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Original Article

The Role of Co-Innovation and Absorptive Capacity on Speed of Innovation and Its Impact on New Product Performance in the Small Sector Industry

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Abstract

Co-innovation is essential in the innovation literature, particularly for small-sector industries. This study examines how co-innovation, absorptive capacity, and speed of innovation influence new product performance. A cohort of 134 participants, drawn from disparate industries encompassing handicrafts, textiles, and food and beverage, was surveyed to garner data. Partial least squares structural equation modeling was employed to subject the research hypotheses to examination. A pronounced, affirmative direct association between co-innovation, speed of innovation, and new product performance was evidenced by the results. A considerable moderating influence exerted by absorptive capacity upon the co-innovation, new product performance relationship was subsequently unearthed. The cultivation of co-innovation practices with a multiplicity of partners; suppliers, competitors, customers, and industrial enterprises, is underscored as vital for securing a wider array of resources capable of enhancing new product performance. Moreover, businesses must possess the capacity to assimilate and reconcile newly acquired knowledge with their extant knowledge base, so that it might be exploited to fullest effect.

Keywords: Co-Innovation, Absorptive Capacity, Speed of Innovation, New Product Performance, Small-Sector Industry.

1. Introduction

Small industries are essential for boosting economic growth in developed and developing countries. A well-managed small sector ensures commercial stability and contributes to a nation's economic advancement. Despite the significant role of small and medium-sized enterprises (SMEs) in driving economic growth, research suggests that SMEs' overall performance is lower in developing countries than in developed countries. Therefore, they can only contribute partially to economic development. Besides that, small industries often face significant industrial expansion in product competition. A multiplicity of challenges is confronted by small industries, among them meager rates of innovation, workers of insufficient skill, and constrained resources. Consonant with this, it is asserted by Martowardojo (2016) that amelioration is still required with respect to the quality of human resources and the technical and non-technical competencies found within small industries, that new product innovation remains confined to what is already extant in the market, and that the pace of innovation could be augmented. Creativity is thereby impeded. Furthermore, it is contended by Rizal (2014) that the foremost impediment presently besetting small industries resides in the insufficient deployment of technology and the sluggish pace of

innovation in the development of new products, a deficiency by which the substandard performance of marketed products is occasioned. Such constraint is recognized as a pervasive predicament among small industries, which are frequently found wanting when contending with the ascendancy of large enterprises. Were the innovation of small industries to be expedited, the development of the enterprise would be rendered considerably less arduous.

A heightened sense of urgency is engendered by environments subject to rapid flux, whereby businesses are impelled toward swift innovation so that competitive advantage might be acquired and sustained (Cankurtaran et al., 2013). Speed of innovation has become the primary performance indicator for organizations (Ojha et al., 2021). Innovation in the small sector industry provides a unique challenge, and environmental conditions might make rapid innovation more difficult. Although the speed of innovation is rarely studied, it is essential for small industries which operate in unstable conditions in technical and commercial settings with high unpredictability (Ojha et al., 2021). There has been limited research on the speed of innovation in small industries, particularly in developing nations such as Indonesia. Moreover, scant investigation has hitherto been undertaken into the impact wrought by co-innovation, together with the moderating effect exercised by absorptive capacity, upon the speed of innovation and its consequent bearing on new product performance.

Businesses can use innovative ideas to provide new products, services, or ventures. This method demands collaboration with internal and external partners to establish a new blue ocean free of competition (Lee et al., 2012). New products or services are not required based on new technology or inventions. In addition, they may be the product of unique convergence or the bundling of several accessories or applications. New companies can be founded on a combination of intrapreneurship and inter-organizational collaboration. Lehtimäki et al. (2018) define co-innovation as inter-organizational collaboration on the idea, development, and innovation of new products and the pooling of resources to drive innovation.

It is suggested by Saragih and Tan (2018), further, that co-innovation (CI) value inheres in the creation of novel market values through innovative partnerships forged between internal and external stakeholders. Partnerships of this nature with external partners, such as competitors, partner organizations, government, universities, suppliers, and customers, are deemed indispensable if companies are to acquire fresh ideas and insights conducive to innovation.

Absorptive capacity (AC), for its part, is understood to denote an organization's capacity by which new knowledge, germane to its business goals, is valued, assimilated, and applied (Cohen & Levinthal, 1990). It is based on acquiring, assimilating, and applying knowledge for profit (Tzokas et al., 2015). Applying knowledge is crucial for companies to commercialize new knowledge and achieve organizational goals (Zhai et al., 2018). Firms that enhance their absorptive capacity may be better equipped to leverage external knowledge and resources to innovate and create value, potentially gaining a competitive advantage in their respective markets. In small firms, absorptive capacity can be vital in enabling them to overcome their resource constraints and leverage external knowledge and resources to innovate and create value (Valentim et al., 2016). Therefore, enhancing absorptive capacity can be a critical organizational capability for small firms seeking to compete in dynamic and uncertain environments (Liao et al., 2003).

Within today's dynamic and competitive business milieu, the rate at which novel products or services are proffered to the market by organizations, denoted the speed of innovation (SI), is regarded as critical to the determination of business success (Allocca & Kessler, 2006). The impact of innovation speed upon a range of business outcomes, new product performance (NPP) among them, has been investigated by a multiplicity of studies

(Carbonell & Rodríguez Escudero, 2010) According to empirical research, speed-to-market correlates positively with overall new product success, highlighting the significance of speed of invention in obtaining superior market performance (Carbonell & Rodríguez Escudero, 2010). The speed of innovation is a socially complex capability that is challenging to imitate and embedded within teams, enabling companies to stay in sync with customer demands (Wang & Wang, 2012). Additionally, mounting competition, technological advancements, and shorter product life cycles have raised the stakes for companies to innovate faster (Heirman & Clarysse, 2007).

This study aims to improve the performance of new products in the small sector industry by examining the roles of co-innovation (CI), absorptive capacity (AC), and speed of innovation (SI). In addition, this study aims to fill the research gap in the preliminary examination of AC as moderators in the setting of the small sector industry. Consequently, the research issue in this study is whether CI positively affects SI and NPP. Then, whether AC can moderate the relationship between CI and SI, this investigation is significant for the small sector industry to foster better business growth in the future.

2. Literature Review

2.1. Co-Innovation

In recent years, co-innovation (CI) growth through partner networks has increased. This trend has prompted researchers to dig deeper into CI and incorporate it as a fundamental component of business research. CI collaborates with companies and business partners to create innovative processes and new products (Tsai, 2009). Furthermore, CI enhances the availability of resources, promotes the exchange of implicit and explicit knowledge, mitigates research and development (R&D) risks, and enables cost-sharing among partners (Yan & Dooley, 2014). The current research centers on innovation collaboration between industries and suppliers, customers, competitors, and academicians. Such collaborations are a fundamental component of the innovation process (Möller & Halinen, 2017).

According to Liao et al. (2011), CI between an industry and its supplier facilitates direct interaction and fosters trust between the two entities. Additionally, this collaboration may promote information exchange among businesses, as Luzzini et al. (2015) noted. Working with consumers, as suggested by Hoyer et al. (2010), can reveal previously unmet and latent needs of customers, leading to the production of better products by companies. As proposed by Wu (2014), a collaboration between industry rivals can reduce the adverse effects of competition and foster innovation by increasing information sharing. Finally, collaborating with universities is crucial to successful innovation (Brettel & Cleven, 2011). This type of collaboration can lead to long-term research and development opportunities with other partners.

Within the value-creation process, knowledge, abilities, and experience are typically demanded by product innovation (Wang & Wang, 2012). In accordance with this view, the sharing of expertise and information with partners is regarded as an important factor in innovation (Chiang & Hung, 2010). A company's capacity to employ knowledge and data derived from CI may be said to determine the level of innovation attained. NPD speed can be augmented by CI (Carbonell & Rodríguez Escudero, 2010). Novel solutions and the pace of innovation, for instance, are identified by them as a response to market demands that are ever in flux (Du Plessis, 2007).

2.2. Absorptive Capacity

A vital concept, incorporated into a diversity of organizational theories, is constituted by Absorptive Capacity (AC). It is asserted by Apriliyanti and Alon (2017), that the concept of AC has been subsumed within organizational learning, social cognition, resource dependence, networks, knowledge, and dynamic capability theories. An essential aspect of organizational success across disparate theoretical frameworks is thereby suggested to be embodied by the concept of AC. It is argued by (Lau & Lo, 2015) that a firm's ability to absorb and assimilate knowledge is significantly impacted by the diversity of external knowledge. When, however, external and internal knowledge bear resemblance to one another, the firm's capacity for transformation and exploitation may thereby be enhanced. It is thus implied that the greater the resemblance between external and internal knowledge, the greater the effectiveness with which such knowledge will be leveraged and transformed into innovative ideas by the firm (Lau & Lo, 2015). Absorptive capacity is described by Cohen and Levinthal (1990) as an organization's ability by which external knowledge is absorbed, utilized, and transferred to the organization (Cohen & Levinthal, 1990). It is proposed by Arshad et al. (2020) that a company's absorptive capacity is contingent upon its human resources and average internal resources. Coordination of internal organizations toward the utilization of external knowledge is entailed by adequate absorptive capacity, whereby the absorption of external knowledge, its interpretation, its integration with existing knowledge, and its commercial exploitation are rendered possible. Value-creating exploration may be occasioned by such an approach, resulting in cost and risk reduction for the firm (Scuotto et al., 2017).

Knowledge acquisition and assimilation are the hallmarks by which prospective absorptive ability is characterized, whereas knowledge transformation and exploitation are the hallmarks of its realization (Jansen et al., 2005). It is said by Scuotto et al. (2017) that this strategy assists organizations in the building of partner relationships. The company's absorption is improved through the integration of implicit and explicit knowledge. A company's success, thus, is contingent upon its capacity to harness external knowledge toward the generation of new products and services. Organizations possessing a higher degree of absorptive capacity are rendered more proficient, both in the utilization and communication of novel insights and knowledge obtained from external collaborators and in the assimilation of new knowledge and expertise germane to the enhancement of their innovation performance (Rangus et al., 2017).

2.3. Speed of Innovation

Technology and globalization have shortened product life cycles and increased competitiveness, making the speed of innovation more critical for innovation management (Chen et al., 2010). Speed of Innovation (SI) represents a company's capacity to generate new products or processes faster than its competitors (Allocca & Kessler, 2006). Speed of innovation in product development refers to the company's ability to accelerate activities and tasks during the new product development process (Carbonell & Rodríguez Escudero, 2010). This classification is employed because the speed of innovation reflects crucial innovation success qualities in a complex environment (Le & Lei, 2018). The strategic factor drives innovation speed; hence time-based competition requires attention to innovation speed (Menon et al., 2002).

Innovation is compelled to proceed apace by firms, given that product life cycles are undergoing contraction, competition is on the ascendant, and the business environment is beset by instability (Shan et al., 2016). High value, procured at low cost and with expedition, is furnished by innovation within an industry subject to ceaseless change (Chen et al., 2010). Testing and vetting of new service offerings or technology may, notwithstanding the risk

thereby incurred, be forgone by businesses so that rapid development might be facilitated (Ojha et al., 2021). It is demonstrated by Cankurtaran et al. (2013), in their meta-analysis, that lower development costs, higher quality, competitive advantage, and financial success are all connected with the speed of innovation.

2.4. Hypothesis Development

2.4.1. Co-innovation and Speed of Innovation

It is suggested by Kang and Kang (2010) that priority is accorded to the speed of innovation by firms which implement co-innovation within the small industry, this being done so that market share might be increased. When a new product is delivered by a firm more expeditiously than by its competitors, the potential for growth in market segments is thereby afforded, and efficiency is preserved, given that access to the selfsame information and knowledge is required by its competitors. Furthermore, the frequency of innovation, such as the speed with which innovation is enacted in response to shifting market needs, may be affected by a company's capacity to exploit knowledge and information garnered through cooperation with partners; thus, an improvement in the speed of innovation may be occasioned by co-innovation (Du Plessis, 2007).

H1: Co-innovation positively and significantly affects the speed of innovation.

2.4.2. Co-Innovation and New Product Performance

It is suggested by Du Plessis (2007) that a firm's level of innovation may be determined by its capacity to apply knowledge and information acquired through co-innovation undertaken with partners. Various aspects of innovation may be impacted by this ability, among them the approach employed in the discovery of new solutions and the speed with which response is made to market volatility (Kang & Kang, 2010). Benefits such as the streamlining of the innovation process, the obtaining of greater access to resources, the facilitation of knowledge transfer, the reduction of development costs and time, the minimization of financial risks, and the targeting and influencing of customers by whom new product performance may be enhanced can be provided to a company through collaboration with partners on innovation (Wang et al., 2015). Moreover, a direct contribution to NPD may potentially be made by co-innovation (Lehtoranta, 2010).

H2: Co-innovation positively and significantly affects new product performance.

2.4.3. Speed of Innovation and New Product Performance

Crucial to the development of products is the concept of "speed of innovation," by which the rate at which a company progresses in the creation and bringing of new products to market is denoted (Carbonell & Rodríguez Escudero, 2010). Additionally, the company's ability to expedite activities and tasks throughout the new product development process is entailed thereby (Chen et al., 2005). From a strategic perspective, such as that of time-based competition, emphasis must be placed upon the speed of innovation (Menon et al., 2002) given that the product life cycle, from growth to decline, is becoming ever shorter, competition is on the increase, and the business environment is subject to volatility; the speed of innovation is, therefore, regarded as the primary solution for new product performance (Shan et al., 2016). Thus, quick changes in the market environment can be adapted to by the speed of innovation, minimal costs and short periods being taken into consideration (Chen et al., 2010).

H3: Speed of innovation positively and significantly affects new product performance.

2.4.4. Moderating Role of Absorptive Capacity

Zhai et al. (2018) noted that businesses with high absorption could receive knowledge about the industry, see possibilities in the market, and comprehend the requirements of their customers. Businesses may be assisted by a high AC in the identification and acquisition of new external information, the assimilation of newly acquired knowledge, and the combination of such knowledge with existing knowledge so that new knowledge might be developed. Thus, expertise may be applied by businesses toward the solution of specific problems. Moreover, an increase in the speed of innovation and its overall performance can be boosted by the possession of a high absorptive capacity, leading, in turn, to an increase in the frequency of innovative ideas (Zhai et al., 2018).

According to Kafouros et al. (2020), a co-innovation customer or supplier can expedite innovation when a firm collaborates with external partners or adopts internal practices to disseminate the knowledge acquired externally. Such practices help align the firm's structures more closely with its supply chain partners, facilitating knowledge flow and assimilation. To foster collaboration among partners, practices such as integrated planning, interrelated product development processes, co-located teams, and concurrent engineering tools and systems can accelerate the innovation process (Kafouros et al., 2020).

H4: Absorptive capacity positively moderates the relationship between co-innovation and speed of innovation.

Figure 1 outlines the proposed framework which depicts the interrelationships among co-innovation, speed of innovation, and new product performance, with absorptive capacity as a moderating factor.

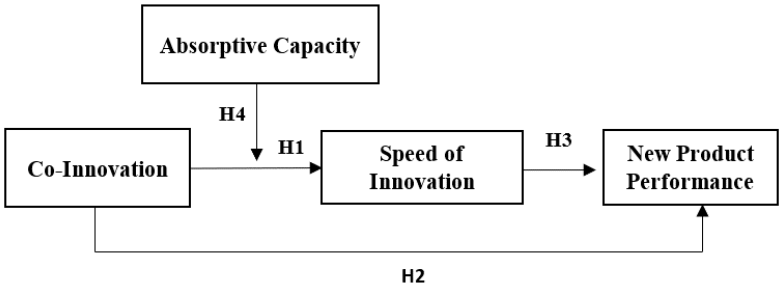

Figure 1. The proposed research framework

3. Methods

The method by which data collection was undertaken in this study is constituted by a survey. Information pertaining to the research's objective was furnished to the participants by the researchers, confidentiality was assured them, and their participation in the questionnaire was requested. Distribution of the survey was made to either the owner or management of each company. So that social desirability bias might be eliminated in the measurement of constructs, respondents were reminded that no responses were to be deemed either correct or incorrect. In addition, they have assured anonymity, and their responses were not connected to their companies or products. This method was intended to encourage participants to collaborate without fear of repercussions (Carbonell & Rodríguez Escudero, 2010).

Consistent with previous research, data were collected using the critical informant method (Molina-Castillo et al., 2011). The informants contributed to innovative efforts and were familiar with the organization's general strategies. Their knowledge of the subject topic was evaluated through the data-collecting tool. This study is concerned with innovation

activities carried out by small industries. Therefore, the target population was selected from small manufacturing industries where innovation is essential. According to information procured from the Office of Industry and Trade of West Java Province, 10,757 small industries are to be found within the Bandung area, comprising 4 (four) principal centers, among them the textile sector (25%), the handicraft sector (25%), the agribusiness sector (25%), and the miscellaneous sector (25%). Bandung and its adjacent regions were selected as the location for the population, this being owing to the concentration of small manufacturing firms found therein, within West Java. So that the sample size might be determined, the recommendation of Ghozali (2011) is followed by the study, whereby the number of samples is suggested to be calculated on the basis of the size of parameters, multiplied by a factor of 5 to 10. Twenty-four parameters, derived from two exogenous and two endogenous variables, are possessed by the study; thus, a minimum sample size of 24 x 5 = 120 is required. Nevertheless, an increase to 134 was seen in the number of samples collected for the study.

So that information pertaining to the demographics and business characteristics of the respondents might be gathered, four questionnaire components, adapted from disparate sources, were comprised by the research instrument. Employed for this purpose was the first component, constituted by the biodata-filling instrument. Employed to capture data pertaining to the co-innovation, absorptive capacity, speed of innovation, and new product development variables was the second component, constituted by the variable filling instrument. A five-point Likert scale, ranging from strongly disagree to strongly agree (1 = Strongly disagree, 5 = Strongly agree), was employed in the measurement of the research constructs.

Six items adapted from Brettel & Cleven (2011) measure co-innovation, which reflects collaboration in co-creating products with partners such as suppliers, partner organizations, competitors, outside collaborators, customers, and universities. Six items were adapted from a study by Flatten et al. (2011) that measures absorptive capacity. The sample item is “our company is used to absorbing new knowledge from outside the organization for our company to use.” The speed of innovation is measured by six items adapted from Wang and Wang (2012) which reflect, for example, "a company's ability to innovate new products or processes more quickly than competitors.” New product performance is measured by six question items relating to, for example, "success in selling new products since they were marketed to the present.”

4. Results and Discussion

4.1. Research Results

4.1.1. Respondent Demography

The results of descriptive statistics showed that the respondents were male and female, with a frequency of 102 (76.1%) and 32 (23.9%). Then, the business operation period was 16 (11.9%), 48 (35.8%), 38 (28.4%), 26 (19.4%), and 6 (4.5%) respondents with time business operations for 2-5 years, 5–10 years, 11–20 years, 21–30 years and above 30 years. The descriptive analysis also reflects that 32 (23.9%), 59 (44.0%), 12 (9.0%), and 31 (23.1%) small sector industries come from the shoes & bags, craft, food & beverage, and miscellaneous. Finally, new product sales (1 year) in the ranges less than 500 units, 500 to 1000 units, 1000 to 2000 units, 2000 to 3000 units, and greater than 3000 units new product sales in one year are respectively 38 (28.4%), 24 (17.9%), 38 (28.4%), 10 (7.5%), and 24 (17.9%) (see Table 1).

Table 1. Descriptive Statistic Results

Control	Range	Frequency	%
Gender	Male	102	76.1
	Female	32	23.9
Business Operation	2-5 year	16	11.9
	5-10 year	48	35.8
	11-20 year	38	28.4
	21-30 year	26	19.4
	>30 year	6	4.5
Industry Category	Shoes & Bag	32	23.9
	Craft	59	44.0
	F&B	12	9.0
	Miscellaneous	31	23.1
New Product Sales (1 year)	< 500 unit	38	28.4
	500-1000 unit	24	17.9
	1000-2000 unit	38	28.4
	2000-3000 unit	10	7.5
	>3000 unit	24	17.9

Source: Data processed in 2025

4.1.2. Data Analysis

The statistical tool Smart PLS, a partial least squares equation modeling method, was employed in the data analysis undertaken in this study. Owing to the nature of the data and the need for mediation and moderation analyses, this approach was chosen. Smart PLS finds widespread use across several fields, marketing and human resource management among them, and is recommended by Hair et al. (2019) for the prediction of the impact of dependent variables. As a validated reporting method by which robust analyses might be conducted in the management sciences, PLS-SEM was employed in this study. The relationship between concepts may be investigated, and direct and indirect pathways measured, by researchers through this technique, rendering it the most effective method for the evaluation of latent variables that are difficult to examine and unobservable. The relationships between independent and dependent variables, together with their observable points, were assessed through inner and outer model analyses. Emphasis is placed upon variance analysis by PLS, which may be performed with Smart PLS (Vinzi et al., 2009). Consequently, this method was chosen for the present investigation. The measurement of factor weights, together with reliability and validity, was tested using Cronbach's alpha and factor weights. Categorization of each question item according to each variable is ensured by factor weight. Constructed reliability and average extracted variance (AVE) follow next.

4.1.3. Measurement Model

A measurement model was employed by the researchers in this study so that the reliability of constructs, composite reliability (CR) and average variance extracted (AVE) among them, might be assessed. Cronbach's alpha (CA) and composite reliability were employed by them so that reliability might be tested and measured. Presented in Table 2, and ranging from 0.876 to 0.956, are the results of CA and CR for co-innovation, speed of innovation, new product performance, and absorptive capacity. According to Hair et al. (2019), values above 0.70 are considered acceptable for CA and CR, and it is within that range that the values in this study fall. Discriminant validity was evaluated by the researchers using the Fornell Larcker and heterotrait-monotrait (HTMT) ratios, the latter being more commonly used. Presented in Table 3 are the results of both tests, whereby it is indicated that values higher than the correlation between variables were yielded by the Fornell and Larcker test. At the same time, the 0.90 threshold was fallen below by the HTMT ratio.

In addition, convergent validity was checked so that the AVE value might be obtained, and the 0.50 threshold was exceeded by all values (for co-innovation, speed of innovation, new product performance, and absorptive capacity, the AVE values stood, respectively, at 0.612, 0.786, 0.691, and 0.654) (see Table 2). Shown by the results is a VIF value for the antecedent constructs ranging from 1.197 to 1.517, this falling within the threshold of < 3 (Hair et al., 2019). Hence, collinearity among these constructs was not deemed a problem for this study.

Table 2. Measurement Model

Construct	Item Code	Loading	Outer Weights	CA	CR	AVE
Co-Innovation (CI)				0.876	0.904	0.612
	CI1	0.821	0.231			
	CI2	0.826	0.284			
	CI3	0.811	0.234			
	CI4	0.708	0.130			
	CI5	0.710	0.152			
	CI6	0.808	0.230			
Speed of Innovation (SI)				0.945	0.956	0.786
	SI1	0.894	0.188			
	SI2	0.888	0.182			
	SI3	0.933	0.189			
	SI4	0.873	0.189			
	SI5	0.899	0.195			
	SI6	0.828	0.185			
New Product Performance (NPP)				0.912	0.931	0.691
	NPP1	0.770	0.220			
	NPP2	0.851	0.256			
	NPP3	0.885	0.218			
	NPP4	0.829	0.176			
	NPP5	0.823	0.160			
	NPP6	0.828	0.172			
Absorptive Capacity (AC)				0.893	0.918	0.654
	AC1	0.713	0.163			
	AC2	0.914	0.247			
	AC3	0.818	0.178			
	AC4	0.845	0.239			
	AC5	0.797	0.200			
	AC6	0.749	0.202			

Note: co-innovation (CI); speed of innovation (SI); new product performance (NPP); absorptive capacity (AC)

Table 3. Discriminant validity (latent variable correlation and square root of AVE)

	AC	CI	SI	NPP
AC	0.809			
CI	0.485	0.782		
SI	0.764	0.543	0.886	
NPP	0.758	0.584	0.721	0.832

Note: co-innovation (CI); speed of innovation (SI); new product performance (NPP); absorptive capacity (AC)

Table 4. HTMT (Heterotrait–Monotrait Ratio)

	AC	CI	SI
CI	0.513		
SI	0.821	0.581	
NPP	0.825	0.583	0.757

Note: co-innovation (CI); speed of innovation (SI); new product performance (NPP); absorptive capacity (AC)

The importance of the path coefficient was then examined, and the proposed hypotheses were confirmed. For this purpose, a bootstrapping analysis, comprising 5000 subsamples, was undertaken. Table 5 furnishes the examination outcomes. Adduced by the results of PLS-SEM analysis is a salutary and significant bearing exerted by co-innovation upon the speed of innovation (H1), the value thereof being β = 0.185, t = 2.603, and p = 0.01. NPD, likewise, is significantly swayed by co-innovation (H2), with β = 0.272, t = 4.133, and p = 0.01. New product performance, moreover, is disclosed by the results to be significantly affected by innovation speed (H3), the value amounting to β = 0.573, t = 8.826, and p = <0.01. The nexus betwixt co-innovation and speed of innovation is thereafter found to be moderated, favorably and appreciably, by absorptive capacity, with β = 0.137, t = 1.838, and p = <0.05 (see Table 6 and Figure 2). A salutary interaction wrought by absorptive capacity (CI*AC) upon co-innovation and speed of innovation is elucidated by Figure 3, wherein it is shown that the effect of co-innovation upon new product performance is amplified as the absorptive capacity of a company waxes greater (see Table 6, Figure 3). H4, accordingly, is likewise vindicated. Lastly, recourse was had to the cross-validated coefficients of determination of R2 and the redundancy measure Q2 for the purpose of appraising the model's quality. Table 7 sets forth the findings of this appraisal, conducted per the criterion propounded by Hair et al. (2019) Surpassing zero, furthermore, are the Q2 values obtained for both outcomes, a finding whereby it is intimated that in-sample predictive significance, with respect to these constructs, inheres in our model.

Table 5. Hypothesis Construct

Effects	Relationship	Beta	Mean	(STDEV)	*t*-Value (*t*-Stat.=1.66)	Decision
Direct Relations						
H1	CI → SI	0.185	0.185	0.071	2.603**	Yes
H2	CI → NPP	0.272	0.276	0.066	4.133**	Yes
H3	IS → NPP	0.573	0.574	0.065	8.826**	Yes
Indirect Relation						
H4	CI*AC → SI	0.137	0.146	0.074	1.838*	Yes

Note: **p < 0.01, *p < 0.05, co-innovation (CI); speed of innovation (SI); new product performance (NPP); absorptive capacity (AC)

Table 6. The Quality of the Structural Model

Outcome Construct	R2	Q2
SI	0.632	0.487
NPP	0.572	0.372

Note: speed of innovation (SI); new product performance (NPP)

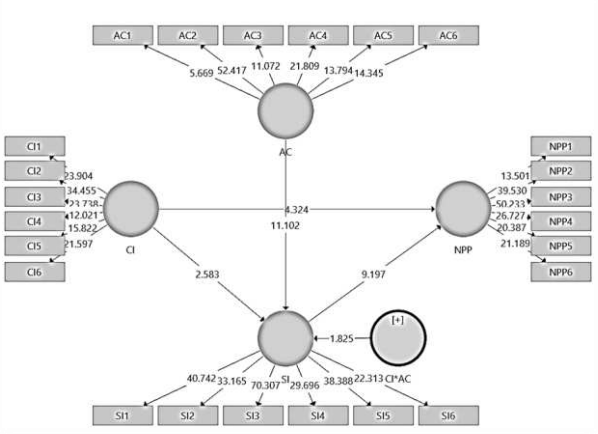

Figure 2. Structural Model Outcome

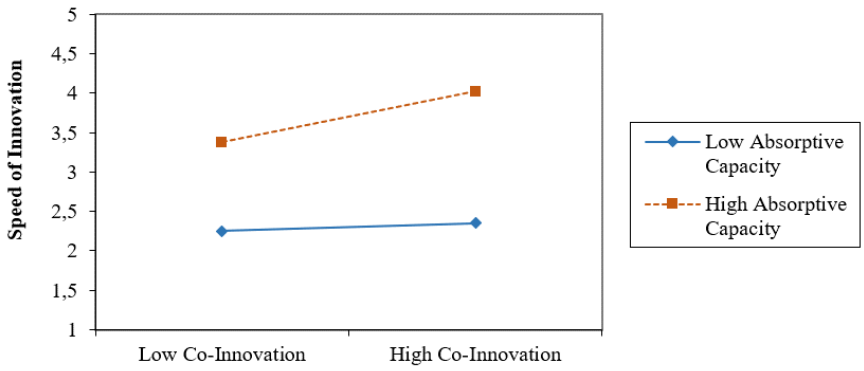

Figure 3. Interaction Effect

4.2. Discussion

This study looks at how co-innovation relates to both the speed of innovation and new product performance. It also examines whether absorptive capacity moderates the effect of co-innovation on new product performance within small-sector industries in a developing economy. Consistent with earlier research, co-innovation was found to positively affect the speed of innovation, and it significantly boosts new product performance. The study further sheds light on the relationship between new product performance and speed of innovation.

According to Santos-Vijande et al. (2016), co-innovation can lead to appropriate market response, reduce delays, and accelerate the speed of innovation, which is consistent with previous research demonstrating that co-innovation can promote the adoption of innovations and expedite the launch of new products, thus allowing companies to keep pace with rapid market developments and boost sales of innovative products. Wang and Wang (2012) suggest that using co-innovation across various business sectors can enable companies to focus on innovation speed and increase market share while retaining efficiency by leveraging the knowledge gained through such collaboration to establish an inaccessible market sector to competitors.

More application-focused development projects, attended by abbreviated timelines, attenuated risks, and diminished outlays, may likewise be occasioned by the enlistment of consumers in innovation (Knudsen, 2007). It was averred, then, by Yeniyurt et al. (2014), that a new product of augmented performance might sporadically be developed by organizations that engage in co-innovation with their suppliers. According to (Brettel & Cleven, 2011), suppliers are to be reckoned indispensable business confederates, and the adaptation of products toward the engendering of novel product ideas is enabled by collaborative undertakings. A valuable wellspring of information is thus constituted by co-innovation with suppliers, and companies may be abetted thereby in the amelioration of their NPD (Brettel & Cleven, 2011).

It is adduced by antecedent studies that NPD is bolstered by enterprises through engagement and confederation with a multiplicity of innovation partners, suppliers, consumers, competitors, and academic institutions among them (Tsai, 2009). Salutary NPP is frequently conjoined with collaboration undertaken with consumers in product development, this being owing to the succor rendered thereby to enterprises in the engendering of novel ideas, the furnishing of product solutions, the discernment of customer demands, and the anticipation of market trends (Brettel & Cleven, 2011). Innovation is contributed to by collaboration with suppliers through the augmentation of technological acumen, the diminution of costs, the amplification of capacities, the amelioration of the design process, and the sustaining of indispensable supplies for enterprises by which NPD is undergirded

(Belderbos et al., 2015). The selfsame interests in product and process development are frequently shared by organizations that confederate with competitors; thus, the acumen possessed by their rivals is rendered applicable unto them as well. Consequently, businesses' acumen may be fortified, and innovation and NPD augmented, through joint research and development undertaken with rivals (Kang & Kang, 2010).

A matter of no small moment for businesses seeking, through product innovation, to acquire competitive advantage is constituted by the relationship subsisting betwixt the speed of innovation and new product performance. It is intimated by the study's findings, congruent with antecedent research, that superior new product performance may be occasioned by a more expeditious innovation speed (Carbonell & Rodríguez Escudero, 2010). Attributable to this outcome is the circumstance whereby firms are enabled, through more expeditious innovation speed, to bring products to market with greater celerity, a first-mover advantage being thereby conferred upon them and the capture of market share facilitated (Shan et al., 2016). A U-shaped relationship between innovation speed and new product performance was, however, likewise discerned by the study, whereby it is intimated that diminishing returns, in terms of NPD, may be occasioned by an increment in innovation speed beyond a certain threshold (Langerak & Hultink, 2006). Higher costs and truncated cycle times may be occasioned by an increment in the speed of innovation beyond a certain point, product quality and overall performance being thereby adversely affected. Firms must, therefore, hold innovation speed in equipoise with other factors, cost, quality, and market demand among them, so that optimal new product performance might be attained.

In addition, it is demonstrated by our results that the relationship between co-innovation and speed of innovation is tempered by absorptive capacity. According to Rangus et al. (2017), by whom European organizations were studied, the nexus between co-innovation and NPD may be enhanced through absorptive capacity. A multiplicity of sources and conduits, whereby information from partners might be absorbed, is afforded unto businesses by robust absorption, the accumulation of innovative knowledge being thereby amplified. Businesses may be abetted by superior absorptive faculties in the efficacious translation and absorption of knowledge and its application to co-innovation research and development, NPD being thus ameliorated (Hong et al., 2019). It is propounded, therefore, by Liu et al. (2017), that small industries must augment their innovation faculties through an increment in their absorptive capacity, external resources being thereby transmuted into corporate innovation performance.

Engagement in innovation activities, such as the acquisition of new technologies and the fabrication of new products, is encouraged among their confederates by firms possessing a high degree of innovation. A company's capacity for innovation activities may, therefore, be augmented by innovation (Zhai et al., 2018). New external information may be efficaciously discerned and absorbed by companies possessing robust absorptive capacity, newly acquired knowledge may be integrated with extant knowledge, and novel knowledge engendered thereby (Todorova & Durisin, 2007). Such firms can then use this knowledge to solve real-world problems, leading to increased innovation frequency, speed, and performance (Lane et al., 2006).

5. Conclusion

The focus of this study is to highlight the co-innovation and absorptive capacity in the new product development of small sector industries in a rapidly changing economy. Indeed, the research shows that in order to speed up innovation and enhance new product performance, collaboration is crucial. The success of innovation is also greatly influenced by a variety of innovation partners, suppliers, consumers, competitors, researchers, and others. Further, the research shows that the speed of innovation is closely related to performance in new product development, so companies must balance the speed of innovation with other aspects (cost, quality, and market demand) to ensure that the new product is best performing. Moreover, it is shown by the study that the speed of innovation and co-innovation is moderated by absorptive capacity. This means that businesses with good absorptive capacity are better able to absorb and use external knowledge, and new product performance is better. On the whole, there are a lot of implications for small-sector industries in a rapidly evolving economy because of the results of this research. If innovation is encouraged and absorptive capacity is increased, then companies will accelerate the pace of innovation, and new products will perform better, making the market more competitive.

The implication is that incorporating consumers, suppliers, competitors, and research institutions in the innovation process can result in more application-focused development projects with shorter schedules, fewer risks, and lower prices. The growth of technological expertise, the reduction of costs, the expansion of capacities, the improvement of the design process, and the maintenance of essential supplies for businesses that support NPD all contribute to innovation that can be made through collaboration with innovation partners. It is disclosed by the study's findings that a correlation subsists between the rate of innovation and the performance of new products, whereby it is suggested that diminishing returns, in terms of NPD, may be occasioned by an increase in the rate of innovation once a certain threshold has been surpassed. Hence, so that optimal new product performance might be attained, an equipoise must be struck by businesses between the speed of innovation and other considerations, cost, quality, and market demand among them. In conclusion, it is indicated by the study's findings that a moderating role, within the connection subsisting between co-innovation and the rate of innovation, is played by absorptive capacity. Therefore, so that their capacity for innovation activities and the generation of new knowledge, applicable to the solution of practical problems, might be increased, businesses are required to augment their absorptive capacity, this term denoting their ability to transmute external resources into firm innovation performance.

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