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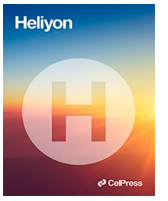

Research article

Strategic collaboration between domestic and foreign firms on production outsourcing processes: Insights from a developing economy Firm's perspective

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ABSTRACT

Worldwide fragmentation of production stages enable the developed and developing economies' firms to gain from 'foreign outsourcing collaboration (FOC)'. Literature indicates that the majority of studies on foreign outsourcing are based on the perspective of developed countries. Nevertheless, a meager amount of literature is available from the perspective of developing countries. This study bridges the research gap by employing field survey based data collected from 217 textile and apparel firms located in Faisalabad-Pakistan, for the fiscal year 2022. This study mainly examines the impact of: (i) investment in information technology (IT) on FOC in the production process; (ii) strategic integration of outsourcing policies on FOC in the production process; and (iii) strategic policy firms' adopted on FOC in the production process. SmartPLS 4 has been utilized to estimate the partial least square structural equation model. The results signify that investment and utilization of IT induce a higher level of firm performance by enhancing firms' efficiency and improving product quality. Moreover, FOC in production processes increases product quality whereas investment in IT attracts FOC in production processes. The study concludes by offering specific policy recommendations.

1. Introduction

The change in the global trading environment has forced manufacturing plants worldwide to change their operations. The outsourcing of production processes and activities significantly affects how developed economy firms manufacture and deliver products to their clients around the world. Developed country manufacturing plants regularly assess whether to produce intermediate goods internally or purchase from developing economy firms (DEFs). These supply chain considerations have become challenging in practice [1].

Developed economy manufacturers have recently begun to outsource core production processes to focus on their core competencies [2]. The US outsourcing institute postulates that 89 % of American enterprises outsource their production processes [3]. Eurostat analysis indicates that 83 % of enterprises outsource their activities in Europe, on average, with 94, 88, and 87 percent in Lichtenstein, France and Germany respectively [3,4]. The global outsourcing market size increases to USD 904.948 billion in 2027 from USD 620.381 billion in 2020 [5]. This underscores the potential of FOC for developing economy firms. By leveraging outsourcing opportunities DEFs better tap into global market, thereby driving competitiveness, enhancing revenue, and increasing indirect exports.

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Additionally, the paradigm shift in customer demands, escalating labor costs and intensifying competitive environment compelled the developed country operators of manufacturing plants to indulge in foreign outsourcing collaboration (FOC) with DEFs across various dimensions. Such collaborations encompass activities and processes that enable firms to improve efficiency by reducing the average cost, improving product quality, minimizing defective rates, improving suppliers' quality, and product reliability. Additionally, FOC enables the firms to access cheaper labor pools, and raw material to reduce their variable and fixed costs.

Information technology (IT) serves as a pivotal catalyst that facilitates firms to achieve competitive advantage. The effective and efficacious use of IT constitutes a critical distinguishing feature of successful organizations as compared to less successful counterparts [6]. Moreover, a plethora of IT-related abilities such as management-related IT capabilities, and competent IT skills, i.e., IT-related human capital, provide firms with a competitive advantage. Existing literature corroborates that IT-related infrastructure significantly enhances firm performance [1–4,8,9]. Furthermore, advancements in IT provide firms with greater flexibility in terms of high-speed communication and connectivity [6,7]. Similarly, prior studies indicate that investment in IT yields enhanced firms' productivity and ultimately culminating higher firms' performance [6,10,11].

The nuanced dynamics between IT and outsourcing precipitate a knowledge gap concerning their concomitant influence on firms' performance [6]. Specifically, the literature lacks an understanding of how investment in IT affects the outsourcing of manufacturing operations, and firms' performance in terms of cost and quality objectives. Notwithstanding, a scant body of literature exists in the context of the USA and a lacuna is apparent in the existent literature as no study has been conducted in the case of DEFs perspective to reflect the impact of IT on FOC and firms' performance.

The firm's performance is also affected by the strategic integration of foreign outsourcing, which is evident in its planning process, strategic goals, and contribution to its success as an element of competitive strategy. Strategic integration of outsourcing allows firms to integrate firms' operations with their objectives. This integration of policies plays an integrative role within the enterprise. Close integration strategic integration among firms and their collaborating partners provides joint capabilities to enhance firms' efficiency, productivity, and quality of products. The strategic deployment of outsourcing of manufacturing activities and processes has emerged as a pivotal mechanism for developed economy final goods producers to reduce fixed costs, transfer demand uncertainty and obtain access to specialized resources [7]. Nonetheless, the prevailing corpus of literature has examined the phenomenon of outsourcing from the lens of development economies. Hansen et al. [12] astutely observed the dearth of literature available on foreign outsourcing from the perspective of developing economy firms. Thus, this study fills this gap by undertaking a nuanced investigation of FOC of processes from the perspective of DEFs, thereby providing novel insights into existing literature.

This analysis focuses on textile and apparel firms operating in the city of Faisalabad, Pakistan, a locale strategically selected due to Pakistan's prominent standing as the eighth-largest textile exporter in Asia, the third-largest consumer, and the fourth-largest producer [13]. According to GoP [14], textile is Pakistan's most crucial industry, boasting innate value addition potential and the largest supply chain among manufacturing industries. It contributes 60 % in the total exports of Pakistan on average, employs 40 % of the total industrial labor force [14], and encompasses 46 % of the manufacturing sector [13]. Many international brands are already working in collaboration with local firms such as Adidas, Levi's, Nike, Target, Puma, H&M, etc. [13]. Moreover, Pakistan's status as the third-largest hosiery manufacturer economy in the world supplying goods to Adidas and Nike, underscores its importance in the global landscape [13]. Additionally, Pakistan has a comparative advantage in cotton which makes it a good location for FOC, thereby enabling this sector as preferred for analysis.

The main objective of the paper is to analyze the effect of investment in information technology, strategic integration, and FOC in processes on firm performance measured through cost efficiency and improvement in the quality of products. Additionally, the study aims to analyze the effect of economies of scope, use of advanced technology, and strategic integration on the FOC of the process to assess their impact on firms' performance from the perspective of a developing economy.

Rest of this study is organized into five sections. Section 2 presents a detailed overview of the literature. Research methodology is discussed in section 3 which provides a detailed overview of the methodology used to test the hypotheses. Section 4 provides a detailed discussion on the results. The conclusion and policy implications are provided in section 5. Finally, limitations and suggestions for future studies have been provided in section 6.

2. Literature review

Transaction cost economics (TCE) provides a theoretical framework to analyze outsourcing choices. Foreign outsourcing reduces firms' cost of production through economies of scale or specialization. However, these benefits are accompanied frequently with higher transaction costs [15]. Such expanses compel enterprises to go for vertical integration or internal production compared to cost savings offered by foreign outsourcing collaborations. Based on TCE, growing IT utilization encourages firms as it lowers coordination expenses which decreases time & cost of communication and promotes closer process integration [16]. Additionally, information technology enables businesses to monitor vendors by mitigating transaction risks [17]. Hence, enterprises invest more in IT which leads to increased outsourcing of activities [18].

Literature indicates that several studies have been conducted to assess the relationship between IT competence and firms' performance. Firms that possess advanced information and communication capabilities outperform their competitors [6]. The study postulates that IT leaders demonstrate significantly better profits and lower costs as compared to the control group that has lower IT capabilities. Santhanam and Hartono [19] strengthen this argument by confirming that IT leaders maintain their competitive advantage by continually outperforming overtime. Several studies contend that superior IT capabilities offer a substantial competitive advantage and have a direct effect on firms' performance. There exists some doubts about the positive association as well [20–23]. Nonetheless, numerous studies found positive impact of IT investment on firms performance [24–27]. Moreover, Bardhan et al. [28]

maintained that prudent IT investment supports distinctive organizational practices, frequently coupled with firms' dedication to particular business processes [28,29].

When determining their outsourcing strategies, enterprises typically anchor their decision on primary strategy or cost leadership strategy [30,31]. A firm's operating characteristics and success are greatly influenced by its strategy [18]. Most enterprises opt either for cost reduction which leverages superior economic efficiency or competency-based strategies. By collaborating in foreign outsourcing, enterprises tap into complementary resources often motivated by the need to access cutting-edge technology, specialized skills, and/or human resources [32]. As IT has evolved, enterprises have creatively used IT to solve the conflict between cross-functional procedures and knowledge silos [1]. IT amplifies a firm's capacity across supply and distribution channels and improves its ability to gather, store, analyze, and distribute data [33]. The promptness of information exchanged, and the automation of regular decision-making are clear examples of IT's positive impact. Thus, IT enhances firms' ability to plan and organize their operations.

Research on the influence of IT on outsourcing has revealed both positive and unfavorable results in terms of performance in terms of cost, quality, delivery, and flexibility [7,32,34]. Common metrics of IT include IT investment or spending, the number of IT systems implemented, and self-assessed IT capability [35,36]. By lowering integration costs—which include the capital expenses of purchasing and maintaining IT as well as the operating costs of gathering, processing, and sharing information throughout the supply chain—IT promotes collaboration [1]. Meanwhile, over expenditure in ITIs might be costly, and insufficient investment might fail to achieve the expected results [37,38].

Production process outsourcing offers various benefits enabling enterprises to mitigate the cost of production and enhance product quality by assessing specialized skills and knowledge [39]. Additionally, foreign outsourcing augments firms' ability to adapt and alter production processes [18]. This study expands the extant empirical literature by investigating the role of IT investment on firms' performance. Moreover, it also analyses the mediating effect of production process FOC on firm performance. The study also incorporates the theoretical viewpoint as proposed by Hansen et al. [12] that a DEFs perspective in the analysis.

2.1. *Theoretical framework*

The theoretical framework depicting the hypotheses has been presented in Fig. 1. The latent variables are depicted in the circle whilst the observed variables are portrayed in the rectangle. Fig. 1 displays the association between IT and firm performance with the mediating role played by the production process FOC. Information technology affects several measures of firm performance [7,11], a very few studies have identified the role of IT as an intermediate determinant in affecting firms' performance [7]. Information technology plays an important role in boosting firm performance. The process of communication and coordination is simplified by the use of IT which helps developing economy firms to engage in FOC. Information technology also benefits firms to better incorporate the results obtained because of FOC in boosting the firm's efficiency and quality of product being produced and delivered. Ultimately the efficient and effective use of IT enables firms to enhance firms' productivity and results in improved firms' performance.

H1. Information Technology has a positive effect on firm performance.

Information technology helps firms to engage more actively in FOC with developed economy firms as it offers firms with a platform to approach firms and provide demonstrations of products being produced by the firms. Information technology also provides opportunities for firms more actively engaged in FOC as it aids firms by providing an immersive environment to conduct meetings through virtual reality and showing products by dressing virtual mannequins using virtual reality. Common IT metrics consist of the number of IT systems employed, IT spending, and self-assessed IT capability [35,36]. Enterprises that invest more in IT have an increased likelihood of outsourcing of activities [18]. Reduction in cost capital expenses, such as operational costs throughout the supply chain, information technology augments outsourcing collaborations [1]. Such initiatives help textile and apparel firms in

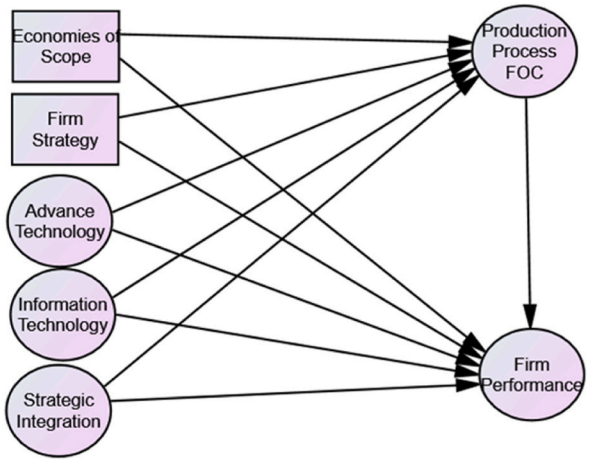

Fig. 1. Conceptual framework.

various grounds including FOC and active use of marketing strategies that foster FOC.

H2. Information Technology has a positive effect on the production process FOC.

The use of the latest and more sophisticated technology such as air jet, and water jet looms, circular and digital knitting machines, and more advanced machines in the area of dyeing, cutting, and other fronts help firms to reduce their cost of production significantly. The use of modern technology also improves product quality. The evolving and increasing customer preferences, joined with the inefficiency of conventional manufacturing paradigms, have encouraged final goods producers to indulge in state-of-the-art manufacturing approaches including the use of advanced manufacturing technology. This shift allows manufacturers to attain higher quality and flexibility in terms of reduced cost of production [40], thereby addressing limitations of traditional manufacturing know-how. Additionally, developed economy firms readily engage in FOC with firms that use advanced technology. FOC provides firms the opportunity to obtain advanced technology from foreign collaborating firms which further improves the firm's efficiency and reduces cost.

H3. The use of advanced technology has a positive effect on firm performance.

H4. The use of advanced technology has a positive effect on the production process FOC.

Strategic integration is the alignment of firms' policies to achieve strategic goals and objectives particularly relevant to outsourcing by ensuring the working of various departments, divisions, resources, and processes together without any duplication or conflict. Remarkably, the concept of strategic outsourcing has undergone significant evolution in response to changing business dynamics [41]. Strategic outsourcing is rapidly expanding as enterprises view it as a means of attaining strategic objectives that boost customer satisfaction, and augment efficiency and effectiveness [42]. Subsequently, strategic outsourcing is meticulously designed to align the long-term strategies of the enterprise [43]. Hence, strategic integration of outsourcing positively influences firm performance multidimensionally by improving firm productivity, output quality, and revenues [44]. More precisely, strategic integration of outsourcing offers a flexible mechanism to lower costs through economies of scale and scope [43,44]. Thus, it fosters communication and collaboration within the firm and ultimately leads to an increase in technical and economic efficiency, improves the firm's productivity, and produces higher-quality products. Furthermore, a conducive and immersive environment within the firm also enables the firm to be involved more in FOC. A plethora of past studies has advocated in favor of strategic integration of outsourcing as a panacea to minimize performance deficiencies of the firms [41–43,45], thereby underscoring firms' potential to revitalize economic efficiency.

H5. Strategic integration of outsourcing positively affects firm performance.

H6. *Strategic integration of outsourcing positively affects production process FOC.*

The competitive strategy has emerged as an indispensable tool for realizing the business objectives of the firms [46–51]. Firms generally follow either a cost reduction strategy or a quality differentiation strategy. Cost reduction strategies mainly aim to reduce cost without compromising on the product quality which may be sustainable in a highly competitive environment in which cost is a major factor in decision making. Whereas, the quality differentiation strategy is based on the differentiation of products by offering superior features that provide final goods producers higher utility. It is also possible that firms follow a hybrid approach by reducing costs and improving quality at the same time. The choice of strategy depends on a variety of factors including final good producer preferences, market competition, and availability of resources. Literature postulates that firms' strategy contributes to the competitive edge [52,53]. More precisely, a cost leadership strategy entails a cohesive and comprehensive set of initiatives aimed to deliver goods at the lowest cost compared to rivals [54]. Dess and Davis [55] maintained that return on assets is the highest in low-cost clusters, on average. Moreover, a cost reduction strategy yields significant performance advantages [56] by affecting firms' performance positively [54,57].

H7. Firm strategy has a positive effect on firm performance.

H8. Firm strategy has a positive effect on production process FOC.

The variety of goods produced by the firms allows firms to share resources such as production facilities, marketing facilities, raw materials, and distribution networks to economies of scope. The sharing of resources reduces the cost of a firm that arises when firms produce a range of products rather than specialize in a single product. It also reduces the fixed cost of the firm as they are spread out over a variety of products being produced by the firm, ultimately reducing the average cost of production. Economies of scope significantly improve the benefits to all FOC partners [58] such economies provide firms with cost reduction and delivery of customizable and integrated solutions, thus it fosters FOC.

H7. Economies of Scope positively affect firm performance.

H8. Economies of Scope positively affect production process FOC.

This study builds upon the theoretical framework of foreign outsourcing from the perspective of DEFs and empirical studies postulating the positive influence of IT investment on the performance of firms mediated through FOC in the production process. In particular, it delves into the mediating role of FOC in production processes in linking investment in IT with firm performance. By exploring the association among IT investment, FOC in production process, and firm performance, this study expounds the mechanisms underlying the effect of IT on firm performance with a focus on mediating role of production processes FOC.

3. Methodology

3.1. Data and sampling

The textile and clothing cluster of Faisalabad has been studied. A total of 240 firms have been surveyed, which include firms that are engaged in FOC. A total of 228 questionnaires have been found complete in all respects. The data have been cleaned using the Tukey boxplot method. After excluding questionnaires with missing data and outliers, we obtained 217 observations that have been used for final model estimation. The survey, that has been conducted from July 17 to August 31, 2023, employs data for the fiscal year 2022. The random sampling methodology has been employed to select the sample of textile and apparel firms. The formal ethical approval for conducting the survey was obtained from the Ethics Committee of the School of Social Sciences and Humanities, National University of Sciences and Technology, Islamabad, Pakistan, as evident vide letter number 0988/Ethic/01/S3H/ECO. The approval was obtained prior to the commencement of the survey. The questionnaire was also pilot-tested and modified in the light of initial responses received before the conduct of the final survey to enhance its reliability.

3.1.1. Definition of variables and their measurement

Firm performance has been measured using economic efficiency and product quality. Firm efficiency and product quality have been measured using the firm's intention to reduce cost and improve product quality. Whereas the FOC in production processes has been measured using the involvement of various processes in FOC. The complete list of latent indicators and their definitions in conjunction with their respective codes are provided in Table 1.

3.2. Economic and econometric model

This study is based on the theoretical model developed by Ali and Mahmood [59] in their examination of FOC from the DEFs perspective, especially in the context of textile and apparel firms of Pakistan. This study explores the association between foreign outsourcing collaboration and its conduits by offering valuable information about how such collaborations function in a developing economy.

This analysis extends the theoretical framework developed by Ali and Mahmood [59] to further analyze its applicability and

Table 1
Variables and their Measurement.

Code	Latent Indicator	Definition of Variable
	Economic Efficiency	
	Indicate how much emphasis your firm intends to put on the following activities in the coming years to maintain or strengthen competitive position.	
	No Emphasis [1]*; Slight Emphasis* [2]*; Moderate Emphasis* [3]*; High Emphasis* [4]; *Extreme Emphasis* [5]	
C1	Input Cost	Reduce material costs
C2	Overhead Cost	Reduce overhead costs
C3	Inventory Cost	Reduce inventory level
	Quality	
	Indicate how much emphasis your firm intends to put on the following activities in the coming years to maintain or strengthen competitive position.	
	No Emphasis [1]*; Slight Emphasis* [2]*; Moderate Emphasis* [3]*; High Emphasis* [4]; *Extreme Emphasis* [5]	
Q1	Supplier Quality	Improve supplier's quality
Q2	Product Reliability	Improve product reliability
Q3	Quality Improvement	Implement quality improvement programs
	FOC in the Production Process	
PFOC1	Woven Process Outsourcing	= 1 if the firm is involved in *full FOC* of the woven process, 0 otherwise
PFOC2	Dying Process Outsourcing	= 1 if the firm is involved in *full FOC* of the dying process, 0 otherwise
PFOC3	Fabrication Process Outsourcing	= 1 if the firm is involved in *full FOC* of the fabrication process, 0 otherwise
PFOC4	Assembly Process Outsourcing	= 1 if the firm is involved in *full FOC* of the assembly process, 0 otherwise
PFOC5	Staging/Packaging Process Outsourcing	= 1 if the firm is involved in *full FOC* of staging or packaging process, 0 otherwise
	Investment and Utilization of IT	
IT1	Computer	= 1 if the firm utilizes computer or information technology, 0 otherwise.
IT2	Computer network	= 1 if the firm is connected through a local area network, 0 otherwise.
IT3	Internet	= 1 if the firm is connected to the open internet, 0 otherwise.
IT4	Email	= 1 if the firm communicates with suppliers and customers by email, 0 otherwise.
	Strategic Integration	
	To what extent following statements are important for your firm	
	Not Important at all [1]*; Slight Important* [2]*; Moderate Important* [3]*; Very Important* [4]; *Extremely Important* [5]	
SI1	Strategic Goals	The division responsible for FOC has good knowledge of the firm's strategic goals.
SI2	FOC Performance	The foreign sourcing performance is measured in terms of its contributions to the firm's success.
SI3	Professional Development	The foreign sourcing professionals' development focuses on elements of the competitive strategy.
	Strategic Policy (Observed Variable)	
ST_H	Hybrid Strategy	= 1 if the firm adopted a hybrid Strategy (low cost and high quality), 0 otherwise.
ST_Q	High-Quality Strategy	= 1 if the firm adopted a high-quality strategy, 0 otherwise.
ST_C	Low-Cost Strategy	= 1 if the firm adopted a low-cost strategy, 0 otherwise.
EOS	Economies of Scope	= 1 if firm operations are characterized by a high mix of goods, 0 otherwise.

implications by delving deeper into the dynamics of FOC from the perspective of DEFs. Additionally, it offers a more nuanced exploration of factors affecting such collaborations. This study, therefore, serves as a direct offshoot of the model developed by Ali and Mahmood [59], aiming to expand its findings within the context of the textile and apparel industry of Pakistan. The economic model indicating the relationship between dependent variables (firms' performance, and production process FOC) and independent variables is shown below

$$FP = f\ (FS, SI, IT, PFOC, EOS, AT) \tag{1}$$

where FP, FS, SI, IT, $PFOC$, EOS, and AT shows firm performance, firm strategy, strategic integration, information technology, production process FOC, economies of scope and use of advance technology respectively. The firm quality has been assessed using cost reduction and quality of products. Thus Eq. (1) expends to the following two equations.

$$cost = f\ (FS, SI, IT, PFOC, EOS, AT) \tag{2}$$

$$quality = f\ (FS, SI, IT, PFOC, EOS, AT) \tag{3}$$

where *cost* and *quality* indicate the cost reduction that is efficiency and product quality respectively. Similarly, the economic model for production process outsourcing is provided as follows,

$$PFOC = f\ (FS, SI, IT, EOS, AT) \tag{4}$$

The econometric models corresponding to Eq. (2) to Eq. (4) are presented from Eq. (5) to Eq. (9), where μ and ν indicate residual terms. Partial least square structural equation modeling (PLS-SEM) has been employed to test the relationship between dependent and independent variables. SmartPLS 4 software has been used to test the hypotheses.

$$cost_i = \beta_1 ST\_H_i + \beta_2 ST\_Q_i + \beta_3 SI_i + \beta_4 PFPC_i + \beta_5 IT_i + \mu \tag{5}$$

$$quality_i = \beta_1 ST\_H_i + \beta_2 ST\_Q_i + \beta_3 SI_i + \beta_4 PFPC_i + \beta_5 IT_i + \mu \tag{6}$$

$$cost_i = \beta_1 ST\_H_i + \beta_2 ST\_Q_i + \beta_3 EOS_i + \beta_4 AT_i + \beta_5 SI_i + \beta_6 IT_i + \nu \tag{7}$$

$$quality_i = \beta_1 ST_{Hi} + \beta_2 ST_{Q_i} + \beta_3 EOS_i + \beta_4 AT_i + \beta_5 SI_i + \beta_6 IT_i + \nu \tag{8}$$

$$PFOC_i = \beta_1 ST\_H_i + \beta_2 ST\_Q_i + \beta_3 EOS_i + \beta_4 AT_i + \beta_5 SI_i + \beta_6 IT_i + \nu \tag{9}$$

3.3. Structural equation model

The partial least square (PLS) method has been developed by Wold [60–62], which belongs to the family of principal component analysis and canonical correlation [63]. Generally, the structural equation model is divided into measurement and structural model whereas in PLS-SEM the two models are termed outer and inner models respectively.

3.3.1. Outer model

The relationship among latent indicators is called manifest variables in PLS-SEM, and latent variables are specified in the outer model. PLS-SEM specifies the outer model as either reflective or formative depending on nature and theoretical considerations among of relationship between manifest variables and resulting latent variables. This study employs a reflective measurement model based on theoretical considerations [64]. Thus, the relationship between manifest and latent variables has been modeled linearly in Eq. (10) as follows.

$$\boldsymbol{M_m} = \boldsymbol{\psi_m \delta} + \boldsymbol{\varepsilon_m} \tag{10}$$

where ψ_m, and δ show the vector of loading parameters, and latent variables, whereas $\boldsymbol{\varepsilon_m}$ shows outer model residual terms. The PLS-SEM assumes independence among manifest variables and outer model residual terms as specified in Eq. (11).

$$(\boldsymbol{M_m}|\boldsymbol{\delta}) = \boldsymbol{\psi_m \delta} \tag{11}$$

3.3.2. Inner model

The PLS-SEM inner model lays down the association among the unobserved latent. For simplicity, the model assumes standardization of manifest and latent variables that allow to discard of location parameters in line with the conventional description of PLS. Thus, the relationship among latent variables in the inner model is described as

$$\boldsymbol{\delta} = \boldsymbol{\alpha \delta} + \boldsymbol{\xi} \tag{12}$$

where $\boldsymbol{\delta}$, α, and ξ indicate the latent variables, coefficients matrix, and residual terms of the inner model, respectively, as described in Eq. (12). The basic PLS-SEM is solved as a system of equations that assumes no correlation among error terms that is no autocorrelation. The model also assumes no endogeneity that a specific endogenous residual is not correlated with its corresponding latent

variable. Finally, the inner model, as shown in Eq. (13), can be written as

$$(\delta|\delta) = \alpha\delta \tag{13}$$

4. Results and discussion

Ensuring the quality of constructs is the first step in the assessment of the outer or measurement model. The outer factor loading results have been presented in Figs. 2 and **3**. All the factor loadings are over 0.60 and 0.55 for models 1 and 2, which indicates a higher level of quality among manifest and latent variables. Hair et al., [65] recommended that outer factor loading should not be less than 0.5.

4.1. Construct reliability and validity

Construct validity is generally established when there exists a convergent validity and discriminant validity. Conversely, the reliability of constructs is validated through Cronbach's Alpha and composite reliability. Construct reliability measures the degree of stability and consistency of manifest variables. Repeatability is the essence of reliability which implies that an instrument will yield the same results if it is used repeatedly. Cronbach's Alpha and composite reliability are commonly used methods for assessing manifest variable reliability. The constructs' reliability and validity results have been presented in Table 2. The generic threshold level for Cronbach's alpha and composite reliability are 0.60 and 0.70, respectively. Cronbach's Alpha and composite reliability ranges from 0.679 to 0.916 and 0.802 to 0.944, respectively, for both models, which are well above the threshold levels. Thus, the results are reliable for further analysis.

Convergent validity ensures that manifest variables measuring a latent variable should covary highly [66]. It is generally assessed using average variance extracted (AVE). The threshold for the AVE statistic is 0.50. The results presented in Table 2 indicate that AVE for all the latent indicators is above the desired threshold level 0.50 which indicates that the convergent validity has been established.

Discriminant validity measures the extent to which the measures are unique, which ensures the absence of high multicollinearity among the instruments in the model. Discriminant validity is assessed through the Fornell and Larcker criterion, Heterotrait-Monotrait Ratio (HTMT), and cross-loadings. Variance inflation factor (VIF) is used as an additional measure to test multicollinearity in the model. The results of the Fornell Larcker Criterion have been presented in Table 2. Convergent validity is achieved when the square root of AVE for a specific latent or observed variable is greater than its correlation with other latent and observed variables. The diagonal values indicate the square root of AVE as shown in Table 3. The square root of AVE is found to be greater than the corresponding correlation for all variables in corresponding rows for Model 1 and corresponding columns for Model 2 indicating the establishment of discriminant validity.

Haterotrait-Monotrait ratio (HTMT) measures the correlation of measures with each other. The threshold level for HTMT is 0.90. The results presented in Table 4 indicate that the HTMT ratio is less than the desired threshold level for all measures except the correlation of IT with strategic integration. To achieve the discriminant validity through the HTMT ratio, its confidence intervals have been obtained employing Bootstrapping. The discriminant validity through HTMT is established if the 95 % confidence interval is less than 1.00 indicating a narrow gap between lower and upper confidence levels.[1] Hence, HTMT indicates that the discriminant validity has been accomplished.

The cross-loadings assess the measure belonging to specific constructs load well on its parent construct as compared to others. The results[2] indicate that cross-loading for each item and it is loaded strongly on its parent construct. Thus, establishing discriminant validity. Finally, the results for VIF presented in Table 5 postulate that the absence of multicollinearity as the VIF for all the variables is well below the threshold level of 10. Thus, the instruments used in the study are valid and reliable based on a variety of tests conducted.

4.2. Discussion of results

The results of PLS SEM have been presented in Table 6 while Figs. 4 and **5** illustrate the path coefficients for the inner and outer models. The Nonparametric Bootstrapping method has been employed to test the significance of the path coefficient in the SmartPLS 4 package. Biase-corrected and accelerated bootstrap methodology is used for obtaining confidence intervals. A subsample of 5000 with replacement has been created to test the significance of path coefficients. Both one-tailed and two-tailed probability values have been obtained to test the hypotheses. We primarily rely on one-tail probability values due to unidirectional hypotheses.

The results of Models 1 and 2 presented in Table 6 indicate that firms with higher IT investment and utilization realize a higher level of economic efficiency due to a reduction in the cost of production ultimately leading to better firm performance. This result is in line with the findings of Barua et al. [24]; Brynjolfsson and Hitt [25]; Kohli and Devaraj [26]; Santhanam and Hartono [19], Bharadwaj [6], Banker [28], Chae and Koh [67]. Such a cost reduction can be in the form of lower input costs, overhead costs such as rent, marketing expenses, insurance, utilities, office supplies, legal fees, etc., and lower inventory costs. One standard deviation (SD) increase in investment and utilization of IT brings 0.521 and 0.464 SD improvement in firms' efficiency respectively for Models 1 & 2 and this effect

[1] The results of HTMT ratio confidence interval are available with authors.
[2] The result not reported due to word limit issues.

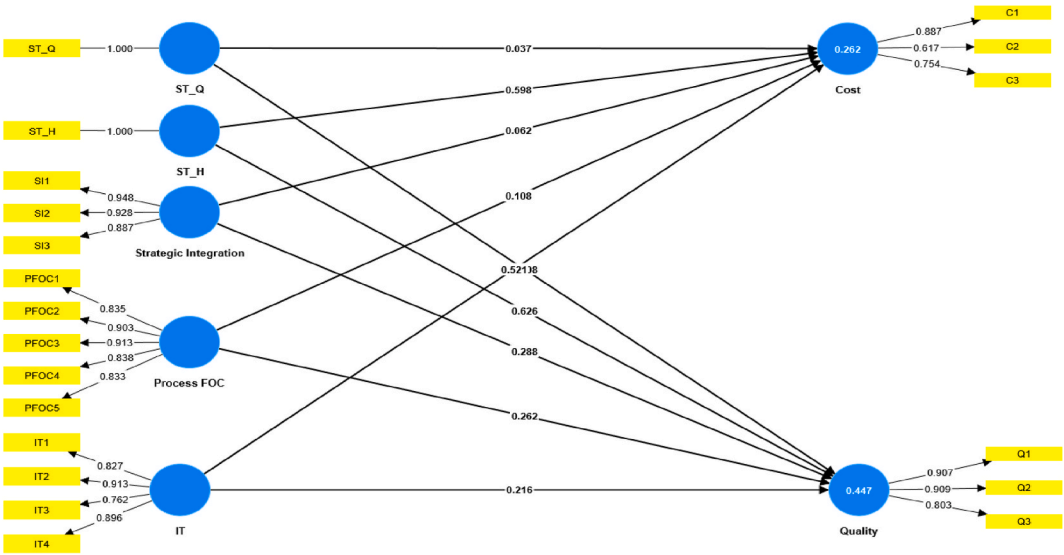

Fig. 2. Outer factor loadings (Model 1).

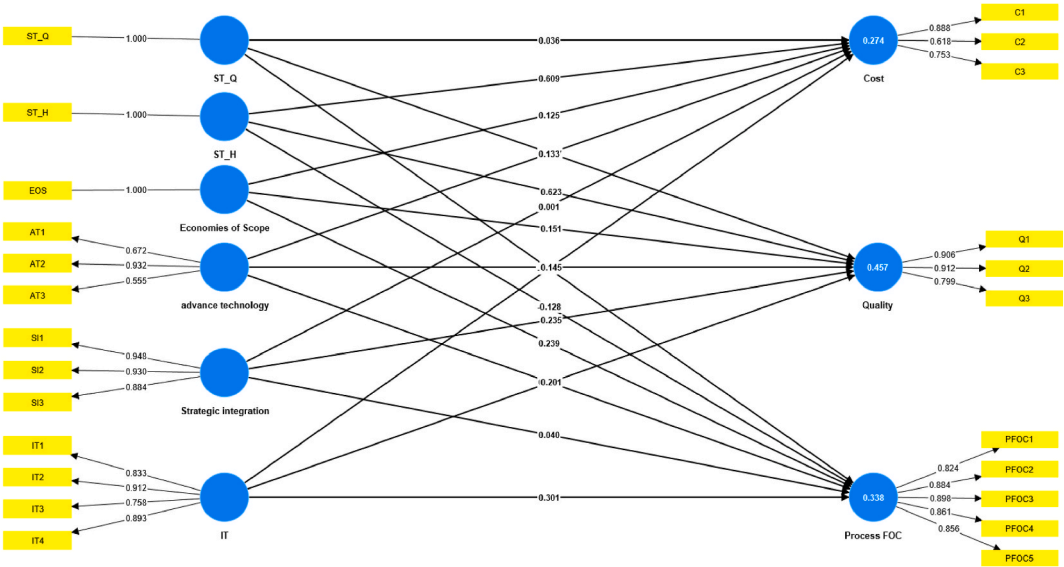

Fig. 3. Outer factor loadings (Model 2).

Table 2
Constructs' reliability and validity.

Latent Variable	Cronbach's Alpha		Composite reliability		AVE	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Cost	0.679	0.679	0.802	0.802	0.579	0.579
IT	0.874	0.874	0.913	0.913	0.725	**0.724**
PFOC	0.916	0.916	0.937	0.937	0.749	**0.748**
Quality	0.847	0.847	0.907	**0.906**	0.765	**0.764**
SI	0.911	0.911	0.944	0.944	0.849	**0.848**
AT		0.717		0.773		0.543

Table 3
Discriminant validity- Fornell Larcker Criterion*.

	Cost	EOS	IT	PFOC	Quality	ST_H	ST_Q	SI	AT
Cost	*0.761*		0.443	0.240	0.482	0.409	−0.045	0.395	
EOS	0.205	***1.000***							
IT	0.443	0.327	***0.851***	**0.497**	**0.617**	**0.404**	**0.329**	**0.842**	
PFOC	0.232	0.394	0.501	***0.865***	**0.389**	**0.143**	**0.178**	**0.466**	
Quality	0.482	0.252	0.617	0.386	***0.874***	**0.294**	**0.255**	**0.622**	
ST_H	0.409	0.163	0.404	0.142	0.296	***1.000***	**−0.583**	**0.345**	
ST_Q	−0.045	0.006	0.327	0.181	0.255	−0.583	***1.000***	**0.321**	
SI	0.395	0.302	0.841	0.472	0.624	0.344	0.321	***0.921***	
AT	0.338	0.235	0.609	0.427	0.508	0.179	0.296	0.647	***0.737***

Note: * means the top right triangle indicates values for Model 1 while the bottom left triangle shows values for Model 2.

Table 4
Discriminant validity - HTMT.

Latent Variable	Cost	EOS	IT	PFOC	Quality	ST_H	ST_Q	SI
EOS	0.218							
IT	0.446	0.345						
PFOC	0.280	0.409	0.548					
Quality	0.573	0.262	0.690	0.444				
ST_H	0.460	0.163	0.440	0.151	0.302			
ST_Q	0.129	0.006	0.355	0.184	0.277	0.583		
SI	0.395	0.315	**0.935**	0.502	0.695	0.362	0.333	
AT	0.302	0.152	0.472	0.363	0.444	0.155	0.231	0.483

Table 5
Variance inflation factor (VIF).

Construct	VIF	Construct	VIF	Construct	VIF
AT1	2.323	IT2	3.070	Q1	2.488
AT2	1.166	IT3	2.038	Q2	2.353
AT3	2.142	IT4	3.155	Q3	1.721
C1	1.293	PFOC1	2.331	SI1	4.049
C2	1.343	PFOC2	5.188	SI2	3.349
C3	1.327	PFOC3	5.549	SI3	2.616
EOS	1.000	PFOC4	3.353	ST_H	1.000
IT1	2.073	PFOC5	2.998	ST_Q	1.000

is statistically significant. However, the impact of investment in IT on product quality is positive but statistically insignificant. Thus, the quality of products is insignificantly affected by investment in IT. This is because textile and apparel firms collaborating in foreign outsourcing do not use highly sophisticated IT-enabled technologies. A negligible proportion of firms in Pakistan use such technology and within those firms, a small proportion of activities are being carried out employing such technologies. The results also postulate that the production process FOC is positively and significantly affected by IT investment and utilization. Thus, IT enables textile and apparel firms to collaborate more effectively in FOC in production processes. This result corroborate with the results of Mithas et al. [18].

Firms' performance is also affected by strategic integration of foreign outsourcing as indicators of firms' strategic goals, competitive strategy, and success. The results indicate that strategic integration positively but insignificantly affects firms' efficiency in both PLS-SEM models. Product quality is positively and significantly affected by the strategic integration of outsourcing as it enables coordination within the various divisions of operators of manufacturing plants in a developing economy firm. Thus, close integration among firms and their collaborating partners increases product quality as desired. Furthermore, strategic integration has a positive but insignificantly effect on FOC in production processes as postulated by the results of Model 2.

PLS-SEM results for Model 1 presented in Table 6 demonstrate that FOC in production processes has a positive impact on the firms' efficiency, however, this impact is insignificant. Whereas the quality of products is positively and significantly affected by the FOC in production processes. One SD increase in foreign collaboration in processes brings 0.262 SD improvement in the quality of products. Such an improvement in the quality of textile and apparel goods is brought about by higher quality of suppliers and product reliability. Additionally, the implementation of quality improvement programs also results in further improvement in the quality of products. Thus, FOC in production processes leads to better quality products as desired by developed economy final goods producers. The developing economy firms realize a significant improvement in the quality of products as a result of FOC.

Utilization of modern and sophisticated technologies significantly improves firms' efficiency, productivity, and quality of products. Modern technologies cut costs, improve product quality, and permit developing economy firms to engage more in FOC. Model 2

Table 6
SEM path coefficients.

Variable	Model 1				Model 2			
	Coeff.	SE	P values (1 tail test)	P values (2 tail test)	Coeff.	SE	P values (1 tail test)	P values (2 tail test)
IT → Cost	0.521**	0.313	0.048	0.096	0.464*	0.329	0.079	0.158
IT → PFOC					0.301***	0.098	0.001	0.002
IT → Quality	0.216	0.231	0.174	0.348	0.201	0.228	0.189	0.378
SI → Cost	0.062	0.115	0.295	0.590	0.001	0.119	0.496	0.992
SI → PFOC					0.040	0.040	0.160	0.321
SI → Quality	0.288***	0.095	0.001	0.003	0.235*	0.097	0.008	0.016
PFOC → Cost	0.108	0.147	0.232	0.465				
PFOC → Quality	0.262**	0.136	0.027	0.053				
AT→ Cost					0.133**	0.080	0.048	0.097
AT → PFOC					0.066***	0.028	0.009	0.018
AT → Quality					0.145***	0.058	0.006	0.012
ST_H → Cost	0.598**	0.284	0.018	0.035	0.609**	0.282	0.015	0.031
ST_H → PFOC					−0.128**	0.064	0.022	0.044
ST_H → Quality	0.626***	0.204	0.001	0.002	0.623***	0.203	0.001	0.002
ST_Q → Cost	0.037	0.297	0.450	0.901	0.036	0.301	0.452	0.905
ST_Q → PFOC					−0.084**	0.066	0.100	0.200
ST_Q → Quality	0.608***	0.207	0.002	0.003	0.597***	0.208	0.002	0.004
EOS → Cost					0.125	0.163	0.220	0.441
EOS → PFOC					0.239***	0.072	0.000	0.001
EOS → Quality					0.151*	0.114	0.092	0.184

Note: * have been marked based on 1 tail test.

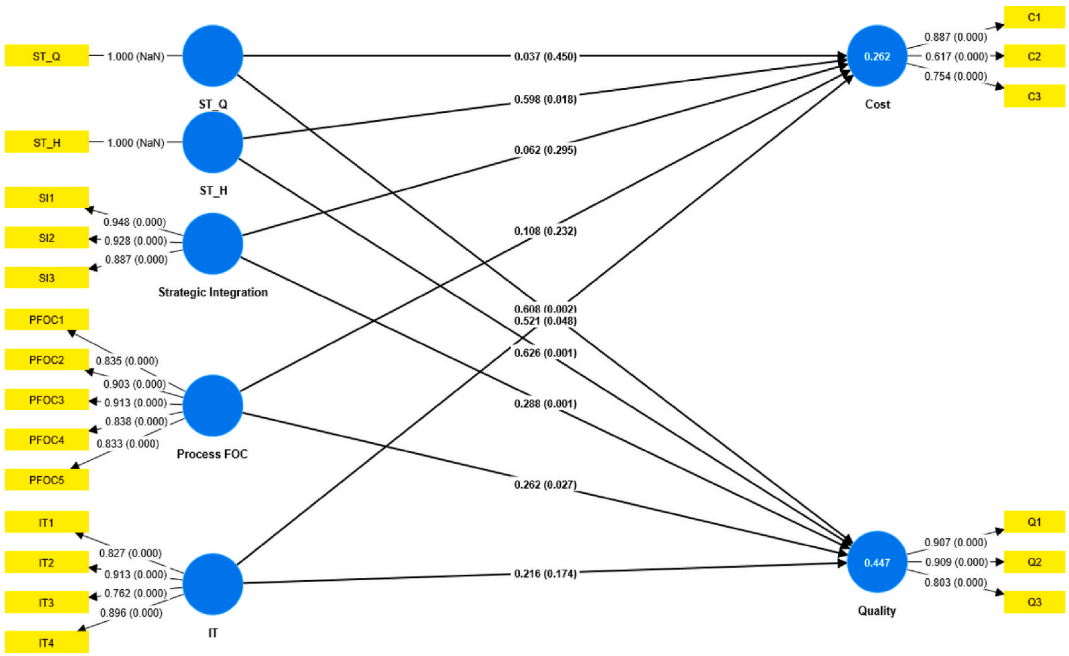

Fig. 4. Path coefficients of SEM (Model 1).

presents the result for the utilization of advanced technology which indicates that advanced technology significantly enhances firms' efficiency, & product quality and enables DEFs to collaborate more in foreign outsourcing.

Firms typically adopt a plant strategy that prioritizes either reduction of cost as the primary strategy or on the quality of products termed as a quality strategy based on the differentiation of products and services. A cost leadership strategy entails concerted efforts to lower costs while a quality differentiation strategy focuses on increasing product utility and satisfaction. Moreover, some firms may opt for a hybrid approach by reducing costs as well as quality strategy concurrently, thereby striking a balance between two distinct objectives. This study uses cost strategy as a base category. The PLS-SEM result for both models indicates that firms that follow a hybrid strategy experience a significantly higher level of efficiency compared to those adhering to a cost strategy. Moreover, the hybrid strategy facilitates the firms to produce significantly higher-quality products.

Conversely, firms that follow a quality differentiation strategy produce a significantly higher quality product as compared to ones

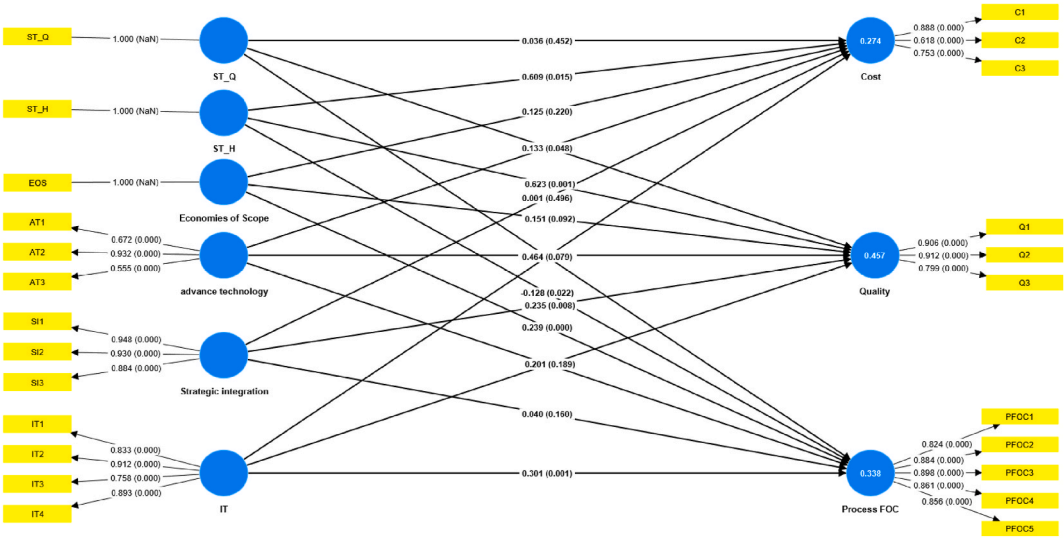

Fig. 5. PLS-SEM path coefficients (Model 2).

that follow cost reduction strategies. Nevertheless, quality differentiation strategy does not have a significant effect on firms' efficiency which implies that firms that follow either quality differentiation strategy or cost reduction strategies produce the same quality. Furthermore, firms that pursue either hybrid or quality differentiation strategies collaborate less as compared to firms that follow a cost reduction strategy. Thus, developed economy firms collaborate in production processes with such developing economy firms whose primary plant strategy is efficiency. As a whole, results indicate that firms that follow a hybrid strategy experience higher levels of efficiency and product quality as compared to firms following either a quality differentiation strategy or a cost-lowering strategy. Thus, hybrid strategy firms experience higher levels of performance while collaboration is more prevalent in firms that primarily aim to enhance firms' economic efficiency by reducing the cost of production. The results of positive association between cost strategy and outsourcing are in line with the results of Bardhan et al. [32].

Economies of scope arise when the firm's operations are characterized by the production of a bigger variety or mix of products in a more cost-effective manner. The results indicate that the production of a high mix of products is positively but insignificantly related to firms' efficiency. This is because textile and apparel firms are inherently inefficient as they mainly rely on subsidies sometimes in the name of R&D whilst sometimes due to balancing, modernization, and replacement (BMR). Additionally, the industry also faces resource constraints in terms of machinery, raw material and skilled labor along with supply chain challenges which hamper its potential.

Furthermore, lack of strategic focus is another factor of inefficiency as the majority of firms are working to satisfy final goods producer demand only rather than producing products by focusing on their core competencies or products in which they have a competitive advantage. As a result, the production of a high mix of good lead to increased inefficiency and higher costs.

The effect of producing a high mix of goods on the quality of products is positive and significant indicating higher quality products being produced as a result of economies of scope. Nonetheless, the production of a high mix of goods on FOC in production processes is positive and significant. These results corroborate with the findings of Ali and Mahmood [58,59] in the case of FOC from the perspective of DEFs. This implies that developing economy firms that collaborate with developed economy firms produce a variety of goods and collaborate more as a result of a high product mix.

5. Conclusion and policy implications

5.1. Conclusion

Firms from developed and developing economies benefit from the international fragmentation of production stages. Customer demands for a variety of final goods, and a competitive environment compel the operators of manufacturing plants to indulge in foreign outsourcing collaboration with developing economy firms in various aspects. The data come from 217 textile and apparel firms from the city of Faisalabad, Pakistan. The survey has been conducted from July 17 to August 31, 2023. The period covered in the survey includes data on the financial year 2022.

This study has focused on investment and utilization of IT, strategic integration of outsourcing, utilization of advanced technology, implementation of plant strategy, and diverse product mix production as enablers of firms' performance and constituent of FOC in production processes.

The results indicate that higher investment and utilization of IT increases efficiency within the firms collaborating in outsourcing production processes. Such a cost reduction can be in the form of lower input costs, overhead costs such as rent, marketing expenses,

insurance, utilities, office supplies, legal fees, lower inventory costs, etc. The investment and utilization of IT influence product quality insignificantly whereas strategic integration affects product quality positively and significantly. Utilization of modern and sophisticated technologies significantly improves firms' efficiency, productivity, and quality of products as such technologies reduce cost, and improve product quality. These technologies also allow developing economy firms to engage more in FOC. Furthermore, firms that primarily follow a hybrid strategy by focusing on cost reduction and quality improvement at the same time experience higher levels of efficiency and product quality as compared to firms following either a quality differentiation strategy or a cost-lowering strategy while the economies of scope have no impact on firm efficiency, they significantly improve product quality.

Investment in IT, utilization of modern machinery, and economies of scope have a significant positive influence on the FOC in production processes. The developing economy firms that collaborate with developed economy firms produce a variety of goods and collaborate more as a result of a high product mix. However, strategic integration plays no role in attracting FOC in production processes.

Finally, firms that pursue either hybrid or quality differentiation strategies collaborate less as compared to firms that focus on a cost reduction strategy. Consequently, developed economy firms are more likely to engage in collaboration of production processes with such developing economy firms whose primary plant strategy emphasizes efficiency.

5.2. Policy implications

Keeping in view the aforementioned conclusion, the following policy implications may be deducted to enhance firm performance and foreign outsourcing collaboration in production processes between developing and developed economy firms. First, increase the investment and utilization of IT as well as IT-enabled technologies to increase the firms' efficiency, and satisfy the quality requirements of developed economy's outsourcing firms. Additionally, firms need to strategically integrate outsourcing in their policies and decision-making at all levels i.e., strategic, tactical and operational levels to further enhance product quality. A successful strategic integration of outsourcing brings efficiency and attract more FOC. Furthermore, firms need to introduce economies of scope to boost product quality, efficiency, and FOC. For example, textile and apparel firms can recycle redundant products to save costs of raw materials and production processes. Firms producing apparel can use discarded materials from the main product production to make other small products or convert them into yarn rather than wasting them.

6. Limitations and suggestions for future studies

This study focuses on the association between IT investment and firm efficiency while considering production process outsourcing as a mediator. The paper is based on cross-sectional data from textile and apparel firms located in the city of Faisalabad, Pakistan, which cannot be generalized to other industries. Studies considering data from other industries enable researchers to make comparisons in inter-industry analysis. Furthermore, cross-country analysis is suggested to enable researchers to understand the functioning of foreign outsourcing collaborations from the perspective of DEFs.

CRediT authorship contribution statement

Irfan Ali: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Zafar Mahmood:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Data curation, Conceptualization.

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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