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Original Research

Effect of Innovation capability on Competitiveness: A Study on Manufacturing Firms in Ethiopia

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Abstract

The study examines the impact of innovation capabilities on the competitiveness of Ethiopian manufacturing enterprises using an explanatory research methodology. A systematic questionnaire was used to gather primary data from industrial organizations. The study found that product, process, marketing, and organizational innovations are independent variables influencing firm compatibility. The data was analyzed using SPSS v26 and AMOS v23, and confirmed factor analysis (CFA) was employed to assess the validity and reliability of the results. The average variance extracted (AVE) was greater than 0.5, indicating construct validity. There was guarantee of construct reliability because the Cronbach alpha and composite reliability score were both more than 0.7. The study revealed that innovations in products, processes, markets, and organizations significantly and positively impacted the competitiveness of the firms studied through structural equation modeling and multiple regression analysis. The independent variable that has the most significant positive effect on competitiveness is product innovation (β=0.355, p<0.01, t=8.25), followed by organizational innovation (β=.333; p<0.01; t=9.00). To maintain competitiveness, Ethiopian large and medium-sized manufacturing business owners should continuously enhance their innovation capabilities.

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INTRODUCTION

Innovation is a fundamental element of business success, signifying the collective accomplishments of an organisation through the revitalization and enhancement of concepts (Alhemairy & Hussain, 2022). As one of the factors that have changed businesses in recent decades, innovation in the form of new products, processes, marketing strategies, and organisational structures has made innovators more profitable than non-innovators (Edwards-Schachter, 2018). In connection with this, Jamai et al. (2021) claimed that in a market of global competition and rapid change, firms attempt to adapt their strategies by introducing new or improved innovation types in order to take advantage of existing opportunities. Innovation is the act of turning knowledge into value through the

application of new or improved goods, processes, and systems that are doing things differently. Moreover, as noted by Tidd and Bessant (2018), the ability of an organisation to innovate will determine its long-term survival, given that yesterday's solutions cannot ensure a solution to today's issues due to market volatility worldwide. Innovation is one of the main factors that increase the value of business and is a driver towards improved performance, according to Ponta et al. (2021). In addition, innovation performance is construed as the extent to which business organisations intentionally deploy resources for research and development to bring improved and novel products to the market.

In regards to Ethiopia, consumers can purchase a large variety of imported goods, but enterprises in Ethiopia make small, incremental improvements to increase productivity and competitiveness. For this reason, building innovation capabilities is particularly important for Ethiopian firms. Previous studies in Ethiopia underlined that it is a must for firms to effectively involve themselves in innovative activities to produce innovative products, processes, and services to be active and make their enterprise environment so attractive, without which market share and customers would be lost (Abibo et al., 2022). In a globalised market, customers have access to a wide range of options to choose from, necessitating businesses to produce a good or service more effectively than their competitors, which is best known as organizational competitiveness (Tomalá & Olives, 2022). Competitiveness can be viewed as closely linked to the market mechanism, and it explains the capability to produce and sell products in order to function effectively to meet what the competition needs (Shirinyan et al., 2021). The presence of competition between enterprises will drive firms to produce more and better quality items, which will benefit consumers as well as companies and generate larger profits, grow market share, and attract more clients (Vîrjan et al., 2023). Productivity, market share, profitability, efficiency, product variety, value creation, and customer satisfaction are just a few of the numerous interconnected firm factors that determine competitiveness (Kiveu et al., 2019). The current study used most of these indicators when assessing manufacturing firms' competitiveness at the firm level. There is no universally applicable definition that works across organisations, but business performance has been replaced with firm-level competitiveness in strategic management (Farhikhteh & Farhikhteh (2023).

The competitiveness is a concept that manifests itself in all spheres of human existence, irrespective of the size and nature of organisations, from the micro to the macro level, as well as in social and personal life. But larger firms are stronger compared to smaller ones, as larger firms have more opportunities to capitalize on competitiveness (Lafuente & Vaillant, 2023).

Therefore, evaluating the competitiveness of businesses in both larger and medium-sized organisations and how innovation orientation contributes to improved success in a highly competitive market is the current study's goal. Product, process, market, and organizational innovation are the four categories of innovation that have been identified in the literature (Sigalat-Signes et al., 2020). Product innovation is taken as a business endeavor to develop, refine, and

produce new products (Ashrafi & Zare Ravasan, 2018). Process innovation implies searching for the best methods to produce products compared to how others produce them (Siriram et al., 2023). The competitiveness of enterprises is impacted by organisational innovations, which are closely associated with all administrative efforts to update organisational routines, procedures, mechanisms, and systems (Jiang et al., 2019; Alhemairy & Hussain, 2022). It was construed in various literatures that all kinds of innovations have the potential to produce improved performance and a long-term competitive advantage. In connection with this, Zand and Rezaei (2020) unlined that the central concept of the necessity for innovation is environmental change and the presence of competition, without which innovation misses its meaning. The purpose of this proposed dissertation is to evaluate the types of innovation that are used in Ethiopian industrial sectors and how they affect the competitiveness of businesses in large and medium-sized manufacturing firms. It was argued that innovative practices can occur in small, medium, and large enterprises (Admasu, 2017). But the focus on large and medium enterprises in this study was due to the study's nature of not merely describing the innovation activities that would take place but also the explanation of how those innovative behaviours would lead to the competitiveness of firms compared to others in the industry.

This is how the rest of the article is organized. The problem is briefly stated here, and then research questions and objectives are developed. The empirical literature review is followed by a comprehensive discussion of the relationship between the independent and dependent variables. The research methodology is covered after this. Following that, the findings and analyses from several statistical analyses were explained. The conclusion and suggestions for potential policy implications are given in the last section.

Statement of the problem

Ethiopia's manufacturing sector is still far from being an engine of growth and economic transformation, despite the country having one of Africa's fastest-growing economies (Arkebe, 2018). The low competitiveness of the majority of industrial sectors in Africa underscores the need for knowledge on how to foster innovation and industrial policies that are successfully executed, supported by sufficient finance and strong collaborations (Ahmad, 2022). Furthermore, given the manufacturing sectors' substantial contribution to the "Ethiopian economy," empirical study must comprehend their performance in terms of organisational capability development and the degree to which they are pursuing innovative endeavors. This is because the manufacturing sector is critical to the stability and health of the economy (Mishra, 2019). Despite the fact that innovation is essential for boosting competitiveness, many of the earlier empirical studies are incomplete in their examination of the extent to which Ethiopian businesses are pursuing innovative practices and the effects of various forms of innovation on their competitiveness. It was emphasised that in order to improve business-level innovation processes, Ethiopia must encourage firms' involvement in knowledge production (Keraga & Araya, 2023). It is therefore essential to research Ethiopian

enterprises' innovation imperatives in order to determine the state of the current practices in relation to various kinds of innovation and how those innovative behaviours affect the performance and competitiveness of the firms. As a result, numerous earlier studies were examined both inside and outside of Ethiopia. First, the research that is currently available on the relationship between innovation capability and firm competitiveness is geographically and thematically limited, despite the large number of studies in this area. Even though positive and significant effects between all of the innovation capability dimensions and competitiveness were confirmed by the majority of studies (Zand & Rezaei, 2020; Somwethee et al., 2023), Still, other studies produced findings that are not consistent (Wei & Luo, 2022; Issau et al., 2022; Yulianto & Supriono, 2023) are also undertaken in developed nations than Ethiopia, leading to a disagreement gap and a geographic gap demanding further studies. Therefore, it is imperative to study the innovation behaviours and types's effect on organizations in developing nations such as Ethiopia, since the innovation efforts of these firms may differ from those of industrialized nations. In some of the available studies in Ethiopia, there are many gaps left to be filled. For instance, Admasu (2017) addressed the innovation types and firm performance in industries located in Eastern Ethiopia, including all-sized firms (small, medium, and large), which are limited geographically. While Ayinaddis (2023) studied the impact of innovation on the performance of micro and small-scale enterprises in the Awi zone. The aforementioned studies, as is evident, have concentrated on a small number of companies and covered a narrow geographic area of Ethiopia, making them unable to adequately represent the total manufacturing organisations in Ethiopia. Therefore, this study, using the stratified random sampling technique, tries to represent manufacturing firms in various industries comprehensively. Furthermore, the goal of this study was to clearly illustrate how manufacturing firms in various industries apply innovation capabilities in their production and marketing processes and how that affected their performance during the study period. This study is distinct since it employed a variety of data analytic approaches, such as regression analysis, correlation analysis, descriptive statistics, and structural equation modelling, to arrive at its conclusions. The current study focused on all four categories of innovation capability.

Research Questions

1. How does product innovation affect Ethiopia's manufacturing firms' competitiveness?
2. How does process innovation affect Ethiopian manufacturing companies' competitiveness?
3. How does market innovation affect Ethiopia's manufacturing companies' competitiveness?
4. How does organisational innovation affect Ethiopia's manufacturing companies' competitiveness?

Empirical literature Review and Hypothesis Development

Product Innovation and Competitiveness

The presence of a positive and significant association between forms of innovation and

the competitiveness of organisations has been proven by numerous prior studies. According to Cho and Linderman's (2020) establishment, both processes and product innovations function as mechanisms for determining order winners. Ayinaddis (2023) examined the relationship between innovation orientation and the performance of micro and small manufacturing enterprises in Ethiopia's Awi Zone towns. The results demonstrated a strong and positive correlation between business success and organisational innovation, marketing, process, and product. Su (2023) examined the relationship between product innovation, environmental sustainability, corporate social responsibility, technology innovation, and firm performance and found a direct correlation between product innovation and firm performance. Alinda et al. (2024) discovered a substantial association between product innovation and sustainability practices. Na & Kang (2019) also discovered a robust positive correlation between product innovation and sales growth. Salim et al. (2021) came to the conclusion that product innovation had a partial influence on marketing performance. Saleh & Al-Nimer (2022) found that the introduction of a new product or service into the market helps to increase revenue and financial performance compared to other firms. Thongsri & Chang (2019) posited that higher performance is mediated by product innovations.

[Ho1] There is no relationship between product innovation and the competitiveness of manufacturing firms in Ethiopia.

[Ha1] There is a relationship between product innovation and the competitiveness of manufacturing firms in Ethiopia

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Process innovation and Competitiveness

Widya-Hasuti et al. (2018) used primary data gathered at the firm level to study the relationship between process innovation, firm-specific capabilities, and sustainable innovation in SMSEs in Indonesia. They discovered that process innovation mediates the relationship. When Suwignjo et al. (2022) looked into the framework for studying process innovations in state-owned enterprises in Indonesia, they found that the success criteria for adopting process innovations are a crucial component for state-owned companies. Cheng et al. (2023) used primary data sources and came to the conclusion that green process innovation has a significant impact on sustainability. Green process innovation was found to be able to mediate the relationship between sustainable supply chain management and sustainable performance in Pakistan, as studied by Shahid et al. (2020). According to a study by YuSheng and Ibrahim (2020), all aspects of innovation capability were found to have a substantial impact on performance. Aliasghar et al. (2019) confirmed that there is a relationship between a firm’s openness and process innovation. Alinda et al. (2024) discovered a substantial association between process innovation and sustainability practices. According to Canh et al.'s (2019) analysis of Vietnamese manufacturing enterprises, innovation in both products and processes improves a firm's performance in terms of market share.

[Ho2] There is no relationship between process innovation and the competitiveness of manufacturing firms in Ethiopia.

[Ha2] There is a relationship between process innovation and the competitiveness of manufacturing firms in Ethiopia.

Marketing Innovation and Competitiveness

Numerous studies have confirmed the connection between industry performance and market innovation. For example, an empirical study on the effects of innovation on the performance of small and medium-sized firms carried out in Hargeisa, Somaliland, by Abdilahi et al. (2017) confirmed a positive and significant relationship. An empirical study on the effect of marketing innovation on the performance of small and medium enterprises in Nigeria by Adamu et al. (2020) found that marketing innovation techniques have a beneficial impact on the efficiency of small and medium-sized businesses. All dimensions of innovation capability, including marketing innovation, were found to have a significant effect on the performance of the banking sector in Ghana (YuSheng & Ibrahim, 2020). Digital marketing innovation had a significant effect on firm performance (Jung & Shegai, 2023). Peng et al. (2021) established that marketing innovations significantly affect firm performance. Research by Vokoun and Píchová (2020) on market orientation and marketing innovation in manufacturing in Czech manufacturing established that marketing innovation does not have a role in the sales of innovative goods and services in the manufacturing sector. Ungerman and Dědková (2019) found a strong correlation between marketing innovation tools and strategic objectives after researching marketing innovations in Industry 4.0.

[Ho 3] There is no relationship between marketing innovation and the competitiveness of manufacturing firms in Ethiopia.

[Ha3] There is a relationship between marketing innovation and manufacturing enterprises' competitiveness in Ethiopia.

Organizational innovation and competitiveness of manufacturing firms

Organizational innovation was found to be the basis for both product and process innovation, according to a study done by Ozturk and Ozen (2021). Additionally, a study on the performance implications of organisational and technological innovation on Serbian manufacturing firms confirmed the significant contribution of organisational innovation (Todorovic et al., 2022). Organisational innovation has a direct and indirect impact on human capital practices, according to a study by Alhemairy and Hussain (2022). Chuang & Lee (2023) find that organisational innovation has an impact on financial performance. Jeong & Park (2023) find that both strategic management and organisational innovation are important features for organisational sustainability. Stoffers et al. (2021) studied workplace innovation and organisational performance in the hospitality industry and concluded that work place innovation is lowest in the hospitality industry when compared with others. Yousaf et al. (2022) find that the continuous survival of small and medium-scale industries rests on continuous organisational innovation. Farooq et al. (2021) confirm that innovation orientation has a significant impact on business performance.

[H04] There is no relationship between organizational innovation and a manufacturing firm's ability to compete in Ethiopia.

[Ha4] There is a relationship between organizational innovation and manufacturing firms' ability to compete.

MATERIALS AND METHODS

The Research Design

To test the formulated hypotheses, this investigation used cross-sectional data, which assumes a particular period across all different firms in Ethiopia and also gives equal opportunity for firms in the manufacturing sector. This study design has the advantage of minimizing bias among firms and improving representatives, as was justified by Malhotra et al. (2017). The data collection for this study was carried out in 2023.

Population and sample size

The target populations of the study were legally registered large and medium-sized manufacturing companies in Ethiopia. Currently, according to the official report from the Investment Commission of Ethiopia for January 2023, there are about 3687 legally registered large and medium-sized manufacturing firms, of which 3500 are currently active. We were provided with a list of those manufacturing firms along with their full addresses, which helped with the process of data collection and sampling. The classification of firms into different sizes was made based on the classification given by the Ministry of Trade and Industry that is being implemented across Ethiopia in different reports and empirical investigations. Which is that firms with more than 10 but less than 51 employees were taken as medium enterprises and those with 51 or greater were taken as large firms. The reason for focusing on large and medium-sized firms is due to the nature of the study objectives and the closeness of those firms to innovation and competitiveness compared to those firms with less size, as witnessed in previous studies.

An enterprise's size determines innovation owing to the factors of knowledge and large opportunity for increasing innovation opportunities and awareness about gaining competitive advantage through innovation. Accordingly, primary data was collected through a structured questionnaire from 300 firms' sampled using the Kothari (2004) sample size determination formula, and 270 of these were correctly filled, making up about 90% of the response rate. Of these 270 firms, 131(48%) were medium-sized manufacturing firms, and 139 (52%) were large. While the numbers of these targeted firms are larger, majority of them are found in Addis Ababa and the surrounding Sheger city administration towns of Oromia and were the focus of data collection.

With regard to the type of manufacturing firms, Ethiopian firms are engaged in a variety of manufacturing types, and the current study uses stratified random sampling techniques to ensure inclusiveness. In those manufacturing firms, a stratified random sampling technique was used to collect primary data using structured, closed-ended questionnaires.

Procedure of data collection

As this research was based on primary data sources from top management of manufacturing enterprises, certain procedures were followed to ensure technical and ethical soundness of the research outcome. The first questionnaires were developed from previous works, and content validity was assured by a group of professional experts working as

professors at the university. Content validity was tested to make sure that the research instrument intended to collect data covered all the required objects in the research. All research objectives and conceptual frameworks were given to a group of five experts along with the proposed questionnaire items. All experts reflected their own views, and some modifications were made based on their comments. Second, after assurance of inclusion of all relevant information, a pilot test was done with 20 manufacturing firms, and direction was provided as to the different wordings, clarity, and appropriateness of the statements. And after pilot study feedback, the questionnaire items were modified without dropping their original objective. Finally, with the assistance of trained enumerators recruited for this study, data collection was executed. Wollega University provided the approval letter to conduct this study, for which all manufacturing firms were approached.

Instrument Development

Measurements of all research variables were made with approved tools. Innovation survey data collection can take place in two different types based on the Oslo Manual of 2005: the subject and the object approach, in which the subject approach focuses on the innovative behaviors of firms while the latter focuses on each individual innovation record. This study adopts a subjective approach in that the innovative behavior of firms was assessed. Hence, a structured questionnaire was used to measure innovation capability based on the Oslo Innovation Manual (OECD, 2005/2018). It was used by many later studies and included process, product, marketing, and organizational innovations using Likert scale items. (1) = lack of innovation implementation; (5) = innovative original goods and processes. Competitiveness was represented by four indicators of profitability, sales volume, market share growth, and productivity of firms when compared with other similar product or service providers in the industry using a multi-item scale, with 1 representing very poor, we are the worst in the industry, and 5 representing excellent, we are far better than the competitors (Kajurová & Linnertová, 2018).

Competitiveness and business performance were also represented by market share and profitability by Kiveu et al. (2019); market share, profit level, sales volume, and return on investment by Singh et al. (2019) when a cross-sectional study was done on micro and small-scale enterprises. In addition, according to the European Commission's report on measuring competitiveness, financial performance in terms of profitability, market share growth, productivity, growth in terms of the sales volume of products, and productivity were taken as the generic measures of competitiveness and were adopted in this study. Hence, in this study, competitiveness, being a dependent variable, was measured using these indicators so that companies were expected to rate their position in the market compared to similar industries.

Empirical model specification

Structural equation modeling supported by multiple regression modeling was used with the following model to investigate the direct relationship between innovation capability categories and firms' competitiveness.

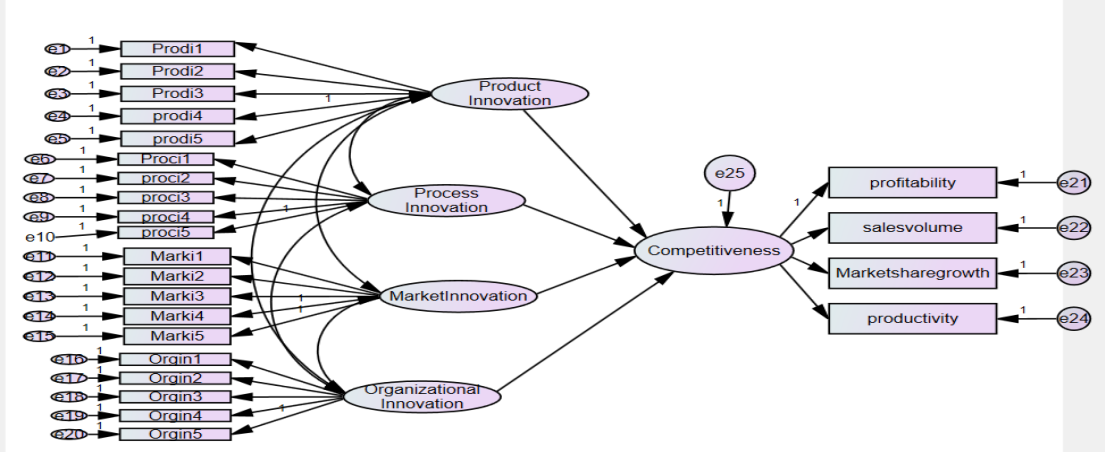

Figure1, *Conceptual Framework of the study*

Yi is the dependent variable for the ith observation, β0 is the intercept, xi is the independent variable, βn are the regression coefficients, and ei is the ith observation's error term. Yi is represented as β0+β1x1i+β2x2i+……. βnxni+ei.

Using the variables utilized in this study, the basic regression model is modified as follows to show the relationship between the variables based on the conceptual framework shown in Figure. 1.

β01 + β1ProI + β2ProcI + β3Mark I + β4OrgI + ε1 = FC..... (1) Where β01 is the intercept

Where: FC = firm competitiveness,

Prodi = Product Innovation Capability

Proci = Process Innovation Capability

Marki= Marketing Innovation Capability

Orgi =Organizational Innovation Capability; E = Error Term

Data Analysis Approach

Descriptive statistics were used to illustrate the characteristics of the study variables. Structural equation modelling with measurement and structural data analysis was used as a second-generation multivariate data analysis technique that explores the relationship between complex models (Dash & Paul, 2021). Two main types of structural equation modelling can be mentioned in the literature: covariance-based structural equation modelling (CB-SEM) and partial least squares structural equation modelling (PLS-SEM) (Hair &Alamer, 2022). CB-SEM was the most widely used statistical technique among researchers (Shao et al., 2022). As the study's objective was theory testing based on pre-specified theories and prepositions to measure how the suggested model could predict the covariance matrix, covariance-based structural equation modelling was used (Hair et al., 2020). Application of confirmatory factor analysis indicates that at least some theories are available indicating the relationship between the hypothesis that the proposed theoretical relationship among the observed and latent variables exists, and researchers are expected to test this relationship (Hair et al., 2020). Of the two types of reflective and formative measures, the reflective one was used in which the latent variables cause the indicators (Rose et al., 2023).

RESULTS AND DISCUSSION

Descriptive statistics

Descriptive statistics were employed to elucidate the general characteristics of the respondents and study variables, particularly those related to innovation capability practices in and across firms of different types and sizes. Accordingly, a total of 300 closed-ended questionnaires were distributed to firms in Addis Ababa and surrounding Sheger city administrations in Ethiopia, and 270 of them were properly filled, making the response rate 90%. The questionnaires were distributed to different manufacturing firms in the industrial sector using stratified random sampling techniques. Data was collected from 10 different types of firms in the manufacturing sector, as displayed in Table 1.

Table 1

Types of sampled Manufacturing companies

S. No	Manufacturing category	Frequency	Percent
1	Basic and fabricated metal products	20	7.4
2	Manufacture of wood and wood products	7	2.6
3	Chemical and chemical products	26	9.6
4	Manufacture of food and beverage products	52	19.3
5	Manufacture of furniture	38	14.1
6	Manufacture of leather and leather products	12	4.4
7	Manufacture of other non-metallic mineral products	39	14.4
8	Manufacture of paper and paper products	3	1.1
9	Manufacture of rubber and plastic products	35	13.0
10	Manufacture of textile and wearing apparel	38	14.1
	Total	270	100.00

Table 1 illustrates that the manufacturing of furniture, textile and wearing apparel, and other nonmetallic mineral products were some of the largest in umber next to the food and beverage industries (52 (19.3%).

Table 2

Demographic characteristics, educational background and position of respondents

		Frequency	Percent	Valid Percent	Cumulative %
Sex	Male	183	67.8	67.8	67.8
	Female	87	32.2	32.2	100.0
	Total	270	100.0	100.0	
Education	Diploma	26	9.6	9.6	9.6
	Bachelor's Degree	154	57.0	57.0	66.7
	Masters	87	32.2	32.2	98.9
	Above Masters	3	1.1	1.1	100.0
	Total	270	100.0	100.0	100.0
Position inthe organization	General Manager	52	19.3	19.3	19.3
	Operation Manager	74	27.4	27.4	46.7
	Production Engineer	45	16.7	16.7	63.3
	Assistant Production Marketing Manager	33	12.2	12.2	75.6
		48	17.8	17.8	93.3

The demographic characteristics of the respondents were presented in Table 2. As a result, 183 respondents or 67.8% are men, and the remaining 87 respondents or 32.2% are women. About the respondents' educational background, 154 (or 57% of them) have at least a bachelor's degree, 87 (32.2%) have a master's degree, and only 3 have a higher. Operation managers hold the highest share of respondents' positions in manufacturing enterprises, with 74(27.4%), followed by general managers (52,19.3%), marketing managers (48, 17.8%), production engineers (45, 16.7%), assistant production (33, 12.2), and quality control (eight, 6.7%).

Table 3

Innovation capability Dimensions practices

		Frequency	Percent	Cumulative Percent
Product Innovations	Introduced	199	73.7	73.7
	Not introduced	71	26.3	100
	Total	270	100.0	
Process innovations	Introduced	190	70.4	70.4
	Not introduced	80	29.6	100
	Total	270	100	100
Marketing Innovations	Introduced	169	62.6	62.6
	Not Introduced	101	37.4	100
	Total	270	100	
Organizational Innovations	Introduced	174	64.4	64.4
	Not introduced	96	35.6	100
	Total	270	100	

The degree to which manufacturing firms are utilizing innovation capability across its four dimensions is displayed in Table 3. As a result, the vast majority of firms (199 (73.7%) stated that over the previous three years, they have introduced improved products and items to the market. Only 71 manufacturing firms, or 27.3%, did not implement any kind of product enhancement within their establishments. About 190 manufacturing firms, or 70.4%, have incorporated innovations into their production processes to generate high-quality products. Merely 80 manufacturing companies, or 29.6%, did not make any advancements to their processing methods or procedures. The majority of the organisations, 169 (62.6%), practiced marketing innovations, which involve making changes to the overall marketing process. Only 101 (37.3%) of the enterprises tried any modifications to their marketing procedures. Regarding organisational innovation as an enhancement of overall operating processes, working methods, and organisational structures, the majority of the firms reported having introduced new or enhanced organisational setups in their manufacturing organisations, accounting for 174 (64.4%) of the total responses.

Table 4

*Enterprise Size *Innovation Types Practiced Cross Tabulation*

		Enterprise Size		
Count		Medium	Large	Total
Product innovation	Introduced	78	121	199
	Did Not Introduce	53	18	71
	Total	131	139	270
Process Innovation	Introduced	77	113	190
	Did Not Introduce	54	26	80
	Total	131	139	270
Marketing innovation	Introduced	64	105	169
	Didn't Introduce	67	34	111
	Total	131	139	270
organizational innovation	Introduced	68	106	174
	Didn't Introduce	63	33	96
	Total	131	139	270

Table 4 compares the enterprise size and innovation activity implementation of Ethiopian manufacturing companies. All major dimensions of innovation capability practices were primarily implemented by larger firms in the last three years as compared to medium enterprises (121 large firms versus 78 firms implementing product innovations); 113 larger firms out of the 190 firms that introduced process innovation; 105 larger firms out of the 169 marketing innovations implemented; and 106 larger firms out of the 174 organizational innovations implemented were larger firms. It can be inferred that larger manufacturing firms in Ethiopia are more likely than medium-sized firms to be implementing innovation capabilities practices. This finding aligns with earlier research findings showing that larger enterprises innovate more than smaller ones, as demonstrated by the works of (Megersa et al; 2018; Kiveu et al., 2019). This is also consistent with Zenebech(2017) findings, which demonstrated that although innovation had a positive relationship with firm performance, process and product innovations were associated with large firms (68%) and 49% with medium-sized businesses and 42% with small businesses).

Table 5

Cross tabulation of Innovation capability Practices across manufacturing firms

		Basic And Fabricated metal products	wood and wood products	chemical & chm products	Food And Beverage	Furniture	Leather	other non-metallic	papa and products	Rubber & Plastic	Textile &Wearing	Total
Product innovation	Introduced	9	5	17	46	24	10	25	2	26	35	199
	Didn't	11	2	9	6	14	2	14	1	9	3	71
	Introduce total	20	7	26	52	38	12	39	3	35	38	270
Process Innovation	Introduced	12	3	20	33	25	9	24	1	25	36	190
	Did Not	8	4	6	19	13	3	15	2	10	2	80
	Introduce total	20	7	26	52	38	12	39	3	35	38	270
Marketing innovation	Introduced	10	5	14	23	26	3	20	0	28	33	
	Did Not	10	2	12	29	12	9	19	3	7	5	169
	Introduce Total	20	7	26	52		12	39	3	35	38	101
Organizational Innovation	Introduced	13	4	16	30	24	8	20	1	25	33	174
	Did Not	7	3	10	22	14	4	19	2	10	5	96
	Introduce Total	20	7	26	52	38	12	39	3	35	38	270

The cross-tabulation results of the manufacturing sector enterprises in the study samples and their innovation capabilities and practices are shown in Table 5. Firms in the food and beverage sector accounted for 23.2% of all firms that introduced product innovation over the course of the last three years, followed by businesses in the textile and apparel sector (17.6%). Firms in the rubber and plastic product sector made up approximately 13% of all firms that introduced product innovation, followed by enterprises that manufacture furniture (12%) and firms that produce other nonmetallic mineral products (12.5%). Regarding process innovation, companies in the textile and apparel manufacturing sector improved and updated their production processes and systems, accounting for roughly 18% of the total, while companies in the food and beverage sector make up 16%. Regarding marketing innovation, manufacturers of paper goods and paper products did not introduce any new or improved methods of marketing their products. In contrast, the largest number of firms that did so was in the textile and apparel manufacturing category (16.5%), followed by companies in the rubber and plastic manufacturing category (14%). Comparably, companies that produce textiles and clothing—which make up 16% of all organizations—are at the forefront of implementing organizational innovations. These companies are followed by those that produce food and drink.

Reliability and validity assessments

Both validity and reliability tests were undertaken in the current study, as illustrated in Table 6. Internal consistency and reliability One of the reliability assessment methods was assessed using Cronbach's alpha, the most widely recognized indicator of internal consistency, with a value of 0.70 or higher being adequate (Sideridis et al., 2018). In addition, composite reliability was also used as one of the requirements for construct reliability in structural equation modeling, in addition to Cronbach's alpha. While Kamranfar et al. (2023) underline that the prerequisites for construct reliability assurance are indicators with higher factor loadings, the acceptable result of composite reliability would be greater than 0.7. Hair et al. (2020) have indicated that composite reliability results ranging from 0.70 to 0.95 indicate adequate to good reliability levels. In addition, one of the validity test indicators employed in this study is converging validity, which explains the variance of its indicators based on factor loadings. It is determined by utilizing the average variance extracted (AVE) (Sujati et al., 2020; Hair & Alamer, 2022), and loadings must be >0.5 with a significant corresponding p value ($p<0.05$) for a measurement tool to have acceptable convergent validity. Thus, the validity and reliability test results displayed in Figures 2 and 3 and Table 6 of this study were above the recommended threshold in the literature, so validity and reliability were ensured.

Table 6

Reliability and validity test result of the study

Indicators/Items and variables	Item-Total Correlation	Cronbach's alpha	composite reliability	Average variance extracted (AVE)	Square root of AVE
Product Innovation	.629**	.783	0.82	0.564	0.751
Process	.791**	.857	0.87	0.575	0.761
Marketing	.543**	.866	0.91	0.636	0.78
Organizational	.631**	.910	0.92	0.694	0.84
Competitiveness	.752**	.905	0.930	0.821	0.89

Another validity measure in structural equation modeling is discriminant validity, which clarifies how distinctively an indicator measures its own construct and how much a construct differs from other variables in practice (Taherdoost, 2018). If the correlation value between these constructs is less than the square root of the average variance extracted, then discriminant validity is ensured (Sujati et al., 2020). When comparing the two criteria, the results of the current study shown in Table 7 indicate that discriminatory validity is assured. This is also in support of Basco et al.'s (2022) claim that discriminant validity is achieved to a greater extent when the square root of the average variance extracted is greater than the inter-factor relation. Furthermore, discriminant validity would not

be a problem in this study because all of the constructs passed the convergent validity assessment. It is true that achieving convergent validity is the first requirement for establishing discriminant validity because, if an indicator cannot adequately define its own latent variable, it is useless to investigate whether it would be distinguished from other constructs (Rönkkö & Cho, 2022). Table 7 displays that the square root of the AVE is above the inter-correlation among variables, confirming that there is no discriminant validity issue.

Table 7

Discriminant validity using cross correlation and square root of AVE

	Competitiveness	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
Competitiveness	0.89				
Product Innovation	.600**	0.751			
Process Innovation	.329**	.526**	0.76.		
Marketing Innovation	.640**	.551**	.514**	0.78	
Organizational Innovation	.557**	.490**	.452**	.496**	0.84

Assumption Test Results

Structural equation modeling is viewed as a novel measuring option among the several multivariate data analysis techniques because it allows to simultaneously examining the correlation observed and latent/unobserved variables (Dash & Paul, 2021; MohdDzin& Lay, 2021). It is regarded by academics as sophisticated developments of statistical modeling methods, which are versatile modeling approaches that enable researchers to evaluate equation-based models in elucidating relationships between latent and observed variables (Henseler, 2020). Here are a few of the requirements that must be fulfilled.

Table 8

Skewness and kurtosis analysis for Multivariate normality

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std.err	Statistic	Std. error
Product Innovation	270	-1.085	.148	.060	.295
Process Innovation	270	-1.266	.148	.280	.295
Marketing Innovation	270	-1.094	.148	-.100	.295
Organizational Innovation	270	-1.055	.148	-.133	.295
Table 8 continues.					
Profitability	270	-1.325	.148	.572	.295
Sales Volume	270	-1.574	.148	1.266	.295
Market Share growth	270	-1.155	.148	.563	.295
Productivity	270	-1.555	.148	1.777	.295

Multivariate Normality

To ascertain if the data met the requirements for multivariate normality, one of the formal testing approaches that required calculating the values of skewness and Kurtosis was employed, in accordance with (Effendi et al., 2018). All of the study's variables, as shown in Table 8, have values that are normally distributed and fall between the ranges recommended by various authors. This is especially true for the absolute value, skewness, and Kurtosis values, which should all fall within the ranges of -+1.96 and -+7, respectively, as recommended by (Hair et al., 2020).

Multi Collinearity Diagnostics

When two or more indicators exhibit strong correlation, co-linearity occurs, rising standard error of the indicators' weight (Hair et al., 2020). This study applies different methods to detect the presence of multicollinearity such as the variance inflation factor, tolerance and inter factor association. Hair et al. (2022) states that tolerance <0.25 and variance inflation factor>= 5 are a condition that dictates presence of multicollinearity. In the same vein, variance inflation factor greater than 5 would be an indication for multicollinearity to present (Kim, 2019). More over multicollinearity can also be detected using inter factor correlation in which higher correlation among the variables is likely to result in collinearity to occur particularly when correlation coefficient between variables is greater than >0.8 (Young, 2018). Consequently, the study's multi-co linearity test results, which are shown in Figures 2 and 3 and Table 9 indicates that multi-co-linearity is not present, as evidenced by the correlation matrix below 0.80, VIF <3, and tolerance >0.25.

Table 9

Multi collinearity diagnostics using Pearson's correlation tolerance and VIF

		1	2	3	4	5	Tolerance	VIF
1	Competitiveness	1					.680	1.471
2	Product Innovation	.651*	1				.789	1.267
3	Process Innovation	.425**	.456	1			.890	1.123
4	Market Innovation	.541**	.571**	.534*	1		.757	1.320
5	Organizational innovation	.536**	.493**	.644**	.586**	1	.894	1.122

Sufficiently Large Sample Size

For multivariate research such as structural equation modeling (SEM), the sample size needed should be at least 200. According to the above-mentioned guidance on SEM assumptions, the current study's manufacturing enterprises sample size of 270 is adequate for the analysis.

Furthermore, the Kaiser Mayor Olkin (KMO) technique was employed in assessing sample size rightness, with a minimum result of 0.50 required. Table 10 presents the result for

sample size sufficiency which yielded a KMO value of.928 significantly above the lowest threshold for factor analysis and a Chi2=1536.88, DF=28, P <.001.

Table 10

KMO and Bartlett's Test

KMO and Bartlett's test		
Kaiser Mayer- Olkin Sampling adequacy		.928
Bartlett's test of Sphericity	Approximate Chi.2.	1536.88
	DF	28
	sig.	0.000

Measurement model validation using Confirmatory Factor Analysis (CFA)

Two steps were followed in order to validate the structural equation modeling with confirmatory factor analysis done first followed by the structural part as suggested by (Sovey et al., 2022; Zyphur et al.,2023). Some of the criteria's used to asses model goodness of fit were Chi-Square model over degrees of freedom (X2/df), Root Mean Square Error of Approximation (RMSEA), Tucker Lewis Index (TLI), Comparative Fit Index (CFI), Adjusted Goodness of Fit (AGFI), and Goodness of Fit Index (GFI) as these were commonly used by many researchers employing structural equation modeling including (Savalei, 2021; Falke et al.2020).

Validation of measurement model for independent variables

Measurement model for the independent variables of the study as described in the conceptual framework was done. As seen in Figure 2 and Table 11, the model goodness of fit test result (GOF) indicated a perfect fit.

Table11

Summary of model fit the measurement model of independent variables

Model fit indicators	Benchmark	Test outcome
X^2/Df	≤*5*	1.153 (Satisfactory)
GFI	≥0.90	0.946 (Satisfactory)
TLI	≥0.90	0.993(Satisfactory)
CFI	≥0.90	0.995 (Satisfactory)
RMSEA	≤0.08	0.024 (Satisfactory)
P and P close values	≥0.05	P = .106, Pclose 0.263 Good fit)

Validation of measurement model for the outcome variable

Similarly, the measurement model result for firm competitiveness as a dependent variable with four measurement items was found to be a good fit in all fit criterion. In terms of loadings, the result in Figure 3 and Table 12 shows that the loadings of all items were > 0.5 with factor loadings falling between 0.7 to 1.00 fulfilling the requirement outlined in the literature.

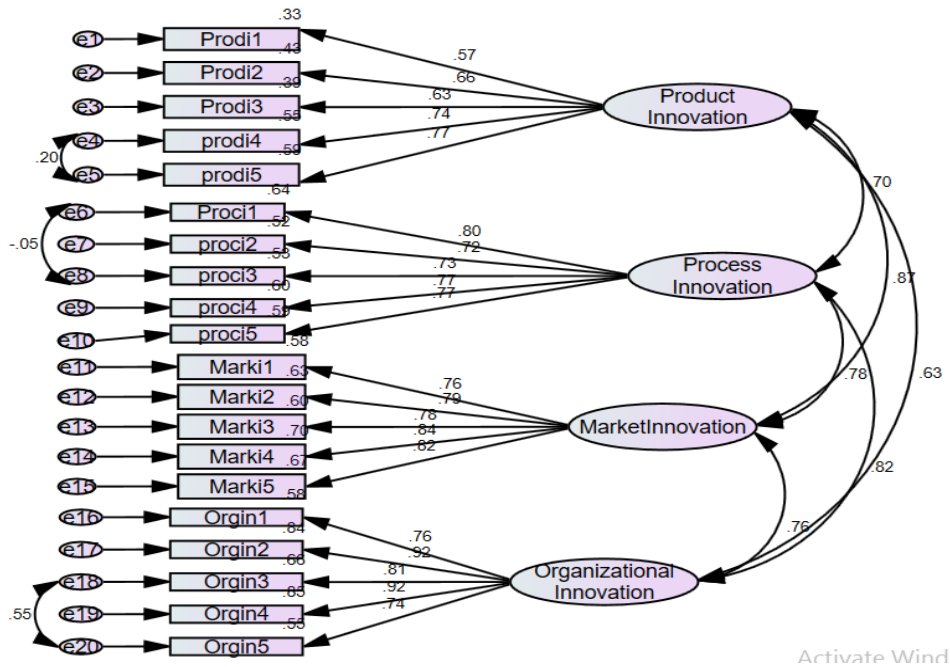

Figure 2. Measurement Model For independent variables

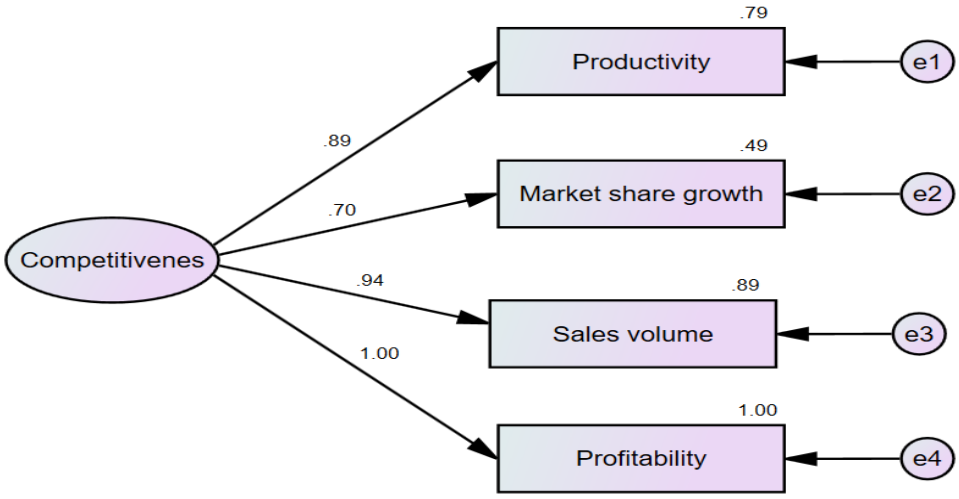

Figure 3. *Measurement Model for Firm Competitiveness*

Table12

Measurement model for Firm competitiveness from CFA output

Model Fitness Standards	Bench Mark	Outcome
Chi2 /DF	≤ 5	2.016 (satisfactory)
GFI	≥0.9	0.992 (satisfactory)
AGFI	≥0.9	0.962 (satisfactory)
TLI	≥0.9	0.998(satisfactory)
CFI	≥0.9	0.998(satisfactory)
RMSEA	≤0.08	0.041(satisfactory)
P value and PClose	≥ 0.05 (insignificant value)	P=0.133 &0.310 (satisfactory)

Result from Structural Equation Model

Structural model was formulated as shown on Figure 4, with four independent variables and their respective indicators on the left, followed by the endogenous construct at the right (firm Competitiveness with its indicators as suggested by (Zyphur et al., 2023). The model goodness of fit test result was a perfect one as indicated in Table 13 and Figure 4; the model is fit.

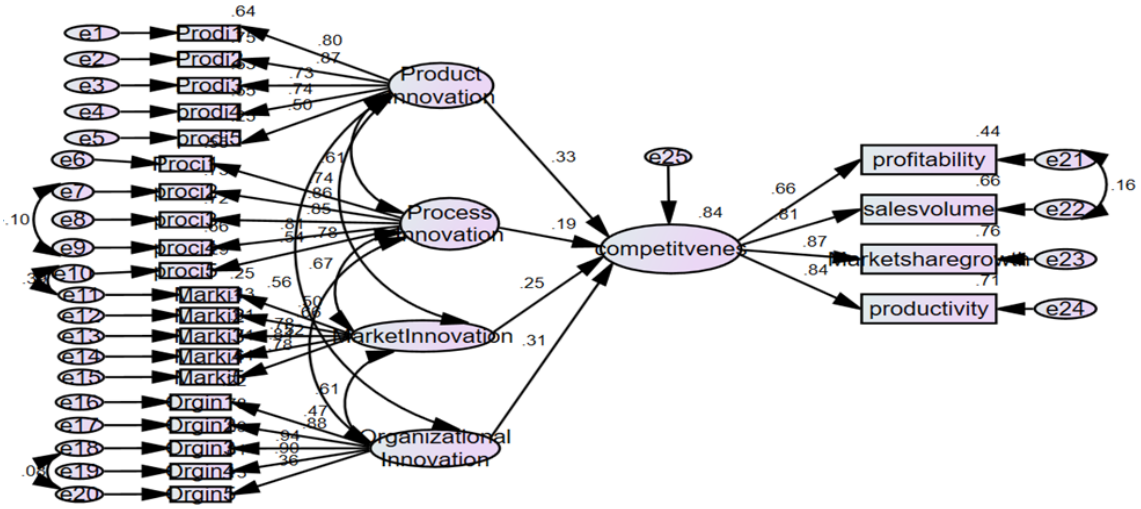

Figure 4. Full structural model showing the relationship between the outcome and predictor variables

Table 13

Model fit summary of the structural model

Model Fitness Standard	Benchmark	Outcome
Chi2 /Df	≤*5*	1.336 (Satisfactory)
GFI	≥0.90	0.984 (Satisfactory)
AGFI	≥0.90	0.957Satisfactory)
TLI	≥0.90	0.993 (Satisfactory)
CFI	>0.90	0.996 (Satisfactory)
RMSEA	≤0.08	0 .035 (Satisfactory)
P value and PClose	≥ 0.05	P=.177; P close 0.696 (good fit)

Before interpreting the result from the structural equation modelling illustrated above, significance evaluation was established based on the bootstrapping of standard errors that calculates the t-values of the path coefficients and also as alternatively confidence intervals in line with (Streukens & Loroi-Werelds, 2016), as a path coefficient is regarded as significant if zero doesn't fall into the 95% confidence interval. Consequently, all path coefficients are positive and significantly different from zero (P<0.001; C.R.>1.960), as shown in Table 14 of this study.

Table 14

Standardized regression weights (Direct effects): (group number 1-default model)

			Estimate	S. E	C.R.	P
Competitiveness	<---	Product Innovation	.331	.056	5.91	.026
Competitiveness	<---	Process Innovation	.186	.085	2.22	.020
Competitiveness	<---	Market Innovation	.252	.047	5.36	.035
Competitiveness	<---	Organizational	.310	.076	4.07	.002

**** p<0.001*

In terms of interpretation, all coefficients were interpreted using standardised regression coefficients, as these will make regression coefficients more comparable than the unstandardized regression weight (Nieminen, 2022). As a result, the standardised direct impact of product innovation on competitiveness is.331 which is significantly different from zero at the 0.05 level (p =.026 two-tailed). The lower and upper bound confidence intervals are not bound by zero, at.085 and.602, respectively. Process innovation has a standardised direct impact of.186 on competitiveness. Accordingly, when process innovation increases by 1 standard deviation, competitiveness increases by 0.186 standard deviations, which is significantly different from zero at the 0.05 level (p =.020, two-tailed). The lower and upper bound confidence intervals are not bound by zero, with values of.065 and.427, respectively. Likewise, market innovation has a standardised direct effect of.252 on competitiveness. That is, a one-standard deviation increase in market innovation causes a 0.252 standard deviation increase in competitiveness (p =.035, two-tailed). The lower and upper confidence intervals also significantly differ from zero, with values of.085 and.567, respectively. Lastly, organisational innovation has a standardised direct effect of.310 on competitiveness. This indicates that, as a result of the direct relationship between organisational innovation and competitiveness, competitiveness increases by 0.310 standard deviations for every one standard deviation increase in organisational innovation. This relationship is significant at the 0.01 significance level (p =.002 two-tailed), and the lower and upper bound confidence intervals are not bound by zero, with values of.131 and.386 respectively. This finding demonstrates that the competitiveness of organizations is positively

and significantly impacted by all aspects of innovation capabilities, including product, process, market, and organizational innovations. Accordingly, for manufacturing firms, 84% of variations in their competitiveness can be explained by the combined effects of four independent variables (product, process, marketing, and organisational innovations). According to Hair et al. (2022) and Ozili (2022), R-square values greater than 0.75 are considered substantial, which the current study also justifies. Product innovation has the highest positive significant effect in terms of variable significance and relevance, as indicated by the standardized coefficient results from the SEM path diagram above and Table 14, followed by organizational innovation.

Result from Correlation Analysis

Correlation illustrates the association between variables and as a result degree of correlation can be measured (Zhang et al., 2023).As a result, the calculation of the link between these independent variables and the dependent variable is shown in Table 15 below.

Table15

Pearson's correlations

Correlations (N=270)	Competitiveness	Product Innovation	Process Innovation	Marketing Innovation	Organizational
Competitiveness	1	.790**	.700**	.722**	.718**
Product Innovation	.790**	1	.592**	.742**	.527**
Process Innovation	.700**	.592**	1	.720**	.568**
Marketing Innovation	.722**	.742**	.720**	1	.645**
Organizational Innovation	.718**	.527**	.568**	.645**	1

***. Correlation is significant at the 0.01 level (2-tailed).*

The relationship between product innovation and competitiveness was shown to have a strong positive and significant association, as indicated by the Pearson correlation value (r = 0.790, N = 270, &P<0.01), as presented in Table 15. The correlation between organizational innovation and competitiveness is also positive and significant (r=0.718, N=270& p<0.01), whereas marketing innovation and competitiveness have a strong positive and significant link (r=0.722, N=270& p<0.01). The least significant but highly positive and significant connection (r=0.700, N=270&p<0.01) was established between process innovation and firms' competitiveness. In conclusion, it was discovered that there was a substantial, significant, and positive association between the dependent variable; manufacturing firm's competitiveness and the independent variables (product, process, marketing, and organizational innovation) in Ethiopia

Multiple Linear Regression Result

According to Zhang et al. (2023), multiple linear regressions quantify the impact of each

independent variable on the dependent variable while accounting for the impacts of all independent factors on the dependent variable. The regression model summary, displayed in table16 calculates the total variation in the dependent variable caused by the independent variables. The study's adjusted R-squared value was 0.758, meaning that the model's explanatory power is significant based on the previous section illustration of model explanatory power that innovation capability dimensions account for roughly 75.8% of the total variance in the competitiveness of firms in Ethiopian manufacturing sectors, leaving 24.2% unexplained.

Table 16

Model summary from multiple linear regressions

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.872[a]	.761	.758	.50956

a. Predictors: (Constant), Organizational Innovation , product innovation process innovation, Market innovation

ANOVA/ analysis of variance

Based on the significance and F ratio, analysis of variance (ANOVA) was performed to confirm the regression model's goodness of fit. The regression model in Table 17 had a large F ratio (F=211.15) and a significant p value of 0.000, indicating that it fits the data well and was the best choice for figuring out how the four independent variables impact firm's competitiveness.

Table 17

The ANOVA Table

ANOVA[a]						
Model		Sum of Squares	DF	Mean Square	F	Sig.
1	Regression	219.310	4	54.827	211.15	.000[b]
	Residual	68.80	265	.260		
	Total	288.11	269			

Regression Coefficients

The coefficient table displays the estimated model parameters (Table 18). The prediction equation's unstandardized β coefficient is shown in the B column. When one looks at the sig. column in Table18,8 one can see that all of the β coefficients are positive, meaning that a firm's competitiveness will grow if the value of any of the innovation capabilities dimension, product, process, market, an organizational innovation increases. .as all explanatory variables in this model have a significance level of less than 0.05.

Consequently, the percentage of firm competitiveness varies by.308 standard deviations for every standard deviation change in the percentage of product innovation, for every standard deviation change in process innovation, there are 0.138 standard deviation changes in the competitiveness of the manufacturing enterprises. And the standard deviation of firms competitiveness varies by 0.21 for any standard deviation changes in market innovation and firms' competitiveness varies by 0.333 standard deviations, for every standard deviation change organizational innovation. When the parameter coefficients of the four explanatory variables are compared product innovation has the highest positive effect (β=0.355, p<0.01t=8.805), 5) followed organizational innovation (β=.333, p<0.00t=9.00), 0) and process innovation (β=0.138, p<0.00, t=3.483) have the lowest and highest positive effects, respectively, on competitiveness. The above structural equation modeling path coefficient comparison was likewise similar to this result.

Table 18

The regression coefficient

Coefficients [a]						
Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta		
1	(Constant)	.224	.062	-	3.7	.000
	Product innovation	.341	.043	.355	8.25	.000
	Process innovation	.140	.043	.138	3.28	.000
	Marketing innovation	.227	.059	.201	3.48	.000
	Organizational innovation	.304	.037	.333	9.00	.000

Hypothesis testing

Using structural equation modeling, Pearson correlation, and multiple linear regression models, the four hypotheses formulated in this study were examined. Based on the multiple regression model result and structural equation path analysis result of T value being ≥1.960 and the very significant result from the Pearson correlation, the following hypothesis assumes that all C.R. and t values of the path coefficients. As a result, the null hypotheses were rejected.

[H01] There is No relationship between product innovation and competitiveness of manufacturing firms in Ethiopia =Rejected

[Ha1] Firm competitiveness is significantly affected by product innovation (β=0.355, p<0.01, t=8.25) = Supported

[H02]Firm competitiveness is not significantly affected by Process Innovation =Rejected

[Ha2]Process innovation significantly affects a company's ability to compete (β=0.138, p<0.00, t=3.281) = Supported.

[H03]Marketing innovation doesn't affect competitiveness of manufacturing firms in Ethiopia= Rejected

[Ha3] Marketing innovation significantly affects Firm's competitiveness in Ethiopia (β =.201, p<0.01, t=3.483) = Supported

[H04]There is no relationship between organizational innovation and firm's competitiveness in Ethiopia = Rejected

[Ha4] Firm competitiveness is significantly impacted by organizational innovation (β=.333, p<0.01, t=9.00) = supported

Regression equation based on the standardized direct effect

The regression equation was produced by the researchers in accordance with the above Table and path diagram figure, which demonstrated the impact of independent factors on the outcome variable.

Competitiveness=β0+0.355prodin*0.138proc in+0.201markin+0.333organin

CONCLUSIONS

This study looked at how innovation in product, process, market, and organisations directly affects a company's ability to compete in the manufacturing industry. Primary data sources were collected using questionnaires from both large and medium-sized firms in different manufacturing types, adopting the subject approach to innovation survey data collection that assesses how innovative the firms are and how innovative behaviours contribute to competitiveness measured in terms of profitability, market share, sales volume, and productivity. According to the result, innovation capability practices measured in four different types were implemented mostly in large firms compared to medium-sized firms. In terms of innovation capability relevance to improving competitiveness, it was found that all four dimensions of innovation (product, process, marketing, and organisational innovation) positively and significantly affect the ability to compete in the market. In conclusion, in order to boost their competitiveness to the highest level and ensure their sustainability, firms in the manufacturing sector of Ethiopia should continue to improve the implementation of innovation capability dimensions.

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DECLARATION

We confirm that there is no any competing interest in the article

DATA AVAILABILITY

Data used for this study are available from the corresponding author for reasonable issues.

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