, "Open-book accounting in networks: Potential achievements and reasons for failures," *Management Accounting Research*, vol. 16, pp. 179-204, 2005.

[22] A. Bryman and E. Bell, "Ethics in business research," *Business Research Methods*, vol. 7, pp. 23-56, 2011.

[23] M. Zhao, T. Barber, P. A. Cistulli, K. Sutherland, and G. Rosengarten, "Simulation of upper airway occlusion without and with mandibular advancement in obstructive sleep apnea using fluid-structure interaction," *Journal of biomechanics*, vol. 46, pp. 2586-2592, 2013.

[24] Hair, G. T. M. Hult, C. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*: Sage publications, 2016.

[25] N. Urbach and F. Ahlemann, "Structural equation modeling in information systems research using partial least squares," *Journal of Information technology theory and application*, vol. 11, pp. 5-40, 2010.

[26] Mahmoud, O. Managerial Judgement Versus Financial Techniques in Strategic Investment Decisions: An Empirical Study on the Syrian Coastal Region Firms., 2016.

[27] T. Ramayah, J. W. C. Lee, and J. B. C. In, "Network collaboration and performance in the tourism sector," *Service Business*, vol. 5, p. 411, 2011.

[28] C. Fornell and D. F. Larcker, "Structural equation models with unobservable variables and measurement error: Algebra and statistics," ed: SAGE Publications Sage CA: Los Angeles, CA, 1981.

[29] Mabika, H. The Human Capital Retention Strategies that Local Authorities in Zimbabwe Can Adopt for Successful Talent Retention. International Journal of Management and Sustainability,vol. 5,pp. 17-22., 2016.

[30] Hair, M. Sarstedt, L. Hopkins, and V. G. Kuppelwieser, "Partial least squares structural equation modeling (PLS-SEM) An emerging tool in business research," *European Business Review*, vol. 26, pp. 106-121, 2014.

[31] C. M. Ringle, M. Sarstedt, and D. Straub, "A critical look at the use of PLS-SEM in MIS Quarterly," *MIS Quarterly (MISQ)*, vol. 36, 2012.

[32] Manaf, N. A., & Ibrahim, K. Poverty reduction for sustainable development: Malaysia's evidence-based solutions. Global Journal of Social Sciences Studies, vol.3,pp. 29-42., 2017.

[33] Malik, K., & Khan, F. N. Narcissistic Leadership at Workplace and the Degree of Employee Psychological Contract: A Comparison of Public and Private Sector Organizations in Pakistan. International Journal of Economics Business and Management Studies,vol. 2,pp. 116-127., 2013.

[34] C. J. Robinson and M. K. Malhotra, "Defining the concept of supply chain quality management and its relevance to academic and industrial practice," *International Journal of Production Economics*, vol. 96, pp. 315-337, 2005.