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Article

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

Impact of Government Intervention on Manufacturing Enterprises Innovation level, in Ethiopia

Hayleslasie Tsegay Aregawi^{1*} and B.C.M Patnaik²

Abstract: Besides alert devastation situation of Small Manufacturing Enterprises (SMEs) in the country, what support receives from the government, banking, microFinance institutions, technology transfer and their role in the local economic development are the main issues that need to be addressed. Hence, the main objective of the study is to evaluate the impact of government intervention on the Small Manufacturing Enterprises Innovation level in Tigray, Ethiopia. For this purpose, we conducted a survey of 464 small manufacturing enterprise (textile and garment, metal and wood works, input for construction, chemical products, jewellery, and agro-processing sectors) owners. The study is, stressed the primary data, adopt a Cross-sectional survey study with a mixed research approach, and the types of research are explanatory. Multistage cluster sampling was applied to select each business owner. Descriptive statistics, chi-square test, propensity score matching and logistic regression were relayed for the analysis part with the help of Stata version 12. The average score innovation level of the enterprise is found at 2.89 which is assembled under the low innovators in the sample of the enterprise analyzed. Innovations activity has performed with the highest score level in the customer dimension. With regard to the PSM estimated, government intervention plays a significant role in utilizing innovation and technology transfer. Likewise, in a binary logistic regression, the study found that the intervention of the program has a positive effect on the innovation process dimension. Before and after matching, the findings of both models are similar in



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Hayleslasie Tsegay has completed his first degree in Accounting and Finance from Gondar University, Master's degree in Finance and Investment from Mekelle University and PHD In Finance from Indian University; Kalinga Institute of Technology and Industry (KIIT). Now Hayleslasie Tsegay is a lecture at Samara University, Department of Accounting and Finance. He has been conducting and involving in various research and community engagement of the University. The Authors research interest includes financial economics, Micro Finance, Banking, Taxation and Audit perspectives.

PUBLIC INTEREST STATEMENT

Micro- and small enterprises have a significant role in the socio-economic development of one's nation, especially in less developed countries. To enhance their significance, it requires to apply modern technological advancement. It is critically known that small enterprises have a significant role in utilizing local resources for economic development, but difficulty to produce competitive products in a modernized environment. In addition, in the absence of enough finance and skillfull human power, government intervention policy is mandatory. Hence, designing a new government policy intervention of small manufacturing enterprises is among the resolutions to enhance productivity, self-employability, sustainability and transformation into medium and large enterprises to produce innovative products to substitute imported goods.

terms of the owner's innovation of offering dimension, solution dimension, customer dimension, and value capture, which is positive and significant. Designing a new government policy intervention of Small Manufacturing Enterprises is among the resolutions to be applied by the government for purpose of productivity enhancement, self-employability, sustainability of the business and transforming to produce innovative products to replace imported goods.

Subjects: Finance; Business, Management and Accounting; Industry & Industrial Studies

Keywords: Government Intervention; Manufacturing Enterprises; Innovation level; Propensity Score Matching

1. Introduction

Micro and small enterprises (MSEs) are complementary to industries as supportive units make up and contribute in different aspects of economic growth as well as the socio-economic development of a nation (TekleLeza & Kuma, 2016); especially developed countries consider MSEs as a vibrant and dynamic sector in the last decade. The contribution, as well as the coverage of MSE, varies from country to country, for instance, in the USA more than 96%, Thailand and Mexico around 97%, and in the EU about 90% of the businesses are small enterprises (Tirfe, 2015). Nonetheless, in some aspects, there is a contradictory argument among scholars concerning the significance of MSEs on economic development. Bosma and Levie (2010) describe as a contribution that depends on the economic development of the country. With consideration of their significance, many countries endeavor to formulate policies, programs and packages for the development of MSEs. "Ethiopia is not an exception to this understanding." It has prioritized its MSE strategy, starting from the past 3 decades. In 1997 national MSEs development and promotion strategies were designed by the government to facilitate and pave the growth and development of the sector.

As a report held with the cooperation of the National Bank of Ethiopia and the central statistical agency (CSA) 2014/15, the performance of the Ethiopian economy is growing rapidly at a double-digit (10.2%) per annum. In addition, MSEs have the ability to substitute large enterprises for providing raw materials for large projects at affordable costs, a hub for entrepreneur training, technology transfer, and generally overall economy of the world (Bekele & Worku, 2008a; Negash & Kena, 2003). Following the MSE development agency strategy, the Federal Micro and Small Enterprises Development Agency (FeMSEDA) was established by the council of ministers and formulated for the development and operation of MSE to provide technical and managerial advice, vocational training, industrial extension services, credit facility, owner's short-term training, market linkage, and infrastructure that are among the services provided by the agency. Definition of MSEs varies from country to country and from culture to culture, but there are common factors that are applied in most countries using a combination or single parameter such as the volume of production or turnover, capital investment and the number of employees partook in the sector.

Therefore, in Ethiopia, MSE is defined according to the revised definition formulated in 2011 based on capital and labor. Manufacturing, construction and mining sub-sectors are included in the industrial sector. Small enterprise is defined as a business which has 50,000 up to 500,000 ETB (equivalent to US \$ 1,736 to 17,361) service and 100,001 up to 1,500,000 ETB (equivalent to US \$ 3,472 to 52,0083) industries on both, a number of the labor, force is the same, which engaged 6–30 employees (FeMSEDA, 2013).

MSEs play vital roles in poverty reduction, income and employment generation as well as economic development in developing countries like Ethiopia. The sector is now increasingly recognized unlike the previous pessimist notion that these sectors are not linked to the modern and formal sectors and would disappear once industrial development is achieved.

Even though the increased role and contribution that the MSE sectors could provide to the country's economy are immense, the sector is largely constrained by various structural, institutional and policy-related problems and bottlenecks that stifle its rapid growth and development (FeMSEDA, 2004).

The government of Ethiopia has been implementing and incorporating the program as a strategic agenda in three consecutive five-year national developmental plans of the country, i.e. the 1st five-year plan called Poverty Reduction and Sustainable Development Program (PRSDP), in the 2nd five-year plan called Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) and in the 3rd five-year plan which is called Growth and Transformation Plan (GTP) covering the years from 2010/11 to 2014/15 (MoFED, 2011).

In times of economic devastation situation, the innovation process undertakes greater relevance due to market reduction and the amplified competition between companies. Therefore, those that are more innovative and aware of the needs of change can achieve a competitive advantage regarding the provision of a better service to their customers. MSEs with a different mindset do not innovate and, for this reason, end up by losing business opportunities that arise during periods of instability. The practice of innovation in MSEs does not necessarily relate to a great discovery; innovation, as a competitive differential, can also comprise practices for continuous improvement of processes and services, or new management practices (Anderson & Frogner, 2008). More specifically, to innovate in the context of small manufacturing enterprises can mean, for instance, searching for new markets, solving customers' problems, developing new pricing systems, improving the information flow in the supply chain and also the creation of mechanisms to promote innovation, such as suggestions of programs that encourage employees to develop new ideas (Esteves et al., 2011). The general assumption of this study is that innovation is a critical factor for any organization, especially for small ones; it is one of the variables that enable a company to adapt to the new demands of the environment, thus ensuring a competitive advantage and, consequently, its own organizational survival.

The Ethiopian government has some policy trends to intervene in supporting MSEs for the last 25 years in terms of the financial services, including credit and saving scheme. Mentioned as business development services (BDS), they include trainings, technology transfer, counseling, provision of working premises and the likes.

Although policies, strategies, and packages are developed regionally as well as at the federal level, but as direct forward of the policy determination or implication of MSE, accrues properly implemented or not, seeks to the dearth of literature, which explains the impacts of government intervention on Innovation and technology transfer. Therefore, the researcher was instructed to address the contribution of SMEs on improvement of innovation and technology transfer; impact of government intervention on the innovation level and financing preference relation with Innovation level.

1.1. Statement of the problem

To understand the issue of MSEs' innovation level, the researcher has assessed an extensive literature review. Studies on innovation score level is a recent issue that gets little attention in developing countries and less empirical evidence, as most of the literature favors developing and industrialized countries. Understanding their immense contribution, the Ethiopian government tries to formulate and amend various initiatives, development policies and plans to spur economic growth, strategies and packages that govern micro and small enterprises in achieving sustainable economic development. In 1997, National MSEs development and promotion strategies were designed with the intention of empowering women's participation in business, reducing the unemployment rate, poverty reduction, income generation and enhancing the standard of living of the society. However, to what extent they are contributing is unknown, and knowledge about the level of innovation and technology transfer and effectiveness of policy evaluation gets little

attention by researchers. Similarly, the practical implementation of what is happening on the innovation score level is unexplained so far. Likewise, there were no aforementioned issues concerning financing preference related to innovation level.

2. Objectives of the study

- (1) To identify the contribution of Small Manufacturing Enterprises on improvement of innovation and technology transfer.
- (2) To evaluate whether government intervention has an impact on the innovation level of Small Manufacturing Enterprises or not.
- (3) To explore whether financing preference has a relation with the innovation level of Small Manufacturing Enterprises.

3. Literature review

As micro and small enterprises are the central points of innovation, Noreen et al. (2011) described that in the absence of limited resources small enterprises are the functions of the need to grow in the market and innovation strategy. At an aggregate level of the small enterprise is said to be a source of creativity, on the basis which they are more dynamic, more flexible and more responsive to moves in demand than larger enterprises do. On the other hand, firms may likely be true innovators in the technological advancement sense, is small, more importantly, to see the majority of the role of innovation, and firms a competitive advantage. Thus, innovation activities are a mechanism to the bit in the competitive market, to have successful business development and sustainable growth by increasing productivity and making oneself more valuable to customers.

Lee et al. (2001) justified that the Product/service innovation differs from country to country, not astonishingly possibly, in the domestic market service or product was only innovative on relative products. In addition, innovation depends on the extent of using communication technology and information.

A study carried out by Hibret (2009) was dedicated to indicating whether innovation is influenced by government involvement or not. Accordingly, the researcher explains that creative thinking is the dynamic of wealth creation, job creation and economic growth, then the involvement of government through business development services helps to promote contributions for the entrepreneurs and generally to the economy to gain benefits. A survey had been conducted in Brazil concerning micro and small enterprises on competitiveness and innovation; accordingly, 43% were innovative companies, 3% were very innovative companies, and a lion's share of 54% were considered non-competitive companies. Hence, this finding reveals that innovative micro and small enterprises outstripped the non-innovative firms.

There is a consent on the difficulties of innovation practice, which is micro and small enterprises appear to more challenges than large companies. Basically, the main factors were identified as lack of trained employees; absence of physical arrangement; low estimate with technology hubs; the difficulty of attaining credit; technical know-how; high cost of acquiring innovations; inadequate investment in R&D; less emphasis on investing in technological perspective and dependency on suppliers of technological inputs. Bachmann and Destefani (2008) justified that the ratio of revenue spent on R&D is inadequate for micro and small enterprises because the firm's staff members did not perform an advanced degree, do not spend on R&D and do not file patent applications. Similarly, Néto and Teixeira (2014) denoted in their study as MSEs innovation in Sergipe found 2.01 average degree of innovation, which portrays still emerging innovation. Janik (2008) the developing rivalry from outside organizations, likewise assumed a role, and every one of these elements affected the aggressiveness of small enterprises. SMEs are indispensable on-screen characters for improving innovation, intensity, business and the foundation of a viable advancement framework for developing nations.

Moreover, Moreira et al. (2007) argue that innovation in micro and small enterprises is determined by finance because these enterprises have insufficient capital to conduct innovation projects and existence more challenges to obtain external funds than large firms. Conversely, Teixeira and da Silva Néto (2013) justified the difficulties of innovation in the mentioned sectors; the smaller in size the more innovative, and they stressed that location in local productive preparation, transactions and closeness with R&D institutions were the factors favoring innovation among small enterprises. Néto and Teixeira (2014) confirm the main purpose of small enterprises, innovation, is for the sake of continuous development and growth, and found that the aim of innovation was an important contribution to the companies' growth and the owns assures constant growth, profitability, and competitiveness.

Feldens et al. (2012) brought up fundamental components that confronted innovation in items. Legal hindrances; absence of investors to finance; lack of existing modes, presence of close companions among investors and business people; the endeavoring of finding practical and overseeing staff to grow the new business; social extreme aversion to chance; inciting the two business visionaries and financial specialists to conventionalize in their choices; a feeling of good points of view about the future.

According to Obertson et al.'s (2012) suggestion, modification of process MSE is the main reason for the creation of a dynamic and an integrated innovation environment, because these are liable for deviations that impact creativity, from the formation of content to its betterment and take-off. Néto and Teixeira (2014) identified the phases which help with innovation of MSEs; initial idea; preparation of a business plan, detailed examination, improvement of the innovation; scrutiny and confirmation, practice or service formulated; and lastly huge production.

Furthermore, Teixeira and da Silva Néto (2013) point out that to increase product demand every enterprise, large or micro/small, needs to implement innovation. On the other hand, in the absence of a distinct procedure to manage the outcomes, prevent these firms from attaining their complete potential. Néto and Teixeira (2014) MSE's facial challenge to contend in comparison with extensive large firms since they don't have adequate resources to grow their action to places a long way from their command post or to put resources into innovations to enable them to grow all the more comprehensively. Forsman (2011), in disclosing the ability of a small business to create innovation, expressed that the practice improves the earliest firms that ought to be investigated and motivated, to empower them to enhance their practices and process with clients and providers.

According to Sledzik (2013) innovation is divided into five sorts, such as application of new methods of production not yet proven, the launch of new species of already, the opening of a new market not yet represented, the creation new industry structure, and acquisition of new sources of supply of raw material. Tan (2009) divides the innovation process into four dimensions specifically; innovation, invention, diffusion and imitation, and putting a dynamic business visionary.

As innovation is the concern, in this thesis we used the dimensions proposed by Sawhney et al. (2006), with modifications to conceptualize the issues and dimensions to measure small manufacturing enterprises' innovation level practice in Tigray, Ethiopia. To indicate the spreading of technology, innovation, and solution diagnosis model is given. Therefore, this diagnosis helps to measure the existing innovation level of small manufacturing enterprise activities, which are carried out properly and are not, known as innovation radar instruments.

To measure the value of the innovation level score, the enterprise can be categorized into three such innovators who participate in a systematic (consistently engaged in the innovation management), occasional innovators (no systematic process, but innovated in the last three years) and low or non-innovators (innovates very little or not at all). The following are the modified innovation level score dimensions of MSE to be present under this study (Offerings dimension, Solutions, Customers, Value capture, and Processes dimension). Up on the empirical and theoretical review,

the study has formulated 2 null hypotheses, which are presented below, founded on the impact and financial-related parameters.

Ho1: Government intervention does not have a significant impact on utilizing innovation and technology transfer in small manufacturing enterprises owner.

Ho2: Innovation level does not have a significant difference across financial preferences of owners.

4. Research methodology

The study was restricted to Tigray regional state small manufacturing enterprises owned by sole proprietors. The sampling unit in Small Manufacturing Enterprises owners. These enterprises are Wood and Metal Works, Textile and Garment, Argo-processing, Chemical products, Construction Inputs, and Minerals and Jewelry. The types of research are explanatory research types with cross-sectional study design applying both quantitative and qualitative research approaches. Multistage cluster sampling has been used with the help of proportionate systematic random sampling to select enterprise owners, and convenience sampling to select one-stop service coordinators and microfinance credit officers.

To determine the sample size, the Yeman formula has been applied, which is presented below; the total population was 1691 according to Tigray Region Small and Medium Manufacturing Industry Development Agency (TRSMIDA) census held in the 2010 Ethiopian Calendar.

Where: n = sample size, N = population, e = precision

For treated groups $n = 908 / (1 + (0.05)^2) = 277$, For controlled groups $n = 783 / (1 + (1.05)^2) = 264$

Total sample size = 541 SME owners.

The treated groups are these businesses who have got government support, whereas untreated groups are small enterprises who did not get any government intervention. Primary data has been applied with an emphasis on survey data collection instruments. Different methods of data analysis were used as descriptive statistics (frequency, mean, table, figure, and charts), chi-square test, Propensity score matching (PSM) using Stata Version 12, Matching Algorithm (stratification method, Nearest Neighbour method, Radius Method, & Kernel method) and Binary logistic regression.

5. Data analysis and discussion

5.1. Contribution on Innovation, product development and technology

Owners of manufacturing enterprises replied to the questions raised whether they have an attempt or not in innovation practice and technology transfer in their respective sectors. As Table 1 demonstrates, out of the total 464 participants, 72% responded that they attempted to involve themselves in innovation and technology transfer, and 28% did not get any attempt in innovation and technology transfer activities. Out of the total participants who replied absence of innovation and technology transfer, 48% stated that the reason was a lack of skill and knowledge to do so, 31.5% pointed out the restrictions of government, 30.8% pointed out less support from the government and a slight number of participants (0.8%) replied an uncomfortable environment to do so. Business owners engaged in construction inputs, agro-processing, and some mineral and jewelry were among the sub-sectors unable to attempt an innovation and technology transfer.

As if some of the agro-processing (bakery) producers were restricted by, the government to provide a predetermined size, weight (40 g, 75 g, 150 g, and the like), and quality since inputs are provided by the municipality. Likewise, the size of the construction inputs (brisket) is restricted by

Table 1. Innovation, product development and technology transfer

In the past, is there any attempt to innovate, improve technology and products	Control groups (%)		Treated groups (%)		Both groups (%)	
	Yes	No	Yes	No	Yes	No
Total	184 (73.3)	67 (26.7)	150 (70.4)	63 (29.6)	334 (72)	130 (28)
	251(100)		213(100)		464(100)	
Reason for non-existence			Frequency		Percent	
Uncomfortable environment to do so			1		0.8%	
Restriction of government			41		31.5%	
Lack of skill and knowledge to do so			48		36.9%	
Due to less support of government			40		30.8%	
Others			0		0	
Total			130		100%	

Sources: Survey data

size (10 cm, 15 cm, and 20 cm) and there is no demand for this size. Therefore, the owners of these enterprises have less invasion of innovation and technology practice.

5.2. Innovation score level of Small Manufacturing Enterprise owners

Numerous scholars have used different dimensions to measure the innovation level of MSEs. Innovation radar was used to measure the innovation level developed by Sawhney et al. (2006), and adopted by Bachmann & Destefani (2008); Néto & Teixeira (2014). Some of the writers use 8 and others apply 12 dimensions. However, based on the context of the country, considering the different cultures of the enterprise, policy of the country, nature, and size of the enterprise, the researcher used five dimensions with 28 items using a score interval of 1 to 5.

The level of innovator classifies a score greater than or equal to 4 refers to systematic innovators, the score above or equal to 3 and less than 4 refers to occasional innovators, and scores more than 1 and less than 3 are classified as a low innovator or none. In this study innovation, the level of small manufacturing enterprises is classified into five proposed model dimensions, and each dimension has different items to satisfy the score points.

As it is pointed out in Table 2, the average innovation score level of the 464 small manufacturing enterprises under offering dimensions like producing new products scores (3.78), creating new market scores (3.53), biting competition scores (3.54), producing the products in response the environment scores (3.97) and creating new ideas/design scores (3.75). As offering dimension is the concern, the result shows below 4 and above 3 scores; this implies the enterprise was within the category of occasional innovators.

On the same table, customer dimension items like identifying the needs of customers' scores (3.64), identifies markets for products scores (3.81), a manifestation of customer process scores (4.04), a manifestation of customer results, scores (4.16), and product/service lines usually dramatic to satisfy customer needs scores (4.14). This dimension scores the highest average innovation level, which is greater than 4, and is classified under systematic or common innovation level.

The solution dimension is another important issue used to indicate the innovation level of small manufacturing enterprises. Accordingly, as shown in the same table, the enterprise's understudy portrays an average score level of innovation on providing complimentary solution scores (3.05), in performing the integration of resources (2.99), technology modification/copying (3.31), imitating existed innovation (3.29), the strategy of adopting technology (3.42) and ranked in adopting/innovating new things scores (3.42). The innovation score level obtained in the mentioned dimension is 3.25 and classifies as occasional innovators.

On the other side, small manufacturing enterprises score the lowest innovation level of value capture dimension; such as utilizing existing resources scores (2.57) and using opportunities for interaction is (1.90) which can be classified as low or non-innovators with an average score value of 2.22. Similarly, the process dimension scores the lowest score of innovation level, which is 1.90. When we see it separately, it varies in the degree of the score within the same classification such as attempting to improve the process scores (2.43), newly innovated management system (1.77), getting certification for innovation (1.53), developing management software (1.51), waste management process (2.00), and paying attention to innovation, R&D, creativity and technology leadership score (2.18) innovation level. Generally, the level of innovation on the five dimensions lies under low/non-innovators since the score is 2.98, which is below 3 and above 1 score.

As has been pointed out in Table 3, the mean value of the innovation level of the enterprise measured was 2.98. The overall innovation level of the small manufacturing enterprise, based on the classification proposed in this study, is categorized as a low/non-innovator, because the average score level of the enterprises is between 3 and 4. The minimum score for value capture and processes dimension was 1.00, and the maximum score was 3.5 and 5 respectively. The

Table 2. Innovation level score of SME based on dimensions

Dimensions	Innovation level		
	Control group	Treated group	Both Groups
Offering Dimension	3.77	3.55	3.60
Producing new products	3.90	3.64	3.78
creates new market	3.65	3.38	3.53
Biting competition	3.57	3.51	3.54
Producing response to the environment	4.10	3.81	3.97
creating new design/new idea	3.73	3.75	3.75
New technology	4.45	3.36	3.41
new product lines and service to the market	3.43	3.51	3.47
Participating in operating, administrative techniques	3.32	3.42	3.36
Customer Dimension	3.99	3.92	3.96
Identifying the needs of customers	3.68	3.60	3.64
Identifying the markets for products	3.66	3.98	3.81
Manifestation of customer process	4.17	3.89	4.04
Manifestation of customer results	4.14	4.17	4.16
Product/service lines usually dramatic to satisfy customer needs	4.29	3.95	4.14
Solution Dimension	3.27	3.21	3.25
Providing complementary solution	3.00	3.12	3.05
Performs integration of resources	3.00	2.89	2.99
Technology modification (copying,)	3.40	3.19	3.31
Imitating existed innovation	3.43	3.12	3.29
Strategy of adopting technology	3.41	3.40	3.42
Ranked in adopting and innovating new things	3.38	3.54	3.44
Value capture Dimension	2.25	2.22	2.23
Utilizing existing resources	2.59	2.55	2.57
using opportunities for interaction	1.91	1.89	1.90

(Continued)

Table 2. (Continued)

Dimensions	Innovation level		
	Control group	Treated group	Both Groups
Processes Dimension	1.91	1.90	1.90
Attempting to improve the process	2.41	2.45	2.43
Newly innovated management system	1.78	1.76	1.77
Gets certification for innovation	1.54	1.53	1.53
Develops management software	1.53	1.50	1.51
Waste management process	2.04	1.95	2.00
Paid an attention on Innovation, R&D, Creativity and technology leadership	2.17	2.19	2.18
Mean = 2.98			

Sources: Survey Data

minimum and maximum levels of the offering are 2.50 and 4.75; customers 4, 5, and solution dimensions are 1.67 and 4.83 respectively. The standard deviation of offering (0.37), customer (0.49), value capture (0.65) and process dimension (0.43). From this result, we can observe there is homogeneity among the five dimensions; nearly dispensed around the average mean value of the distribution. These are low, which implies the values are intimately apportioned around the mean of the distribution, which indicates the standard deviation is low.

The two dimensions' innovator value is below 3 like capture value (2.22) and process (1.89) which is not expressive. Likewise, the mean value of the offering is (3.60) and the solution (3.25) is classified as an occasional innovator since it is below 3.99. On the other hand, the customer dimension holds (4.00) which are above 3.99 classified as systematic innovators.

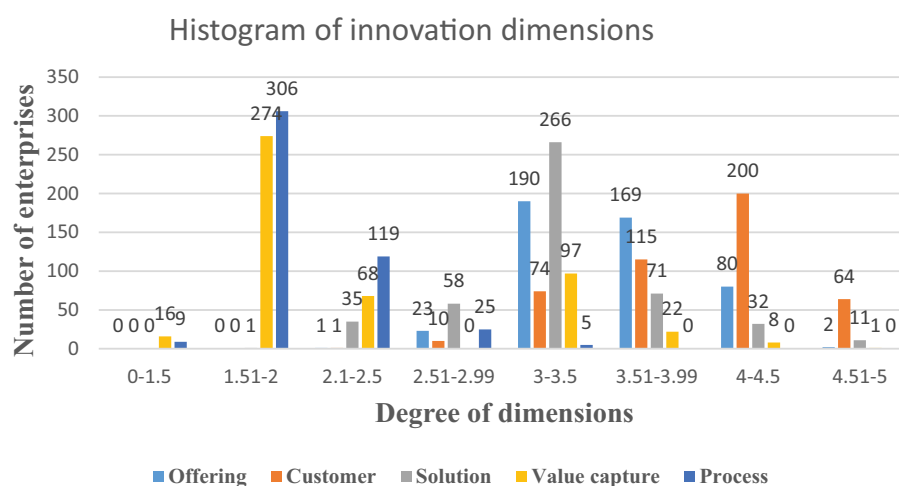
As pointed out in Figure 1, refers to the mode of the offering, customers, solution, value capture, and process dimension together. In the offering dimension, presented the same figure below, the majority of the enterprises level scores of innovations revealed with the interval of 2.51 to 2.99, from 3 to 3.5 followed by 3.51 to 3.99, and from 4 to 4.5 respectively.

Table 3. Innovation level score of SME based on dimensions

Dimensions	Innovation score level				
	Mean	Maximum	Minimum	Mode	S.D
Offering	3.60	4.75	2.50	3.50	0.37
Customer	3.96	5.00	2.40	4.20	0.49
Solution	3.25	4.83	1.67	3.33	0.46
Value capture	2.22	5.00	1.00	2.00	0.65
Process	1.89	3.50	1.00	1.67	0.43

Mean innovation level **2.98**

Figure 1. Five dimensions of innovator score level.

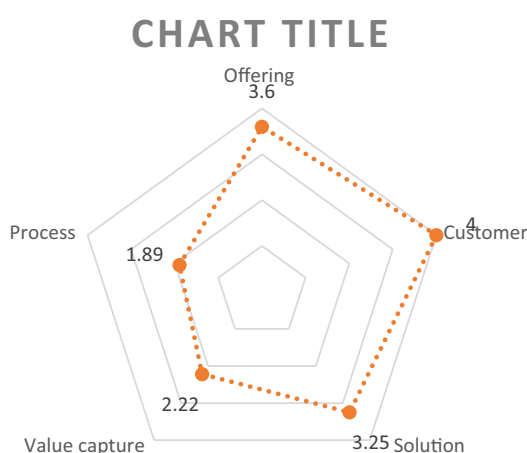


In this dimension, around 41% of the enterprises lay in the interval 3 to 3.5, which are occasional innovators in this aspect.

The second dimension presented in the histogram is the customer dimension; a larger number of the enterprises are within the innovation score level 4 to 4.5 followed by 3.51 to 3.99. The largest number of intervals covers around 46%, which is classified as the systematic innovators, and the second one is 28% categorized as occasional innovators. The third dimension is the solution dimension, which comprises the interval of 3 to 3.5, the highest, followed by 3.51 to 3.99. In this scenario, the largest interval covers around 57% included in the category of occasional innovators. The fourth one is concerning the value capture dimension; a large number of enterprises under this dimension lay within the interval of 1.51 to 2, almost covering 59%, followed by 3 to 3.5. A large number of enterprises are classified under low innovators because the score is below 3. Similarly, the process dimension lies in the interval 3 to 3.5; therefore, the score dimension of the enterprises is categorized as the low (no) innovators.

Generally, as Figure 2 presents the interval of score innovation level, the first and the third dimensions (offering and solution), the enterprise classifies under occasional, enterprises customer dimension categorized under systematic innovator score level and the last two dimensions (value capture and process) classified on low/non-innovators.

Figure 2. Innovation radar of enterprises by dimension.



The key portion of the radar graph represents the lowest score level innovation in each dimension and vice versa. As can be seen in the above figure, the customer (customer needs, the market for products, customer results, satisfy customer needs) dimension scores the highest innovation level. Offering and solution dimension score the second-highest but scores below

6. Innovation score level of SMEs sector-wise

An Innovation score level of 167 metals and the woodwork sector is 3.16 which is still occasionally innovators, this indicates even if in customer dimension scores highest, the score in value capture and process records lower score. This sector can be categorized as systematic innovators in the customer dimension, an occasional innovator in offering and solutions, and low innovators in value capture and process. In the textile and garment, sector the score innovation level is a mean value of 3.25 which implies still-occasional innovation. However, in the offering dimension, the sector obtains the highest score of innovation level, which is classified as a systematic or a common innovator group. Small manufacturing enterprises engaged in the textile and garment sector obtain 3.98 scores in customer and 3.32 in solution dimensions and are classified as occasional innovators. Likewise, this sector scores 2.07 in value capture and 1.91 in process dimension which is grouped into low or non-innovators.

In Table 4, the mean value of the innovation level of the 55 agro-processing sectors was 3. Since the measurement of the scale extends from 1 to 5, the result indicates the sector is the occasional innovator. Therefore, except for value capture and processes, dimension (non-innovators), the remaining three dimensions (offering, customer, and solution) are grouped under occasional innovators.

The average innovation level of 19 chemical products sector was found to be 2.94; this indicates the sector is still just beginning/incipient innovation concerning innovations. Based on the proposed model of classification this sector is low or non-innovators. Table 4 reveals the average score points obtained on the five dimensions in the chemical product sectors scores medium in the offering, customer, and solution dimensions and low scores in value capture and processes dimensions.

The average innovation level of the 88-manufacturing sector engaged in construction input obtains 2.59 scores. As a reference to the model classification, this sector is grouped under low or non-innovators. As the average score obtained in each dimension is presented in Table 5, except in the customer dimension (occasional innovators) in the remaining four dimensions (offering, solution, value capture, and processes) scores are a lower level, which is still no contribution to innovation.

In relation to minerals and jewelry sub-sectors, innovation score level's mean value was found to be 2.9; this indicates the sector intended level is non-innovation. Nonetheless, in offering, customer, and solution dimensions the sector obtains the second-highest score of innovation level, which is classified in the occasional innovator group. Whereas value capture and process dimension are grouped in low innovators, small manufacturing enterprises engaged in the minerals and jewelry sector obtain a score of 3.48 in the offering, in customer 3.91, in solution dimension 3.19, which is classified as occasional innovators. Likewise, this sector scores 2.15 in value capture and 1.79 in process dimension which is grouped under low or non-innovators. Based on the mean value of innovation radar score-wise result, owners engaged in metal & wood, textile & garment, agro-processing, and construction input were found to be occasional innovators. Whereas chemical products and minerals & jewelry were found to be low/non-innovators.

Based on the findings discussed, the contribution of manufacturing enterprises to innovation is low/no innovators. This conclusion is supported by Néto and Teixeira (2014) who found in their study that MSEs' average degree of innovation was 2.01, which portrays still emerging innovation.

Table 5. Chi-square test results related to innovation dimension and financial preference

Chi-square test using cross tabulation

Innovation capability of owners		Sources of Current Capital		Total
		Internal	Both Internal and External	
Systematic Innovator	Count	0	0	0
	Per cent	0	0	0
Occasional Innovator	Count	73	54	127
	Per cent	15.73	11.64	27.37
Low/non-Innovator	Count	206	131	337
	Per cent	44.4	28.23	72.63
Total		279	185	464

Pearson Chi-Square; df = 1, X^2 Exact Sig. (2-sided) = 0.512, significant level = .474 ($p > .000$)

Sources: *Survey Data*

Néto and Teixeira (2014), Néto and Teixeira (2014) Permanent Forum of MSEs (2007), indicated the main factors affecting innovation and technological development in manufacturing sectors. Basically, the main factors were identified as lack of trained employees; absence of physical arrangement; low estimate with technology hubs; less know-how on technical aspects; the difficulty of attaining credit; high cost of acquiring innovations; investment in R&D is less; dependency on suppliers, the little convention of investing in technological development. On the contrary, Biru (2014) has found in his study that MSEs encourage innovation. Innovation is the main constituent of competitiveness and productivity, improving business performance and profitability by increasing the share of both external and local markets.

6.1. Score level of Innovation and financing preference of owners

Table 5 indicates the innovation capabilities and preference for financing among owners of small manufacturing enterprises. Accordingly, an individual who is owner of an enterprise financed by using internal funds accounts 44.4% were low/non-innovators, whereas 15.73% were occasional innovators. On the other hand, both external and internal fund user accounts for 28.23% with low/non-innovators and the remaining 11.64% are considered occasional innovators.

In respect of the relationship on the chi-square test, Table 5 shows that there is no evidence to indicate a significant relationship between the level of innovation and the financial preference of the owners ($\chi^2 = 0.512$, $df = 1$, $p = 0.474$). Therefore, the researcher fails to reject the null hypothesis (H_0), due to the p-value (0.474) being greater than the significance level of 5%. From this result, we can conclude that whether owners of the business use different capital structures (internal, a mix of internal and external) that do not help to improve the level of innovation on the five dimensions as an aggregate result.

6.2 Impact of business support service on innovation or technology transfer

Concerning innovation or technology transfer of owners, five dimensions have been used to determine the owner's innovation level; the aggregate results of these dimensions according to the estimated effect on all methods reveal a significant difference, which ranges from 0.278 up to 0.284. Due to the existence of pre-intervention characteristics of the respondents, after matching the sample gets a little bit smaller. Besides, the ATT outcome difference between the two groups at the innovation level is positive and significant at the 1% level (t-statistics value ranges from 8.95 to 13.19). The null hypothesis (H_0) says participating in support service program intervention does

Table 6. Estimations of average treatment effect using PSM

Outcome variables	No. of Treated	No. of Control	Matching techniques	ATT	Standard error	t-statistics
Innovation offering dimension	213	112	Attnd	0.380	0.061	
	212	248	attr	0.446	0.046	
	213	248	Attk	0.446	0.058	
	212	249	atts	0.447	0.047	
6.219***9.636***7.659***9.477*** Innovation customer dimension		213	112	Attnd	0.263	0.071
		212	248	attr	0.279	0.016
		213	248	Attk	0.290	0.061
		212	249	atts	0.283	0.050
3.719**6.247***4.785***5.665**						
Innovation solution dimension	213	112	Attnd	0.399	0.067	
	212	248	attr	0.369	0.083	
	213	248	Attk	0.368	0.082	
	213	249	atts	0.385	0.049	
5.986***7.734***4.495***7.854*** Innovation value capture dimension		213	112	Attnd	0.535	0.073
		212	248	attr	0.563	0.042
		213	248	Attk	0.536	0.054
		212	249	atts	0.564	0.057
7.318***9.993***9.899***9.835***						
Innovation process dimension	213	112	Attnd	-0.183	0.047	-3.888**
	212	248	attr	-0.269	0.027	-8.48***
	213	248	Attk	-0.250	0.027	9.42***
	212	249	atts	-0.259	0.036	-7.27***
Level of Innovation (On the five dimensions)	213	112	Attnd	0.279	0.031	
	212	248	attr	0.278	0.015	
	213	248	Attk	0.278	0.023	
	212	249	atts	0.284	0.023	
8.95***13.19***12.29***12.15***						

Sources: SPSS version 23 results

Table 7. Comparison of treatment on selected outcome variables before matching and after matching										
Binary logistic			Propensity score matching							
			attnd		attr		attk		atts	
Variables	Effect	Sig	Effect	Sig	Effect	Sig	Effect	Sig	Effect	Sig
IOD	+ve	***	+ve	***	+ve	***	+ve	***	+ve	***
ICD	+ve	***	+ve	**	+ve	***	+ve	***	+ve	**
ISD	+ve	***	+ve	***	+ve	***	+ve	***	+ve	***
IVCD	+ve	***	+ve	***	+ve	***	+ve	***	+ve	***
IPD	NA	no	+ve	**	+ve	***	+ve	***	+ve	***
INVLVL	NA	no	+ve	***	+ve	***	+ve	***	+ve	***
Sources: SPSS version 23 results										

Sources: SPSS version 23 results

not lead to access/utilize innovation and technology transfer in small manufacturing enterprise owners. Consequently, based on the estimated results of the model, we accept the alternative hypothesis at a 1% significant level. This portrays that participating in the program enhances the business owners to move in innovative practices and more able to transform technology than non-participants except in innovation process dimension is negative but significant.

According to the estimated result, the ATT effect of this offering dimension shows (0.380 to 0.447) a positive and significant in all methods (t-statistics range between 6.219 and 9.636 at a 1% significance level). The second dimension is customer dimension, the ATT estimated result of (atnd = 0.263, attr = 0.279, attk = 290, and atts = 0.283). After matching, there is a significant difference between the two groups (t-statistics across all groups' ranges from 3.719 to 6.47) atnd and atts at 1% significance level whereas attr and atts at 5% significance level. The third innovation dimension is the solution; the ATT estimated result shows within a range of 0.368 and 3.99, which is a positive and significant impact in all methods at 1% significance level (t-statistics between 4.495 and 7.854). The ATT effect points out as the program intervention has a significant impact on the outcome of the innovation solution dimension. Similarly, in innovation, the value capture dimension also shows positive and significant changes because of the intervention. This can be evidenced by the significance level of 1% (t-statistics range from 7.318 to 9.993). The last dimension related to innovation level in this study is the innovation process dimension; ATT estimated result shows the reverse of the above, there is a negative and significant, this means the intervention does not have any contribution from the participants. Individual owners of a business which did not get a business support service to be more likely to participate in the innovation process dimension (t-statistics; Atnd = -3.888, attr = -8.48, Attk = -9.42, and atts = -7.27).

Clue: ATT stand average treatment effect on treated; atnd stands for estimation of ATT using nearest neighbor matching; attr stands for estimation of ATT using Caliper/radius matching; attk stands for estimation of ATT using Kernel matching; attns stands for estimation of ATT using Stratification method*** significant at 1%, ** significant at 5%, and * significant at 10%

6.4. Comparing score innovation levels before and after matching

In this part, we discuss the comparison between two models applied to evaluate the impact of the intervention, which is before and after matching. Therefore, in Table 6, except for the degree of acceptance, the impact of the program is positive and significant in innovation, offering, process, and value capture dimensions before and after matching. However, after matching, the innovation process dimension, and the arithmetic mean value result shows a positive and significant at 5% and 10%, whereas, before matching it has dropped due to unavailability of results, similarly, the overall innovation level of logistic regression result showed dropped as shown in Table 7.

*IOD refers to innovation Offering Dimension; ICD refers to Innovation Customer Dimension; ISD refers Innovation Solution Dimension, IVCD refers to Innovation Value Capture Dimension; innovation process dimension; INVLVL refers to overall innovation level. *** refers $P > .01$, ** refers to $P > 0.05$ and * $P > 0.1$. -ve and +ve refers to negative and positive respectively for direction of effects. NA refers to not available, no implies it does not show the level of significant.*

7. Conclusion

With regard to innovation and technology transfer, the study found that the majority of participants attempt to employ innovation and technology activities. However, lack of skill and knowledge and restrictions of government were found to be the reasons why individual owners did not engage fully in innovative activities. According to the discussion, the offering and solution innovation dimensions are categorized within occasional innovators; the customer dimension is categorized at a systematic innovators level, and both value capture and process dimension scores low or non-innovators. Furthermore, the average score innovation level of the enterprise is found at 2.89 level of innovation which is assembled under the low/non-innovators. The majority of the

respondents' innovation activity has performed with the highest score level in the customer dimension, whereas the offering and solution dimension scores the second highest. Based on the performance of each sub-sector cumulative score level of innovation; metals and woodwork sector innovation level was found to be occasional innovators; the contribution of manufacturing enterprises on innovation is low innovators.

With regard to the propensity score matching the estimated result, the program intervention plays a significant role in utilizing innovation and technology transfer. However, in a binary logistic regression, the study found that the intervention of the program has a positive effect only on the innovation process dimension. After matching, the selection bias is reduced. Before and after matching, the findings of both models are similar in terms of the owner's innovation of offering dimension, process dimension, customer dimension and innovation of value capture, which is positive and significant. The author recommends the Tigray Regional Government should Design a new policy intervention of Small Manufacturing Enterprises to practically implement on the ground with a high commitment for purpose of productivity enhancement, self-employability, sustainability of the business and transforming to produce innovative products to substitute imported goods.

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