ISSN (Online): 2958-3810
ISNN (Print): 2077-3420

JBAS Journal of Business and Administrative Studies

Home page: JEBAS (ejol.aau.edu.et)

Inter-organizational Cooperation, Financial Constraints and Innovation: Evidence from Large Manufacturing Companies

Misraku Molla Ayalew[1,2], Tariku Lorato Lodamo[3] and Samson Wondimu Yimam[4]

ABSTRACT

This study examines the relationship between inter-organizational cooperation, financial constraints, and innovation performance of large manufacturing companies. It uses descriptive and explanatory research designs and a quantitative research approach. Using a structured questionnaire partially adopted from the World Bank Innovation Follow-Up Survey instruments, we collect and use primary data from 79 large manufacturing companies in Addis Ababa. The study used a standard probit model as a baseline model along with several robustness tests. We find several interesting findings. Firstly, inter-organizational cooperation can be used as a coping mechanism to alleviate or reduce the adverse effect of financial constraints; however, not all modes of inter-organizational cooperation are effective. Cooperation with domestic firms, academic and research institutions, and government are effective. Despite having a significant direct role in promoting corporate innovations, cooperation with foreign firms and consulting companies is less effective in alleviating or reducing the adverse impact of financial constraints on large manufacturing companies likely to innovate. The managers of financially constrained companies can consider cooperation as a coping strategy to mitigate the adverse influence of financial constraints on their innovation performance but should pay attention to partner selection.

KEY WORDS

Financial constraints, Large manufacturing companies, Inter-organizational cooperation, Product Innovation, Process Innovation.

[1] *Assistant Professor of Accounting and Finance, College of Business Economics, Department of Accounting and Finance, Dilla University, Ethiopia*
[2] *Assistant Professor of Accounting and Finance, School of Business, St. Mary's University, Ethiopia*
[3] *Lecturer of Economics, Department of Economics, College of Business and Economics, Dilla University, Ethiopia*
[4] *Lecturer of Accounting and Finance, Department of Accounting and Finance, College of Business and Economics, Dilla University, Ethiopia*

1. Introduction

Broadly, innovation is defined as the implementation of a new or significantly improved product (good or service) or process, a new marketing method or a new organizational method in business practices, and workplace organization or external relations" (OECD-Eurostat, 2005). Countries investing more in innovation are richer and exhibit better economic growth (Coe, Helpman et al. 2009, Müller and Zimmermann 2009). Similarly, companies investing more in innovation have shown better corporate performances and competition (Gorodnichenko and Schnitzer 2013, Chatzoglou and Chatzoudes 2018). As a result, innovation is placed at the heart of the company's core strategy and the country's national and international policies and strategies.

Due to the unique features of investment in innovation and R&D intangibility, uncertainty, high information asymmetry and moral hazard problems, financers are reluctant to fund innovative projects (Hall 2002, Hall 2010, Hall and Lerner 2010, Kerr and Nanda 2015). As a result, innovative firms often face high degree of financial constraints. Now a day, it has become a widely held view that innovative activities are difficult to finance in a freely competitive marketplace (Ayalew and Xianzhi, 2019). A large volume of empirical studies find that financial constraints have a strong adverse effect on the firm's propensity to engage in investment in innovative activities (Savignac 2008, Aghion, Askenazy et al. 2012, Hottenrott and Peters 2012, Gorodnichenko and Schnitzer 2013, Efthyvoulou and Vahter 2016, Agénor and Canuto 2017, Mateut 2018, Chundakkadan and Sasidharan 2019).

As a coping strategy, financially constrained firms may engage in various inter-organizational cooperation (Levitas and McFadyen, 2009; Czarnitzki and Hottenrott, 2017; Rufei, Hao et al. 2017). Inter-organizational cooperation refers to longer-term relationships between and among organizations pursuing a mutual interest while remaining independent and autonomous (Ebers 2004). Cooperative innovative activity is a topical policy issue in the context of technology transfer and its interactions with competition policy (Abramovsky, Kremp et al. 2009). Its role in promoting innovation is well recognized in international organizations such as OECD and the European Union (EU). The African Union (AU) also recognized and forwarded a policy intervention on the industry-science linkages to maximize the returns from both private and public research investments and innovation.

Ethiopia has signed a member of STI-2024, also recognized the principle of collaboration to boost the development of Science, Technology and Innovation (STI). Promoting innovation, science and technology is the Ethiopian government's policy priority. As a result, especially in recent years, a huge amount of resources have been allocated, and tremendous collaborations have been made.

With the vision to make Ethiopia a leading manufacturing hub in Africa by 2025, the government places a high focus on the industrial sector. Ethiopia has a super ambitious plan to transform its economic structure from an agriculture-led economy to an industry-led economy. To this end, the contribution of manufacturing industries is expected to play a significant role. About 70% of manufacturing companies are concentrated in Addis Ababa and surrounding towns. Thus, a study conducted in this area is worth contributing. This study examined the relationship between inter-organizational cooperation, financial constraints, and innovation performance of large manufacturing companies in Addis Ababa.

2. Statement of the problem

Promoting innovation is a top policy priority in both developed and developing economies. Similarly, it is also a priority strategic issue of most companies. However, innovation remains relatively "spiky", concentrated in a few countries and regions only, and "Leapfrogging", the way in which latecomers can catch up with forerunners and become important players worldwide, remains a hard task (GII, 2019). Particularly, the innovation process is complicated in many African countries, including Ethiopia, partly due to weak domestic capabilities. Firms in developing countries often have low levels of absorptive capacity and hence, have difficulties assimilating knowledge developed elsewhere (Egbetokun, Atta-Ankomah et al. 2016).

There are several key practical problems why this study is needed in Ethiopia. Firstly, Ethiopia is characterized by low productivity, prolonged poverty, and slow economic

development. While the literature boldly states innovation increases productivity and reduces poverty, under-investment in investment in innovation and R&D remains acute in Ethiopia, and the degree of innovation and competitiveness is lower even compared with others. For instance, the 2020 World Bank report shows Ethiopia's average share of GDP devoted to R&D activities is about 0.20%, which is less than 0.4% and 0.7% of the African and Latin America and the Caribbean average, respectively. Similarly, the 2019 GII report indicates that Ethiopia's competitiveness rank from 140 countries decreased from 109th in 2016 to 126th in 2019. In contrast, neighbor countries such as Kenya (95th) and Rwanda (100th) have remarkably improved the global competitiveness index.

Secondly, financial constraints for innovation and R&D are generally high in Ethiopia. In Ethiopia, the level of financial constraints is higher than even compared with other African countries. For instance, Ayalew and Xianzhi (2019) reported that in Ethiopia, about 44% of firms face financial constraints, higher 36% and 42% of East Africa and Africa average, respectively. In Ethiopia, the financial sector is opaque, underdeveloped, and bank-based, adversely affecting the firm's access to external finance to fund its innovative projects. However, we know very little to what extent such a high financial constraint affects innovation investment in Ethiopia.

Thirdly, the government of Ethiopia is putting an effort to strengthen the link between industry and academic, and research institutions, including university-industry linkage. Similarly, we are observing much commitment to the ties between foreign companies and local firms. However, the outcome is not as anticipated. Fourthly, despite the priority of the GoE for many years, manufacturing value added to the percent of GDP remain very low and not more than 6% so far. At the end of 2021, manufacturing share to employment was 5%, and by 2030 the GoE plans to reach 15% by creating 5 million new job opportunities. The industry sector contribution remains spiky and concentrated in the Agricultural and service sector.

Moreover, theoretical research that examines the relationship between corporate financing and innovation has not provided a complete understanding of whether inter-organizational can be a coping strategy to alleviate/mitigate the adverse influence of financial constraints on innovation. Empirically, to the best of the researcher's knowledge, to date, only two papers, Czarnitzki and Hottenrott (2017) for Filmish firms and Rufei, Hao et al. (2017) for Chinese manufacturing firms addressed the role of inter-organizational cooperation in reducing the adverse effect of financial constraints on innovation and R&D investment. However, these two pioneer studies have some limitations. For instance, they have not fully investigated the effect of the various type of inter-organizational cooperation, including cooperation with domestic firms and foreign firms that are important for policy issues. Thus, a question like 'whether or with whom inter-organizational cooperation can be a coping strategy to alleviate the adverse effect of financial constraints on innovation?' remains open for theoretical and empirical investigation.

Overall, the literature that identifies systemic weaknesses and other constraints that inhibit the innovation process in Ethiopia is scant. The characteristics of these constraints and concrete interventions to mitigate them are not yet well understood. Notably, the role of inter-organizational cooperation in promoting innovation and mitigating the adverse effect of financial constraints for innovation, particularly in Manufacturing companies in Ethiopia, should be examined. Considering the government's vision to make Ethiopia a manufacturing hub of Africa, it is worth conducting such a study from a policy perspective.

3. Research Objectives

The purpose of this study was to examine the relationship between inter-organizational cooperation, financial constraints, and the innovation performance of large manufacturing companies in Addis Ababa, Ethiopia.

4. Literature Review and Hypotheses

Due to the unique features of investment in innovation; intangibility, uncertainty, high information asymmetry, and moral hazard problems, financers are reluctant to fund innovative projects (Kerr and Nanda 2015). As a result, innovative firms often face high financial constraints. Nowadays, it is widely believed that innovative activities are difficult to finance in a freely competitive marketplace (Ayalew and Xianzhi, 2019). Many empirical studies find that financial constraints strongly affect firms' propensity to invest in innovative activities (Mateut 2018, Ayalew and Xianzhi 2019, Chundakkadan and Sasidharan 2019).

The majority of existing empirical studies find an adverse impact of financial constraints on companies innovation performance (Savignac 2008, Aghion, Askenazy et al. 2012, Hottenrott and Peters 2012, Gorodnichenko and Schnitzer 2013, Efthyvoulou and Vahter 2016, Agénor and Canuto 2017, Mateut 2018, Chundakkadan and Sasidharan 2019).

Theories such as transaction cost theory, resource-based theory, and knowledge-based view mainly underline the role of inter-organizational cooperation in the innovation process. *Transaction cost theory* argues that inter-organizational cooperation minimizes the sum of transaction and production costs. Thus, through cooperation, a firm can lower and/or share the costs of innovative activities, and new space-shrinking technologies and promote harmonization of regulations and liberalization (Hennart 1988). On the other hand, *Resource-Based Theory* underlines allow firms to engage and share valuable resources (physical, human, and organizational) with other companies (Beck and Dieng 2016). It considers cooperation as strategies used to access other firms' resources, to garner otherwise unavailable competitive advantages and values for the firm (Das and Teng 2000). Finally, *the Knowledge-Based View* argues that all productivity is knowledge dependent; thus, a firm's competitive advantage is based on the creation and integration of knowledge (Grant and Baden-Fuller 1995). Accordingly, through cooperation, a firm can acquire knowledge that the firm might lack (Hamel, 1991) or access knowledge that is formed to allow for better and more integration of own knowledge that might reduce integration costs (Grant and Baden-Fuller 2004, Gravier, Randall et al. 2008). Empirical studies also support the theoretical prediction that inter-organizational cooperation has a positive impact on the firm's innovation performance. See, for instance, Hottenrott and Lopes-Bento (2016), Faems, Van Looy, et al. (2005), De Faria, Lima, et al. (2010), Un, Cuervo-Cazurra et al. (2010), Jaklič, Damijan, et al. (2014) Jiao, Yang et al. (2019).

The extant available prior empirical studies also suggest that inter-organizational cooperation can be an effective strategy to mitigate the adverse influence of financial constraints on innovation. For instance, Lerner, Shane, et al. (2003) report that small U.S.-based biotechnology firms appear to finance their R&D through alliances with larger firms when financial market conditions are disadvantageous. Levitas and McFadyen (2009) show certain alliance activities reduce knowledge asymmetries between the firm and capital markets and consequently lower the firm's need to hold liquid assets of biotechnology firms in the U.S. Abramovsky, Kremp et al. (2009) show that European firms collaborate to overcome risks and financial constraints for innovation, especially in Spain. Czarnitzki and Hottenrott (2017) show that collaborative R&D reduces financing constraints, and collaborating firms rely less on internal funding for research than others. Finally, Rufei, Hao, et al. (2017) show that cooperation with customers is more effective in mitigating the adverse effect of financial constraints on new product development. In contrast, cooperation with suppliers is more effective in improving technological processes in Chinese manufacturing firms.

Therefore, based on the above theoretical predictions and the findings of prior empirical studies, this study expects inter-organizational cooperation to alleviate the adverse influence of financial constraints on the innovation performance of African firms. Hence, the study makes the hypothesis as follows.

> **H1:** *Inter-organizational cooperation alleviates the adverse effect of financial constraints on a firm's innovation.*

The different types of inter-organizational cooperation serve different purposes (Belderbos, Carree, et al. 2004, Belderbos, Carree et al. 2004). Similarly, different collaboration modes are likely to affect the financing conditions of collaborating partners differently. Empirical literature show that various modes of cooperation partner may have different impacts (Visini et al. 2020, Waardenburg, Groenleer et al. 2020, Demircioglu and Vivona 2021, Vivona, Demircioglu et al. 2023). Collaboration partners such as with domestic, foreign and consulting companies can contribute to identify market opportunities and technological applications since these partners may more profoundly understand potential customers' preferences (Gretsch, Salzmann et al. 2019). Cooperation with universities, research institutions, and government are often conceptualized as strategic alliances with a long-term horizon, including basic research and joint development of pre-competitive technologies (Gretsch, Salzmann et al. 2019). It can be of value in the front end of the innovation process than product development (Takahashi, Indulska et al. 2018). Moreover, cooperation with the government

can be a good source of legitimacy and a relatively safe, uncomplicated, low-cost and effortless way of participating in the network (Barrutia and Echebarria 2019). Thus, the distinct advantages of the various modes of cooperation suggest a separate hypothesis should be developed to test with whom cooperation mitigates the adverse effect of financial constraints on a firm's innovation performance.

Inter-organizational cooperation may exist in different modes. Different classifications, such as horizontal vs vertical, business partner vs. non-business partner, private vs. public, and others, surround the literature. In this study, the classification and the number of the type of cooperation modes will align with World Bank's Enterprise Survey approach. Accordingly, we classify inter-organizational cooperation into five modes. These are; 1) cooperation with domestic firms, 2) cooperation with foreign firms, 3) cooperation with academic or research institutions, 4) cooperation with the government, and 5) cooperation with consulting companies or individuals. Thus, a separate hypothesis that indicates the relationship between the firm's innovation performance and each type of inter-organizational cooperation developed as follows.

H1A: *Cooperation with domestic firms positively affects large manufacturing companies' innovation.*
H1B: *Cooperation with foreign firms positively affect large manufacturing companies' innovation.*
H1C: *Cooperation with academic or research institutions positively affects large manufacturing companies' innovation.*
H1D: *Cooperation with the government positively affects large manufacturing companies' innovation.*
H1E: *Cooperation with a consulting company or individuals positively affects large manufacturing companies' innovation.*

5. Methodology

5.1. Method

The study employs descriptive and explanatory research designs with a quantitative approach. Descriptive research includes surveys and fact-finding inquiries of different kinds. The major purpose of descriptive research is to describe the state of affairs as it currently exists. Explanatory research aims to understand phenomena by discovering and measuring causal relations among them (Kothari, 2004). Quantitative research is based on the measurement of quantity or amount. It applies to phenomena that can be expressed in terms of quantity. Qualitative research concerns qualitative phenomena, i.e., those relating to or involving quality or kind (Kothari, 2004). This study mainly uses quantitative research to examine the relationship between financial constraints, inter-organizational cooperation, and innovation. The study uses qualitative research to explore the extent of financial constraints for innovation and the degree of collaboration within firms.

5.2. Data

This study uses primary data collected using the survey method. The data is collected from top managers of a company (CEO, general manager, and other equivalents). Data related to the company's innovation, cooperation, and funding activities for innovative activities are understood mainly by top managers than by other levels of managers and ordinary staff. Therefore, the target respondents should be the top manager of a company. The primary data is collected using structured questionnaires. The questionnaires are adapted from the World Bank Innovation Follow-Up Survey (WBIFS) with little modification, as needed. The questionnaire has four sections; Respondent and company profile, innovation, inter-organizational cooperation, and indicators of financial constraints and access to external finance. Only one member of the top managers is required to fill out the questionnaire from a sampled company.

Detailed, comprehensive, and well-structured questionnaires were prepared and distributed to 7 selected company managers as a pilot study. In the pilot study, we understood that the questionnaire was too detailed, complicated, and wide, which the respondents could not adequately fill. Thus, we re-developed the questionnaire in a way recommended by individuals who participated in a pilot study and colleagues invited to comment on the instruments. The number of questions in the revised instruments is significantly reduced and complicated, and questions aimed at getting sensitive data such as sales, R&D expenditure, informal payments made to secure government contacts, external loans, and others are dropped. Some of the sensitive questions were included to obtain data for instrumental variables. The questionnaire used to collect the data is attached in the appendix. Finally, the data collected from

sampled company managers were coded, edited, and analyzed using Stata. Both descriptive and inferential statistical techniques were used for data analysis. The data collected using structured questionnaires was converted to measurable for econometrics analysis. Depending on how the questions in the questionnaire developed, variables of different natures (dummy, ordered, continuous) are constructed and used for econometrics analysis.

5.3. Population, Sampling and Sample Distributions

This study's target population is large manufacturing factories/industries operating in Addis Ababa city administration. According to Ezega.com, accessed on July 21, 2022, the total number of large manufacturing industries in Addis Ababa is 972. Ezega.com is a trusted private business guild in Ethiopia. The database provides companies' detailed addresses and some basic financial data, including yearly sales turnover. According to global standards,

We try to cross-check the accuracy of the data from various sources, including 2merkato.com and addisbiz.com business directories, the latest CSA survey on Manufacturing companies, and other various government office reports. Despite some variation, the figure is comparable. Moreover, following the new administrative map of Addis Ababa, it isn't easy to know the exact numbers of large manufacturing companies during our sample determination and data collection. Large companies are those that employ 250 or more people. Unfortunately, we have little evidence of whether these 972 manufacturing industries belong to this category. However, appropriate care was taken during the actual data collection. Thus, all companies included in the actual sample have employees of more than 250 persons.

There are several sample determination formulas for the known population parameter. We use the most commonly employed Yamane's (1967) formula at a 90% Confidence level and 10% of Margin of error. Unlike most prior studies, we increase the margin error to 10% in favor of cost efficiency to decrease the sample number. However, due to the homogeneity of most of the firms, the increase in the Margin of error would not adversely affect the study's conclusion. Thus, the sample size was calculated as follows.

$$n= N/1+NE^2$$

Whereas n = sample size, N= Total population, E= Margin of error

$$n= 972/1+972(0.1)^2 = 972/10.72 = 91$$

However, in the statistical term, the sample size shall be 10% of the population in high population. Thus, we increase the total sample to 98 companies, approximately 10% of the total target population of the study.

Table 1: Same determination and distribution

	Population distribution		Sample distribution	
Category	Number	Percent	Number	Percent
Automobile	2	0.21	1	50.00
Chemicals	77	7.92	8	10.39
Food and beverage	98	10.08	10	10.20
Machinery and electrical	101	10.39	10	9.90
Metal, mines, and minerals	105	10.80	11	10.48
Textile and leather	192	19.75	19	9.90
Other factories	397	40.84	39	9.82
Total	972	100	98	10.08

Source: Ezega.com, accessed on July 21, 2022

The actual selection of companies follows both probability and convenient sampling methods. As presented in Table 1, manufacturing industries are subdivided into 7 clusters (Automobile, Chemicals, Food and beverage, Machinery and electrical, Metal, mines and minerals, Textile and leather, and other factories). Then, using simple random sampling, firms are proportionally selected from each cluster. The top management of companies must fill out the questionnaires. However, most company managers are either unwilling or difficult to approach. Thus, in some circumstances,

convenience sampling is applied concurrently to simple random sampling.

5.4. **Model Specification**

The study used the probit model derived from the latent regression. The model is first specified as follows:

$$Innovation_i = \beta_0 + \beta_1 FIN\_CON_i + \beta_2 COOP_i + \beta_3 FIN\_CON_i * COOP_i + \beta_4 ContVar_{i,j} + \varepsilon_{ij} \quad (Eq\ 1)$$

The dependent variable Innovation_i is a generic dichotomous variable that represents product innovation, process innovation, TPP, organizational innovation and marketing innovation. Subscript i refer large manufacturing companies while. *FIN_CON* represents financial constraints. $COOP$ indicates the inter-organizational cooperation modes. *FIN_CON*COOP* denotes the interaction between financial constraints and inter-organizational cooperation. *ConVar* refer to control variables, such as firm age (*Log (age))*, R&D, export intensity, and top management experience.

Based on the results of prior studies (e.g., Ayalew & Xianzhi, 2019; Chundakkadan & Sasidharan, 2019; Mateut, 2018), this study expect β_1 the coefficient of *FIN-CON* to be negative and strongly significant, while β_2 the coefficient of *COOP* to be positive and statistically significant (see, e.g., Un et al. (2010), Hottenrott and Lopes-Bento (2016), and Jiao et al. (2019)). Moreover, following Czarnitzki and Hottenrott (2017) and Rufei et al. (2017), we expect β_3 the coefficient of $FIN\_CON_{i,j} * COOP$ to be positive, and the result could be it interpreted as an '***alleviating effect***' i.e., interorganizational cooperation completely alleviates the adverse effect of financial constraints on a firm's innovation performance. However, if β_3 is negative but not statistically significant, the result could be interpreted as '***reduction effect'*** or inter-organizational cooperation weaken the adverse influence of financial constraints on innovation. However, if β_3 remain negative and statistically significant the result could be interpreted as '***no effect***' or inter-organizational cooperation do not completely alleviate or reduce the adverse effect of financial constraints on the firm's innovation.

To see the individual effect, overall cooperation *(COOP_ALL)*, divide in to five; cooperation with domestic firms (*COOP_DOM*), with foreign firms (*COOP_FOREIGN*), with academic or research institutions (*COOP_ACA/RES*), with the government (*COOP_GOV*), and with consulting company or individuals (*COOP_CONSULT*). In addition, as indicated in Equation 1 ($FIN\_CON_i * COOP_i$), the interaction of financial constraints with each mode of cooperation should be included to examine the effect of each mode of cooperation in mitigating the adverse influence of financial constraints on innovation. Therefore, by including each cooperation mode and its interaction with financial constraints, Eq 1 can be rewritten as follow.

$$\begin{aligned} Innovation_i &= \beta_0 + \beta_1 FIN\_CON_{i,} + \beta_2 COOP\_ALL_i \\ &+ \beta_3 COOP\_DOM_i + \beta_4 COOP\_FOREIGN_i \\ &+ \beta_5 COOP\_ACA/RES_i + \beta_6 COOP\_GOV_i \\ &+ \beta_7 COOP\_CONSULT_i \\ &+ \beta_8 FIN\_CON_i * COOP\_ALL_i \\ &+ \beta_9 FIN\_CON_i * COOP\_DOM_i \\ &+ \beta_{10} FIN\_CON_i * COOP\_FOREIGN_i \\ &+ \beta_{11} FIN\_CON_i * COOP\_ACA/RES_i \\ &+ \beta_{12} FIN\_CON_i * COOP\_GOV_i \\ &+ \beta_{13} FIN\_CON_i * COOP\_CONSULT_i \\ &+ \beta_{14} ContVar_i \\ &+ \varepsilon_{i,j} \end{aligned} \quad Eq.(2)$$

Prior studies usually control firm size, age, R&D, and top management experience. Except firm size, we include all the remaining three variables and export intensity in our model. Controlling firm size is less intuitive as the same included in this study are from the same group, i.e., large manufacturing industries. The Schumpeterian view assumes that new firms present the highest probability of innovation, while the oldest firms show a lower likelihood. In contrast, due to non-negligible learning-by-doing effects, firms tend to become more innovative (Cohen and Klepper, 1996). Expenditure on R&D is an essential input factor to industrial production, technological improvements, and a manifestation of a systematic search for inventions and innovations (Ayalew et al. 2019). R&D is the major factor affecting corporate innovation (Protogerou et al., 2017; Ayalew et al., 2019).

Finally, the human capital of the senior management teams, encapsulated in their strategic decisions, composition, ability to learn, and organizational skills, can have a significant influence on the innovation performance of entrepreneurial firms (Protogerou et al. 2017). Experience helps individuals to acquire tacit knowledge and develop skills that assist the formulation of entrepreneurial strategy, acquisition of resources, and process of organizing. Experience (particularly management experience) increases the efficiency of human capital, decreases uncertainty about the value of opportunities, and provides access to diverse types of information required for opportunity identification (Protogerou et al. 2017).

A firm that trades products and services internationally encounters fiercer competition. This encourages them to invest in R&D to maintain or even gain a leading edge over their competitors. Trading firms internationally also benefited from their exposure to global technology and the ensuing technology transfers that may take place. Due to better information about the availability of, as well as better access to, foreign embodied and -disembodied technology, these firms may have a better opportunity to innovate (Ayalew & Xianzhi, 2019). Table 2 presents variable definitions and measurements.

Table 2: Variable definitions and measurements

Variable	Measurement
Product innovation (*Prod_Innov*)	A dummy variable equal to 1 if a firm introduces a new or significantly improved product/service in the last three years, 0 otherwise.
Process innovation (*Proc_Innov*)	A dummy variable equal to 1 if a firm introduces a new or significantly improved process such as innovative methods of manufacturing products/offering services, logistics, delivery/distribution, methods/product or service, or supportive activity/process in the last three years, 0 otherwise.
Technological Product and Process Innovation (*TPP*)	Dummy variable equal to 1 if a firm is innovative; an innovative firm is the one that introduced the improved product or improved process in the last 3 years, 0 otherwise (non-innovative).
Patent	A dummy variable which takes 1 if a firm applies for a patent, 0 otherwise
Research and development s (*R&D*)	Dummy variable equals to 1 if a firm conducts internal or external R&D, 0 otherwise.
Financial Constraints (*FIN_CON*)	A dummy variable take value 1 if the firm; 1) have no external sources of finance, 2) applied for loan/credit but their application was rejected, withdrawn, or still in process, 3) need external fund but did not apply for loan/credit because they are discouraged, and 4) Applied for loan/credit but their application approved in part and has no overdraft facility, zero otherwise.
Obstacle acess to finance (*FIN_OBS*)	An ordered variable takes a value equal 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle).
Interorganizational Cooperation (at least one) *(COOP_ALL)*	A dummy variable equals to 1 if a firm cooperates with a domestic, foreign or foreign-owned parent firm, domestic or foreign academic or research institutions, private consulting companies or individuals, or government institutions for innovation-related activities, 0 otherwise.
Cooperation with domestic firms (*COOP_DOM*)	A dummy variable equals to 1 if a firm cooperates with domestic firms, 0 otherwise
Cooperation with foreign firms (*COOP_FOREIGN*)	A dummy variable equals to 1 if a firm cooperates with foreign firms or a foreign-owned parent firm, 0 otherwise
Cooperation with academic or research institutions (*COOP_ACA/RES*)	A dummy variable equals to 1 if a firm cooperates with domestic or foreign academic or research institutions, 0 otherwise.
Cooperation with consulting companies (*COOP_CONSULT*)	A dummy variable equals to 1 if a firm cooperates with consulting company or individuals, 0 otherwise
Cooperation with the government (*COOP_GOV*)	A dummy variable equals to 1 if a firm cooperates with the government, 0 otherwise.
Size (Log(size)	Natural logged value of the establishments permanent employees.
Age (*Log(age))*	Natural logged value of age in years of a firm since its establishment.
Management experience	Log of experience in this sector that the top manager has
Export intensity	The rate of direct export to total annual sales

6. Descriptive Statistics

Table 3 presents the descriptive statistics. Approximately 56.9%, 43.04%, 77.2%, and 66% of managers of sampled firms have reported that during the last three years, their company introduced product, process, organizational, and process innovations, respectively. About 30% of sampled firms apply for a patent concerning product or process innovation/ utility model/ an industrial design/copyright/trademark. On average, 91% of sampled firms have introduced at least one type of innovation (product, process, marketing, or organizational) during the last three fiscal years. Only 30% of sampled firms have patent related to innovation. About 45.5% of firms encountered financial constraints for their innovation activities. Approximately 48.1%, 24 %, 21.5%, 27.8%, and 20% of sample firms had formed cooperation arrangements with domestic firms (*COOP_DOM*), foreign firms (*COOP_FOREIGN*), academic or research institutions (*COOP_ACA/RES*), consulting company or individuals (*COOP_CONSULT*), and government (*COOP_GOV*), respectively.). 62% of firms had cooperation arrangements with at least one cooperation mode.

The average age of the sample firms is 20 years, with a minimum of 2 years and a maximum of 55 years. About 10% of the annual sales of sampled firms are obtained from export, while about 46% of sampled firms are exporters. Finally, the average experience of top managers (respondents) was 17.5 years, with a minimum of 3 and a maximum of 42 years.

Table 3: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Product innovation *(Prod_Innov)*	79	0.5696	0.4983	0	1
Process innovation *(Proc_Innov)*	79	0.4304	0.4983	0	1
Technological product and process Innovation *(TPP)*	79	0.6962	0.4628	0	1
Organizational innovation *(Org_Innov)*	79	0.7722	0.4221	0	1
Marketing innovation *(Mark_Innov*)	79	0.6582	0.4773	0	1
Innovation at least one type *(Innov_All)*	79	0.9114	0.2860	0	1
Patent	79	0.3038	0.4628	0	1
Financial constraints (*FINCON*)	79	0.4557	0.5012	0	1
Financing obstacles *(FINOBS)*	79	1.5696	1.2576	0	4
Cooperation with domestic firms (*COOPDOM)*	79	0.4810	0.5028	0	1
Cooperation with foreign firms (*COOPFOREIGN*)	79	0.2405	0.4301	0	1
Cooperation with academic or research institutions (*COOPACARES*)	79	0.2152	0.4136	0	1
Cooperation with government (*COOPGOV*)	79	0.2025	0.4045	0	1
Cooperation with consulting companies and individuals (*COOPCONST*)	79	0.2785	0.4511	0	1
Cooperation at least one mode (*COOPALL)*	79	0.6203	0.4884	0	1
R&D	79	0.5570	0.4999	0	1
Firm age	79	20.8987	15.4410	2	55
Top manager experience	79	17.4557	9.7123	3	42
Export intensity	79	0.0933	0.2398	0	1

Source: Stata output from 2022 survey

7. Diagnostics tests

This study mainly uses a probit model for the empirical test. Thus, diagnostics tests related to Limited Dependent Variable (LDV) models are required.

7.1. Model Specification test

In order to test whether our model is correctly specified or not, we test the model specification error after the probit estimate. The test result computed after the probit estimate using TPP, Product Innovation, and Process innovation is reported below. Table 4 (Panel A, B &C) presents the specification test output. The variable *_hatsq* is insignificant with a p-value equal to 0.196, 0.788, and 0.16 when TPP, Product Innovation, and Process innovation are used as dependent variables. However, the variable and *_hat* are significant with a p-value equal to 0.000 in all three models. The test result confirms that the model is correctly specified. Table 4 (Panel A, B and C) presents model specification test for the three dependent variables.

Table 4 (Panel A): Model specification for TPP equation

tpp	coef.	std. Err	z	P-value	95% Conf. Interval	
_hat	0.9698	0.26045	3.72	0.000	0.4593	1.4803
_hatsq	0.0642	0.0497	1.2	0.196	-0.0332	0.1616
_con	-0.0304	0.2066	-0.15	0.880	-0.4355	0.3745
No. observation	79					
LR chi2(")	42.24					
Prob>chi2	0.000					
Pseudo R2	0.4354					

Source: Stata output, 2022

Table 4 (Panel B): Model specification for Product Innovation (*prod_innov*) equation

Prod_Innov	coef.	std. Err	z	P-value	95% Conf. Interval	
_hat	1.0434	0.2946	3.54	0.000	0.4659	1.621
_hatsq	-0.0661	0.2455	-0.27	0.788	-0.5474	0.4152
_con	0.0268	0.1914	0.14	0.888	-0.3484	0.4021
No. observation	79					
LR chi2(")	27.34					
Prob>chi2	0.000					
Pseudo R2	0.2532					

Source: Stata output, 2022

Table 4 (Panel C): Model specification for Process Innovation (*proc_innov*) equation

Proc_Innov	coef.	std. Err	z	P-value	95% Conf. Interval	
_hat	1.0135	0.2121	4.78	0.000	0.5977	1.4294
_hatsq	-0.1956	0.1413	-1.38	0.166	-0.4726	0.08113
_con	0.1325	0.1987	0.67	0.505	-0.2569	0.522
No. observation	79					
LR chi2(")	36.1					
Prob>chi2	0.000					
Pseudo R2	0.3343					

Source: Stata output, 2022

7.2. **Multicollinearity test**

Multicollinearity occurs when a linear combination of other independent variables in the model approximately determines two or more independent variables. We used VIF, tolerance, and correlation analysis to test the presence of a multicollinearity problem. Table 5 presents VIF and Tolerance factors, while Table 5 presents correlation analysis. The VIF for all variables is below 10, and the tolerance factor for many variables is near 1, suggesting no multicollinearity problem exists.

Table 5: VIF & Tolerance

Variable	VIF	Tolerance
FIN_CON	1.2	0.8313
COOP_DOM	3.02	0.3307
COOP_FOREIGN	1.45	0.6898
COOP_ACARES	1.67	0.6001
COOP_CONST	1.61	0.6229
COO_PGOV	1.95	0.5126
COOP_ALL	3.59	0.2782
log(age)	1.53	0.6545
R&D	1.19	0.8436
Export intensity	1.27	0.7896
Log(exp)	1.51	0.6608
Average	1.81727	0.61946

Table 6 presents the correlation matrix of all variables. The higher correlation among variables is 0.57, below the minimum acceptable range for the multicollinearity problem. Therefore, the VIF, tolerance factor and correlation coefficients all confirm multicollinearity is not a matter of our study.

Table 6: Correlation Analysis

	Variable Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	PROD_INNOVA	1													
2	PROC_INNOV	0.2392	1												
3	TPP	0.76	0.5742	1											
4	FIN_CON	-0.0773	-0.0767	-0.114	1										
5	COOP_DOM	0.3251	-0.0181	0.1952	-0.0161	1									
6	COOP_FOREIGN	0.1901	0.2287	0.3073	0.2582	0.2881	1								
7	COOP_ACARES	0.0819	-0.1441	-0.056	-0.0462	0.2357	0.1378	1							
8	COOP_CONST	0.1408	0.0874	0.1648	-0.0014	0.3627	0.179	0.4306	1						
9	COOP_GOV	0.1836	0.0072	0.1959	0.0448	0.4604	0.2323	0.5025	0.4598	1					
10	COOP_ALL	0.1627	0.048	0.107	0.0875	0.7533	0.4403	0.4097	0.4861	0.3943	1				
11	Log(Age)	-0.0849	0.0628	0.023	-0.2427	0.0128	-0.0922	-0.0301	-0.049	-0.0239	0.0564	1			
12	Log (Exp)	-0.0612	0.0184	0.0211	-0.015	-0.0026	0.1111	-0.2339	-0.0695	-0.2653	0.0081	0.4374	1		
13	Export intensity	-0.091	0.1157	0.0831	-0.1556	-0.2951	-0.0712	-0.1443	-0.1544	-0.1775	-0.2738	0.2252	0.0649	1	
14	R&D	0.3055	0.3635	0.3528	0.0486	0.2976	0.1442	0.033	-0.0144	0.069	0.2472	-0.0205	0.0213	0.081	1

7.3. Dealing with Heteroskedasticity

The standard MLE based on an assumption of homoskedasticity is inconsistent. Therefore, in order to avoid the heteroskedasticity problem, we robust standard errors in estimating the models.

8. Regression Results

Table 7 presents the estimated results on the relationship between financial constraints, inter-organizational cooperation, and innovation. Product and Process innovations (TPP) are more objective and core than marketing and organizational innovations (OECD-Eurostat, 2005). This is because the constructs of marketing and organizational innovations are diverse, making it difficult for companies to have clear distinctions. Therefore, we used Product innovation, Process innovation, and Technological Product and Process (TPP) as dependent variables. In Table 7, both the coefficients and marginal effects are reported. This is because, in the probit model, coefficients did not indicate the impact of independent variables on the dependent variable. Instead, they show the effect of change in independent variables on the Z-score. Therefore, computing marginal effect allows us to examine the impact of variable x on outcome y. The marginal effects are computed at means.

The result shows that financial constraints (*FIN_CON*) significantly and negatively affect the firm's likelihood to innovate product innovation (*Prod_Innov*). The effect is significant at 1% level. For every incremental increase in *FIN_CON*, the decrease in the product innovation is -0.1378, given the other covariates are set at the observed values. Similarly, the existence of *FIN_CON* has a statically significant negative effect on the manufacturing firm's process innovation. For every incremental increase in *FIN_CON*, the decrease in the process innovation is -0.1972, given the other covariates are set at the observed values. The magnitude of the adverse effect is relatively higher on process innovation than on product innovation.

A Manufacturing company with a cooperation arrangement with at least on mode of cooperation (COOP_ALL) is likelier to have product, process, and TPP. For instance, For every incremental increase in *COOP_ALL*, the incremental increase is 0.5244 and 0.8501 in product and process innovation, respectively, given the other covariates are set at the observed values. However, only firms that form cooperation arrangements with *COOP_DOM*, *COOP_FOREIGN*, and *COOP_CONSULT* are positively and significantly associated with a firm's innovation. Surprisingly, companies forming cooperation arrangements with Academic/research institutions (COOP_ACARES) and the government (COOP_GOV) have shown a negative association with innovation. However, the effect is not statistically significant.

The coefficient of *FIN_CON* COOP_ALL* indicates that cooperation with at least one mode of cooperation alleviates the adverse effect of financial constraints on product innovation. However, its coefficient remains negative and is higher than the coefficient of *FIN_CON* before the interaction term. This suggests that large manufacturing firms cannot alleviate or reduce the negative impact of financial constraints on their process and TPP innovations by forming cooperation.

Table 7: Inter-organizational cooperation, financial constraints, and innovation: Probit estimate

	Product innovation (*Prod_Innov*)		Process innovation (*Proc_Innov*)		Technological product and process (*TPP*)	
Variable	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect
	-0.3599	-0.1378	-0.5127	-0.1972	-0.8098	-0.0040
FIN_CON	(0.5039)***	(0.0473)***	(0.2365)**	(0.1972)**	(0.3134)***	(0.0040)
	-1.6492	-0.6313	0.4855	0.1867	-0.0495	-0.0002
COOP_ALL	(1.0417)	(0.4008)*	(0.2124)**	(0.3272)	(0.8960)	(0.0045)*
	1.3700	0.5244	-2.2101	-0.8501	-1.3663	-0.0068
COOP_DOM	(1.0204)	(0.3925)	(0.8597)**	(0.3276)***	(0.8170)*	(0.0065)
	1.1077	0.4240	2.2207	0.8542	5.5350	0.0275
COOP_FOREIGN	(0.6070)**	(0.2070)**	(0.7016)***	(0.2715)***	(0.5137)***	(0.0184)
	-1.2369	-0.4734	-0.8471	-0.3258	-1.2431	-0.0062
COOP_ACARES	(0.8512)	(0.3230)	(0.7054)	(0.2718)	(0.7003)**	(0.0050)
	1.5396	0.5893	1.6955	0.6522	1.3121	0.0065
COOP_CONST	(0.8595)*	(0.3276)***	(0.9080)*	(0.3495)*	(0.7492)*	(0.0054)
		0.5379	-0.2061	-0.0793	1.9796	0.0098
COOP_GOV	1.4052 (1.2148)	(0.4565)	(1.1226)	(0.4316)	(1.3295)	(0.0082)
	0.3288	0.1258	-0.2576	-0.0991	-14.3918	-0.0715
*FIN_CON*COOP_ALL*	(1.2773)	(0.4892)	(1.1367)	(0.4367)	(1.8148)***	(0.0439)
	0.5147	0.1970	1.2957	0.4984	15.6508	0.0778
*FIN_CON*COOP_DOM*	(1.2161)	(0.4647)	(1.0699)	(0.4104)	(1.7423)***	(0.0469)*
	-0.2192	-0.0839	-1.3014	-0.5006	9.6532	0.0480
*FIN_CON*COOP_FOREIGN*	(0.8470)	(0.3249)	(0.9474)	(0.3649)	(1.4345)***	(0.0275)*
	2.0933	0.8012	-0.7005	-0.2695	4.8933	0.0243
*FIN_CON*COOP_ACARES*	(1.0911)**	(0.4150)**	(1.0427)	(0.4017)	(1.3469)***	(0.0140)*
	-2.0134	-0.7706	-1.3804	-0.5310	-1.2736	-0.0063
*FIN_CON*COOP_CONST*	(1.0814)	(0.4090)**	(1.1392)	(0.4378)	(1.3137)	(0.0049)
	-2.1251	-0.8134	0.4356	0.1676	2.5802	0.0128
*FIN_CON*COOP_GOV*	(1.3902)	(0.5224)	(1.3295)	(0.5111)	(1.5444)*	(0.0116)
	-0.3489	-0.1336	0.2727	0.1049	0.1656	0.0008
Log(age)	(0.5381)	(0.2053)	(0.5435)	(0.2093)	(0.7383)	(0.0039)
	0.8637	0.3306	1.6901	0.6501	1.5861	0.0079
R&D	(0.3753)**	(0.1435)***	(0.4136)***	(0.1606)***	(0.5371)***	(0.0068)
	-0.3330	-0.1275	-0.0919	-0.0353	0.2445	0.0012
Export intensity	(0.7232)	(0.2771)	(0.9222)	(0.3546)	(0.8443)	(0.0041)
	0.0936	0.0358	-0.2173	-0.0836	-0.1461	-0.0007
Log(Exp)	(0.7100)	(0.2716)	(0.7760)	(0.2982)	(0.8867)	(0.0045)
	0.0656		-0.8526		0.1435	
_cons	(0.8653)		(1.0548)	-	(1.0900)	
Wald chi (2)	33.53		40.97		34.9	
Prob. Chi (2)	0.000		0.000		0.000	
Log pseudo-likelihood	-40.35		-36.59		-22.4	
Psedudo R^2	0.2526		0.322		0.433	
McFadden R^2	0.253		0.322		0.433	

Note: 1) Standard errors are given in parenthesis; 2) marginal effects are computed at means; 3) ***, **, * are significant at 1%, 5% and 10%, respectively.

Source: Stata regression output

Specifically, only cooperation with domestic firms effectively alleviates the adverse effect of financial constraints in all innovations (product, process, and TPP). Cooperation with academic and research institutions (*FINCON_COOPACARES*) alleviates the negative effect *FIN_CON* on large manufacturing companies, Product innovation, and TPP but it does not have either alleviation or reduction effect on process innovation. Interestingly, while cooperation with foreign companies enhances firm-level innovation, it does not help to alleviate financial constraints for the innovative activities of large companies. Similarly, cooperation with consulting companies couldn't be an option to reduce the adverse influence of financial constraints on innovation. However, cooperation with the government (FINCON_COOPGOV) alleviates the adverse effect of financial constraints for process innovation and TPP but not especially for product innovation. The result underlines the role of partner selection in promoting corporate innovation.

9. Discussion

The results show a homogeneous picture that financing constraints adversely affect large manufacturing firms' innovation performance and the likelihood to engage in innovative activities such as R&D. The finding is consistent with many prior studies (e.g., Savignac 2008, Aghion, Askenazy et al. 2012, Hottenrott and Peters 2012, Gorodnichenko and Schnitzer 2013, Efthyvoulou and Vahter 2016, Agénor and Canuto 2017, Mateut 2018, Chundakkadan and Sasidharan 2019). Due to the unique features of investment in innovation, intangibility, uncertainty, high information asymmetry, and moral hazard problems, financers are reluctant to fund innovative projects (Kerr and Nanda 2015). As a result, innovative manufacturing firms often face high financial constraints. Ayalew et al., (2019) explain that manufacturing firms are more dependent on R&D and often characterized by a high degree of technology intensity that requires a huge commitment of R&D capital. Thus, the negative effect of financial constraints on the innovation performance of large manufacturing companies should be more severe compared to other sectors. However, this effect might be more disastrous for smaller manufacturing firms than for large counterparts.

The study examines the effect of various modes of cooperation on innovation. The result shows that large manufacturing companies with inter-organizational cooperation with at least one partner is likelier to have product and process innovation. The result it is similar to the finding of recent studies, such as Un et al. (2010), Jaklič et al. (2014), and Jiao et al. (2019). Through inter-organizational cooperation, a company can share the risk of innovation and acquire or access other's knowledge and resources that are important to develop new or significantly improved products and processes (M. Beck & Dieng, 2016).

The main objective of this study was to examine whether or with whom inter-organizational cooperation alleviates the adverse effect of financial constraints on innovation. We find many interesting findings. Generally, inter-organizational cooperation can be used to alleviate the adverse effect of financial constraints for some types of innovations, for instance, product innovation. There are several reasons for this finding. For instance, cooperation with domestic firms have advantage of geographical proximity with partners which is fundamental for successfully implementing inter-organizational relations (Pereira et al., 2019). Foreign firms are usually characterized by new technology and slack financial and human resources to be shared with potential collaborators. International companies often play a big role in knowledge and technology transfer. Moreover, consulting companies have expert professionals and more information about successful innovative projects. In addition, they are often profit-oriented; hence, they give attention to cooperation success because the failure of innovative projects of partners would affect their profit and survival (Jaklič et al., 2014). Various disciplines within the university provide a breadth of knowledge in fields that do not typically coexist in other organizations, thus presenting unique opportunities for access to and integration of knowledge (Un et al., 2010). Cooperation with academic or research institutions provides more economical, less risky, and faster access to valuable, specialized

knowledge and expertise than developing innovative activities in-house.

However, not all modes of cooperation are important to alleviate the adverse impact of financial constraints on innovation. Only some of the modes of cooperation, for instance, cooperation with domestic firms, academic and research institutions, and government, can be effective. Despite their significant role in promoting manufacturing companies, cooperation with foreign firms and consulting companies cannot be used as an effective partner to alleviate or reduce the impact of financial constraints. Except for cooperation with domestic firms, none of the modes of cooperation alleviates the adverse financial constraints in all types of innovations. This suggests companies form cooperation with different partners for different purposes. The results shared some of similar to the findings of prior studies.

There are many reasons why the alleviating effect of inter-organizational cooperation on product innovation and process innovation differ. Firstly, product innovation has more salient external effects, for instance, on the economy and employment. In contrast, process innovation mostly affects organizations because it aims to optimize and reduce costs (Pereira et al., 2019). Secondly, cooperating partners are often interested in observable outputs, such as new product than the process of Manufacturing and distribution of the product. Thirdly, the timing of 'intense' differs between product and process innovation. For instance, product innovation is relatively intense in the first phase, whereas process innovation becomes more intense in the final phase. Even though the need for complementarity between product and process innovation has long been recognized, process innovation continues to be regarded as innovative second-order activity next to product innovation (Reichstein & Salter, 2006). Finally, among the control variables included in this study, only R&D significantly positively affects the firm's likelihood to innovate.

10. Conclusion

This study examines the relationship between inter-organizational cooperation, financial constraints, and the firm's innovation in large manufacturing companies operating in Addis Ababa. Using primary data collected from the top manager of 79 large manufacturing companies, we examine whether or with whom inter-organizational cooperation can be an effective strategy to mitigate the adverse influence of financial constraints on the various types of innovations. Moreover, the study shows the extent and degree of inter-organizational cooperation in the case of large manufacturing companies in Addis Ababa. The study used a standard probit model as baseline estimation. Based on the empirical findings, the study arrives at the following conclusions.

- Financial constraints adversely affect the manufacturing companies' likelihood of having product innovation, process innovation, and TPP. Its adverse effect is more severe in process innovation than in other innovations.
- Companies with cooperation arrangements with at least one cooperation mode are more likely to innovate. However, only firms that form cooperation arrangements with domestic, foreign, and consulting businesses have shown a positive and statistically significant effect on their innovation performance. In contrast, we find a negative but insignificant effect between companies that form cooperation with academic/research institutions, with the government and their innovation performance.
- Inter-organizational cooperation can alleviate or reduce the adverse effect of financial constraints for some types of innovations, for instance, product innovation. However, not all modes of cooperation are important for this purpose. Only some of the modes of cooperation, for instance, cooperation with domestic firms, academic and research institutions, and government, can be effective. Despite their significant role in promoting manufacturing companies, cooperation with foreign firms and consulting companies cannot be used as an effective partner to alleviate or reduce the impact of

financial constraints. Except for cooperation with domestic firms, none of the modes of cooperation alleviates the adverse financial constraints in all types of innovations. This suggests companies form cooperation with different partners for different purposes. Thus, large manufacturing companies' management should pay attention to partner selection.

11. Implications

This study has both managerial and policy implications. The management of companies, particularly financially constrained firms, can use inter-organizational cooperation as an effective strategy to mitigate the adverse influence of financial constraints on their innovation. They can effectively mitigate the adverse influence of financial constraints on innovation if they strengthen cooperation with the government and domestic firms. The government of Ethiopia can foster innovation by designing and evaluating reforms that encourage linkages between industry to government, industry to university or research institutions, and domestic firms to foreign firms. We suggest the policymakers better work more on strengthening cooperation within domestic firms, including domestic academic and research institutions, than on collaboration with foreign firms. This is because, in most cases, collaboration with foreign firms fails to achieve the desired innovation and technology transfer due to the weak absorptive capability of local firms.

The result supports our argument that financially constrained firms with innovative projects use inter-organizational cooperation as a coping strategy to alleviate the adverse effect of financial constraints on innovation. Following resource dependence theory, a firm can better manage and reduce ambiguity and complexity concerning its R&D efforts by pursuing multiple collaborations and therefore limiting partner-specific resource dependence. The study support the Resource View and Resource Dependency Theory.

12. Limitations and further research directions

This study has some limitations. The first limitation revolves around the cross-sectional nature of the data. The data take time is a poor indicator, especially when applying econometrics in business research. The second limitation goes to the sample size. The final sample included in this research was only 79 large companies; thus, increasing the sample might make the finding robust. This study considers only large companies operating in Addis Ababa. However, financial constraints are detrimental to small and medium-sized companies. Thus, similar research can be conducted in SME enterprises. Finally, this study did not further gather data on whether cooperation are made within the same or different industries. As a result, we could not further test the impact of industry differences among cooperating firms in alleviating the adverse impact of financial constraints on cooperating firms' innovation performance. However, recent studies underline the role of industry heterogeneity in R&D and innovation partnerships. For instance, Zhang et al., (2021) show that collaboration between partners in different industry technologies exerts an inverted U-shaped innovation pattern and affects the innovation ability of focal firms very little.

Reference

Abramovsky, L., et al. (2009) 'Understanding cooperative innovative activity: Evidence from four European countries', Economics of Innovation and New Technology, 18(3): 243-265.

Agénor, P.-R. and O. Canuto (2017) 'Access to finance, product innovation and middle-income traps.', Research in Economics, 71(2): 337-355.

Aghion, P., et al. (2012) 'Credit constraints and the cyclicality of R&D investment: Evidence from France', Journal of the European Economic association, 10(5): 1001-1024.

Antolin-Lopez, R., et al. (2015) 'The choice of suitable cooperation partners for product innovation: Differences between new ventures and established

companies', European Management Journal, 33(6): 472-484.
Ayalew, M. M., and Xianzhi, Z. (2019) 'Bank competition and access to Finance: evidence from African countries', Journal of Industry, Competition and Trade, 19(1): 155-184.
Ayalew, M. M., Xianzhi, Z., and Hailu, D. H. (2019) 'The finance of innovation in Africa', European Journal of Innovation Management, 23(3): 348-382.
Ayalew, M. M. and Z. Xianzhi (2020). 'The effect of financial constraints on innovation in developing countries: Evidence from 11 African countries', Asian Review of Accounting, 28(3): 273-308.
Ayalew, M. M., et al. (2020). "The determinants of firm's innovation in Africa." Journal of industry, Competition and Trade 20: 527-567.
Beck, M. and M. Dieng (2016) 'Cooperation Diversity and Innovation Performance: the Role of Firms' Research-and Development-Orientation', ISPIM Innovation Symposium, The International Society for Professional Innovation Management (ISPIM).
Belderbos, R., et al. (2004) 'Heterogeneity in R&D cooperation strategies', International Journal of Industrial Organization, 22(8-9): 1237-1263.
Belderbos, R., et al. (2004) 'Cooperative R&D and firm performance', Research Policy, 33(10): 1477-1492.
Carreira, C. and F. Silva (2010) 'No Deep Pockets: Some Stylized Empirical Results On Firms'financial Constraints', Journal of Economic Surveys, 24(4): 731-753.
Chatzoglou, P. and D. Chatzoudes (2018) 'The role of innovation in building competitive advantages: an empirical investigation', European Journal of Innovation Management, 21(1): 44-69.
Chundakkadan, R. and S. Sasidharan (2019) 'Financial constraints, government support, and firm innovation: empirical evidence from developing economies', Innovation and Development, 1-23.
Coe, D. T., et al. (2009) 'International R&D spillovers and institutions', European Economic Review, 53(7): 723-741.
Czarnitzki, D., et al. (2007) 'The relationship between R&D collaboration, subsidies and R&D performance: empirical evidence from Finland and Germany', Journal of applied econometrics, 22(7): 1347-1366.
Czarnitzki, D. and H. Hottenrott (2012) 'Collaborative R&D as a strategy to attenuate financing constraints', ZEW-Centre for European Economic Research Discussion Paper, (12-049).
Czarnitzki, D. and H. Hottenrott (2017)' 'Inter-organizational collaboration and financing constraints for R&D' Economics Letters, 161: 15-18.
Das, T. K. and B.-S. Teng (2000) 'A resource-based theory of strategic alliances', Journal of management, 26(1): 31-61.
De Faria, P., et al. (2010) 'Cooperation in innovation activities: The importance of partners', Research Policy 39(8): 1082-1092.
Demircioglu, M. A. and R. Vivona (2021) 'Depoliticizing the European immigration debate: How to employ public sector innovation to integrate migrants', Research policy, 50(2): 104150.
Ebers, M. (2004) 'Interorganizational relationships and networks', International Encyclopedia of the Social & Behavioral Sciences, 7855-7860.
Efthyvoulou, G. and P. Vahter (2016) 'Financial constraints, innovation performance and sectoral disaggregation', The Manchester School, 84(2): 125-158.
Egbetokun, A., et al. (2016) Firm-level innovation in Africa: Overcoming limits and constraints, Taylor & Francis.
Faems, D., et al. (2005) 'Interorganizational collaboration and innovation: Toward a portfolio approach', Journal of Product Innovation Management, 22(3): 238-250.
Gorodnichenko, Y. and M. Schnitzer (2013) 'Financial constraints and innovation: Why poor countries don't catch up', Journal of the European Economic association, 11(5): 1115-1152.

Grant, R. M. and C. Baden-Fuller (1995) 'A knowledge-based theory of inter-firm collaboration', Academy of management proceedings, Academy of Management Briarcliff Manor, NY 10510.

Grant, R. M. and C. Baden-Fuller (2004) 'A knowledge accessing theory of strategic alliances', Journal of management studies, 41(1): 61-84.

Gravier, M. J., et al. (2008) 'Investigating the role of knowledge in alliance performance', Journal of Knowledge Management, 12(4): 117-130.

Gretsch, O., et al. (2019) 'University-industry collaboration and front-end success: the moderating effects of innovativeness and parallel cross-firm collaboration', R&D Management, 49(5): 835-849.

Guariglia, A. (2008) 'Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms', Journal of Banking & Finance, 32(9): 1795-1809.

Hall, B. H. (2002) 'The financing of research and development', Oxford review of economic policy, 18(1): 35-51.

Hall, B. H. (2010) 'The financing of innovative firms' Review of Economics and Institutions, 1(1).

Hall, B. H. and J. Lerner (2010) 'The financing of R&D and innovation' Handbook of the Economics of Innovation, Elsevier. 1: 609-639.

Hennart, J. F. (1988) 'A transaction costs theory of equity joint ventures', Strategic management journal, 9(4): 361-374.

Hottenrott, H., et al. (2016) 'Patents as quality signals? The implications for financing constraints on R&D', Economics of Innovation and New Technology, 25(3): 197-217.

Hottenrott, H. and C. Lopes-Bento (2016) 'R&D partnerships and innovation performance: Can there be too much of a good thing?', Journal of Product Innovation Management, 33(6): 773-794.

Hottenrott, H. and B. Peters (2012) 'Innovative capability and financing constraints for innovation: More money, more innovation?', Review of Economics and Statistics, 94(4): 1126-1142.

Jaklič, A., et al. (2014) 'Relevance of innovation cooperation for firms' innovation activity: the case of Slovenia', Economic research-Ekonomska istraživanja, 27(1): 645-661.

Jiao, H., et al. (2019) 'Commercial partnerships and collaborative innovation in China: the moderating effect of technological uncertainty and dynamic capabilities', Journal of Knowledge Management.

Kaplan, S. N. and L. Zingales (1997) 'Do investment-cash flow sensitivities provide useful measures of financing constraints?', The quarterly journal of economics, 112(1): 169-215.

Kerr, W. R. and R. Nanda (2015) 'Financing innovation', Annual Review of Financial Economics, 7: 445-462.

Lerner, J., et al. (2003) 'Do equity financing cycles matter? Evidence from biotechnology alliances', Journal of financial economics, 67(3): 411-446.

Levitas, E. and M. A. McFadyen (2009) 'Managing liquidity in research-intensive firms: signaling and cash flow effects of patents and alliance activities', Strategic management journal, 30(6): 659-678.

Mateut, S. (2018) 'Subsidies, financial constraints and firm innovative activities in emerging economies', Small Business Economics, 50(1): 131-162.

Miotti, L. and F. Sachwald (2003) 'Cooperative R&D: why and with whom?: An integrated framework of analysis', Research Policy, 32(8): 1481-1499.

Müller, E. and V. Zimmermann (2009) 'The importance of equity finance for R&D activity', Small Business Economics, 33(3): 303-318.

OECD-Eurostat (2005) 'Oslo Manual." The Measurement of Scientific and Technological Activities. Guidelines for Collecting and Interpreting Innovation Data.

Peeters, C. and B. v. P. de la Potterie (2006) 'Innovation strategy and the patenting behavior of firms', Journal of

Evolutionary Economics, 16(1-2): 109-135.

Rufei, M., et al. (2017) 'R&D cooperation, financial constraint and innovation performance', Interciencia, 42(6).

Savignac, F. (2008) 'Impact of financial constraints on innovation: What can be learned from a direct measure?', Econ. Innov. New Techn, 17(6): 553-569.

Silva, F. and C. Carreira (2012) 'Measuring firms financial constraints: a rough guide', Notas Económicas, (36).

Takahashi, M., et al. (2018) 'Collaborative research project networks: Knowledge transfer at the fuzzy front end of innovation', Project Management Journal, 49(4): 36-52

Un, C. A., et al. (2010) 'R&D collaborations and product innovation', Journal of Product Innovation Management, 27(5): 673-689.

Vivona, R., et al. (2023) 'The costs of collaborative innovation', The Journal of Technology Transfer, 48(3): 873-899.

Waardenburg, M., et al. (2020) 'Paradoxes of collaborative governance: investigating the real-life dynamics of multi-agency collaborations using a quasi-experimental action-research approach', Public Management Review, 22(3): 386-407.

Yemane, K. (1967). 'Sample Size determination.