

**Addis Ababa University
School of Graduate Studies
Institute of Regional and Local
Development Studies**

**Innovation and conventional lending
practice of banks in Ethiopia:
Perspectives from patented innovators**

By: Sewale Bitew GSR/2182/02



**June 2011
Addis Ababa**

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Art Degree in Regional and Local Development Studies*

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Table of Content

Acknowledgement	i
ACRONYMS	vi
Operational Definition of terms	vii
Abstract	viii
Chapter One: Introduction	1
1.1 Background of the study	1
1.1.1 Knowledge, Innovation and Local Economic Development	1
1.1.2 Ways of Building Indigenous Knowledge	3
1.2 Statement of the Problem	4
1.3 Research Objectives	7
1.4 Significance of the Study	7
1.5 Scope of the study	7
1.6 Limitation of the study	8
1.7 Organization of the Research	8
Chapter Two: Literature Review	9
2.1 Theoretical literature	9
2.1.1 Basic concepts associated with innovation	9
2.1.1.1 Innovation defined	9
2.1.1.2 Importance of innovation	10
2.1.1.3 Patenting and innovation	12
2.1.1.4 Factors affecting success of innovation	13
2.1.1.5 Lending and factors affecting access to credit	14
2.1.1.6 Sources of finance for innovation	16
2.1.2 Selected Theories of economic growth from the perspective of innovation ..	17
2.1.2.1 The Schumpeterian Theory	17
2.1.2.2 Neoclassical Growth Theories	18
2.1.2.3 Endogenous growth theory	20
2.2 Empirical Literature	21
2.2.1 Researches in other countries	21
2.2.2 Researches in Ethiopia	26
2.3 Conceptual Framework and Hypotheses	28
2.3.1 Research Hypotheses	29
Chapter Three: Research Methodology	30
3.1 Description of the Study Area and Research Methodology	30
3.2 Methods of Data Collection	31
3.2.1 Sample size and sampling method	31
3.2.2 Questionnaire design and data collection procedure	31
3.3 Method of Analysis	32

3.3.1	Descriptive Analyses	32
3.3.2	Econometric Model used in identifying factors influencing the success of innovation	32
3.4	Definition of variables used in Probit Equation.....	35
Chapter Four: Results and Discussion		37
4.1	Introduction.....	37
4.2	Policy Document Analysis.....	37
4.2.1	Innovation policies of Ethiopia in comparison with other Countries	37
4.2.2	Patent Laws and Regulations in Ethiopia	40
4.3	Trend of Bank Lending in Ethiopia	41
4.3.1	Trend of Sectorial Share of Outstanding Loan	43
4.3.2	Trend of annual Loan disbursement by sector to GDP of the Nation.....	45
4.4	Current practice of Bank lending in Ethiopia	46
4.5	Analysis based on data from the respondents	48
4.5.1	Descriptive analysis	48
4.5.1.1	Characteristics of the respondents	48
4.5.2	Regression results on Determinants of success of Innovation.....	54
Chapter Five: Conclusion and Policy Implication		58
5.1	Conclusions.....	58
5.2	Policy Implications	61
References		62
Annex:- Questionnaire		



List of Tables

Table 1: Expected Signs of variables.....	36
Table2: loan to GDP comparison.....	41
Table3: Individual characteristics of the respondents.....	48
Table 4: Type of work versus whether inventions are operational or not	49
Table 5: Impediments of inventions which are not operational.....	51
Table 6: Financial need and request for third party assistance	51
Table 7: Reasons for not requesting bank loan.....	53
Table 8: Reason for not getting sponsorship.....	53
Table 9: Access to credit versus operation of inventions	54
Table 10: Probit regression	54
Table11: Marginal effect after Probit	55

List of Figures

Figure 1: Schematic description of the conceptual framework	29
Figure 2: Trend growth of total Domestic loan, annual loan disbursement and total nominal GDP (2006 to 2010)	42
Figure 3: Growth trend of ratio of annual outstanding loan to nominal GDP and annual loan disbursement to GDP ratio	43
Figure 4: Growth trend of outstanding loan by sector (2006 to 2010)	44
Figure 5: Growth trend of loan disbursement by sector (2006 to 2010).....	45
Figure 6: Impediments of operational inventions	50
Figure 7: Reasons for denied credit access	52



ACRONYMS

CSA	Central Statistics Agency
DTS	Domestic Trade and Service
ETB	Ethiopian Birr
FDRE	Federal Democratic Republic of Ethiopia
FDI	Foreign Direct Investment
FINEP	Financiadora de Estudos e Projectos (Brazilian Innovation Agency)
GDP	Gross Domestic Product
IKED	International organization for Knowledge, Economy and Development
IMF	International Monetary Fund
IPR	Intellectual Property Right
LDC	Least Developed Countries
MoFED	Ministry of Finance and Economic Development
MDGs	Millennium Development Goals
NTD	New Thailand Dollar
OECD	Organization for Economic Cooperation and Development
R and D	Research and Development
SEI-	Software Engineering Institute
SME-	Small and Medium Enterprises
UKCDS-	United Kingdom Collaboration on Development and Science
UNCTAD-	United Nations Conference on Trade And Development

Operational Definition of terms

- Annual loan disbursement** is the total amount of loan that all banks in the country inject into the economy at a given year.
- Conventional lending practice** is the known and accepted lending practice and custom of banks in the country.
- Innovation/invention** is an idea of an inventor, which permits in practice the solution of a specific problem in the field of technology. The terms are used interchangeably in the study
- Innovator/inventor** is an individual/ a firm/ an organization known for a minor invention. The terms are used interchangeably in the study.
- Outstanding loan** is the total amount of loan in the economy at a point in time which remains uncollected because it is undue.
- Patented innovator** is an individual/ a firm/ an organization certified for a minor invention by the Ministry of Science and Technology
- Sectorial annual loan disbursement** is the total amount of loan that all banks in the country inject into the economy at a given year for a given economic sector.
- Sectorial outstanding loan** is the total amount of loan for a given economic sector at a point in time which remains uncollected because it is undue .
- Utility model certificate** is a certificate issued to a minor invention, which is fit for practical use.

Abstract

The research was initiated to pinpoint the trend of bank lending from the context of enabling startups and innovations, to clarify the current practice of lending from the above context, to identify the basic factors that influence the success of innovations and to forward workable solutions in the area.

The basic methods of data collection used to come up with the findings of the research were: interviews with bank professionals and patented innovators, desk review of lending policies of selected banks, review of innovation and patenting policy of the nation, reviewing the domestic credit portfolio of the country and survey questionnaires. The survey questionnaire was collected from 40 different minor inventors out of a total of around 70 inventors and 110 inventions. The basic data analysis methods used to analyze the data obtained in the aforementioned ways were description and econometric analysis.

The findings obtained through these methods show that: bank lending has been skewed towards more organized, experienced and collateral possessing firms than new startups and innovators. In addition, the current practice has nothing new when compared with the trend despite the fact that the share of loan granted to the manufacturing sector has increased recently. Finally, in assessing the factors that affect the success of innovation, access to finance was found the only significant variable. Educational level, family size, nature of the invention and availability of training were found insignificant to affect the success of innovation.

Basing this, the researcher forwarded some workable solutions regarding the need for frequent revision of innovation policies, separating the possession of private banks from respective borrowers and encouraging financial policies that favor new startups and innovators.

Key Words: innovation, patenting, access to finance, lending

Chapter One: Introduction

The introductory part of the thesis mainly focuses on the back ground of the study and the statement of the problem. The background of the study gives highlights regarding the conception and the link between knowledge, innovation and local economic development. It also embraces the ways by which indigenous knowledge is built. The statement of the problem shows the study gap that exists regarding the above concepts and factors affecting success of innovations. To the end of the chapter, the general and specific objectives of the research, the significance of this study, the limitations in conducting this research and the overall organization of the paper are found sequentially.

1.1 Background of the study

In the first part of the background of the study, the link between knowledge, innovation and local economic development is dealt. Next to that, the ways by which indigenous knowledge is built, disseminated and used are dealt.

1.1.1 Knowledge, Innovation and Local Economic Development

For emerging economies to achieve sustained growth thereby narrow the existing economic disparities, enhancing their local economies has become desirable since quite sometime now. In order to achieve this, it has been felt desirable to create an enabling environment for effective participation and partnership between relevant stakeholders and development actors. This would help create sustainable economic development. As such, has come to be the pillar and ultimate goal of local economic development initiatives of most developing countries (Canzanelli, 2001).

In addition to partnerships and collaborative works among development actors, innovative practices would help bring sustained economic growth and development in the local economy. According to Feldman and Ian (2007), modern economic growth in

general and the facilitation of local economies in particular has come to be a complex phenomenon, which is increasingly dependent upon innovation¹.

It should be made clear, at this juncture, that innovation may not entail adoption. Rather it is a creation of new ideas and generation of knowledge to achieve desirable outcome in the life of people. In addition, indigenous knowledge is a key element of the poor and constitutes their main asset for gaining control of their lives. Its special features include several attributes, of which the following are important. According to the World Bank (1998), indigenous knowledge is:

- ❧ *Local* in that it is rooted in a particular community and situated within broader cultural traditions and based on the experience of those who live in that community;
- ❧ *Tacit* and therefore not easily codifiable; such knowledge is understood or implied without being stated openly.
- ❧ *Transmitted* orally or through imitation and demonstration;
- ❧ *Experiential* rather than theoretical meaning lesson from indigenous knowledge is transmitted from one locality to another or one generation to the next through actions and experiments and not through theories and principles;
- ❧ *Learned through repetition*, a defining characteristic even when new knowledge is added, as repetition helps retain and reinforce it;
- ❧ *Constantly changing*, produced as well as reproduced, discovered as well as lost, though external observers often see it as somewhat static (World Bank 1998).

From the above discussion, it is plain to observe that development process should encourage the potential contribution of indigenous knowledge to locally managed, sustainable, and cost-effective survival strategies (Gorjestani 2004 in World Bank, 2010)

¹ Innovation is referred to as the ability to create economic value through the creative application of knowledge. For detailed discussion and different definitions employed by several authors, refer to chapter 2

1.1.2 Ways of Building Indigenous Knowledge

There are different mechanisms by which indigenous knowledge can be created, disseminated, modified and used. One of these mechanisms is the provision of physical infrastructure. Research works suggest that adequate infrastructure is a necessary, if not sufficient, requirement for enhancing the creation and application of science, technology, and innovation in development (Feldman and Ian, 2007; Gollin, 2008 and UNCTAD, 2007; World Bank, 2010).

The second method of enhancing indigenous knowledge is unlocking the financial capital of a nation. Banks and financial institutions can play an important role in fostering technological innovation despite their record in this field has been poor in developing countries (World Bank, 2010; Jume and Yee-Cheong, 2005).

The third method of building indigenous technological innovation is protecting the rights of inventors. In fact, overly protective systems may end up constraining creativity. Thus, intellectual property protection systems need to be designed in such a way that they should take into account the special needs of developing countries. As such, provisions in international intellectual property agreements that promote technology cooperation with developing countries need to be identified and implemented (Gollin, 2008; UNCTAD, 2007 and Jume and Yee-Cheong, 2005).

The fourth tool of building domestic technological capacity is attracting foreign direct investment and becoming part of global value chains through creating incentives and promoting an enabling environment for foreign direct investment. Global production systems have changed the ways funds flow and can be used for long-term growth. Foreign direct investment needs to be used as a vehicle for diffusing tacit knowledge and help enterprises learn from the world technological frontiers thereby aspire to reach them (Jume and Yee-Cheong, 2005).

Finally, what has emerged as one of the key measures used to promote the application of technology to socio-economic development is the promotion of regional markets through regional economic integration. This is because, according to Jume and Yee-Cheong

(2005), regional integration increases the potential to benefit from economies of scale, provides the space needed for product diversification, and increases the scope for research cooperation (which enhances the prospects for innovation).

1.2 Statement of the Problem

Several empirical works reveal that the importance of innovation as well as R and D in enhancing economic development has been implicitly and explicitly accepted by many countries and development organizations. At micro-level, innovation is one of the determinant factors for growth of firms as equally important as recruitment of highly educated personnel (Olivary, 2005; Nelson, 1993). Its importance is recognized at different levels. At macro-level, it is one of the most influential ways of transferring knowledge from one economic sector to another, one place to another place and from one cluster to another. The innovation and development agenda of many developed and developing countries in recent period portrays the same fact that, innovation and technology growth rates have a positive impact on economic growth rates (Feldman and Ian, 2007 and Aydogan, 2009). This is because, as Schumpeter (1934) argues, innovation is the process whereby a firm brings new technology into the economy (Schumpeter 1934).

For innovations to be successful at any level, series of prerequisites should be fulfilled. Above all, innovation must be protected by intellectual property right laws such as patent laws, which enlist the state's powers to prevent other people from 'free riding' on an inventor's ideas (Aydogan, 2009). This has already been expounded in the introductory part. The second concern for success of innovations is the availability of startup finance i.e. finance provided to companies and individuals for product development and initial marketing. A competitive financial intermediation helps innovative small players grow large quickly and displace established wealth. In this regard, large, independent and scientifically sophisticated venture capital funds appear critical (Gajanan, 2005).

The above-mentioned arguments reveal that patented innovation supported by appropriate financial intervention in the form of lending leads to growth of individuals, firms and companies in particular and growth of the national economy at large.

Innovation in many developed countries has been aided by a variety of governmental incentives and public-private partnership programs that have emanated from governments' desire to steer private investment towards more basic types of scientific activity (Feldman and Ian, 2007). Furthermore, in these countries, many incentives have been granted so far to enable local innovators invent technological solutions to their societies, which they would not do otherwise. Some of these incentives include: direct grants, research and development subsidies and similar other incentives (Klyuev, 2008; Jume and Yee-Cheong, 2005).

Unlike the aforementioned incentives that innovators in developed world obtain, their counterparts in developing countries like Ethiopia are hindered by many underlying challenges (Emilino, 2005). Some of these obstacles include: imperfection of the capital market, lack of finance, inappropriate credit market and poor infrastructural facilities. According to the World Bank report (2010), lack of access to financial services in these countries is one of the main reasons why the poor are unable to improve their skills through formal education and acquire new technologies.

Evidences in Ethiopia suggest that lending by formal financial institutions (particularly banks) is skewed towards well-organized formal economic sectors including domestic trade and services, import of processed and manufactured products, export of primary products, construction and the like. Statistical abstract of Central Statistical Authority shows that the contribution of loan disbursed to the manufacturing sector by commercial banks accounts only 9.8% of the total amount of loans disbursed in the country as a whole in the 1998/1999 Ethiopian fiscal year. This Figure accounts 10.08% and 10.47% in 1999/2000 and 2001/2001 fiscal years, respectively (CSA report, 2009). Taking into account that the majority of agricultural projects are financed by development Bank of Ethiopia, the meager 10% average share of the manufacturing sector of the total loan disbursement by commercial banks clearly shows the lower attention given to the sector. Segregating the amount of loan provided to new start ups and innovations from the manufacturing sector may further clearly outline the degree of attention innovation is given to. This is discussed at some length in chapter four

While the study of factors affecting the success of innovation is vitally important for policy purposes and/or for targeted interventions, empirical works conducted so far seem to consider this as rather marginal. For instance, the works of Feldman and Ian (2007) concentrates mainly on ways by which innovation and knowledge are transmitted; research work of Powel (2005) focuses on the type of nexus that should exist between innovators and entrepreneurs and Olavi (2005), discusses the impact of history on innovation. Hence, all these efforts mainly focus on determinants of the motives for generation of innovation per se not on innovators being operational and factors impeding them from being engaged in business. On the other hand, Togba (2009), Abay (2006) and Tolesa (2007) mainly focus on impacts of microfinance on growth of social capital of small and medium enterprises and households though there are variations in the scopes, settings, objectives and results among each of them.

All these research efforts do not indicate the basic factors beneath the success of innovation once ideas are generated and innovators are patented. In line with the above discussion and to fill the observed gaps, therefore, it is appropriate and timely to raise and investigate the following research questions:

The central research question is as to what factors determine the success of innovation in Ethiopia. More specifically, this study focuses on the following research questions:

- ❧ What does the trend of bank lending in Ethiopia look like from the context of business development?
- ❧ What is the lending practice of banks in terms of financing potential innovators?
- ❧ What basic factors impede innovators from being successful in their business endeavors?
- ❧ What workable solutions can be forwarded to remedy the ailments as far as innovative business practices are concerned in the study area?

1.3 Research Objectives

The study is aimed at examining banking service-related financial factors that hinder small scale patented innovators from entering into full scale operation. The study has the following specific objectives:

- ❧ To examine the trend of bank lending and the lending approach employed by banks while financing small-scale patented innovators with the objective of enabling them to become operational or expand scale of their operation,
- ❧ To identify the most fundamental triggering factors that impede the success of innovation,

1.4 Significance of the Study

The research will be useful for national policy formulation in the areas of credit market, innovation and R & D, in general and unemployment reduction and local empowerment in particular. Furthermore, it will widen the knowledge about situation of innovation, lending and related issues in the country. Policy makers and academicians can also use the findings of the research to influence policy changes and budget allocation decisions in the banking industry as well as to answer some academic questions and/or to use them as a reference for further study.

1.5 Scope of the study

The study is confined to areas of innovations where respective innovators have got patents and are under legal protection. Hence, the success and failure factors of those innovators within the context of the lending system of the banking industry are under the realm of this study. But, the paper does not incorporate problems of innovators that are not patented.

1.6 Limitation of the study

Scattered nature of the respondents, confidentiality of many related private and public policies and procedures; inability of many related governmental offices to update their respective websites were among other things, the main limitations of the study.

1.7 Organization of the Research

The research contains five chapters in such a way that the first chapter highlights the background and statement of the problem of the study alongside its objectives, significance, and scope. The second chapter focuses mainly on review of related theoretical literature, empirical literature and the conceptual framework. Next to this is the third chapter that discusses the overall methodology of the study and description of the study area. The fourth chapter concentrates on the findings and discussion of the study. Finally, the fifth chapter concludes the whole finding and suggests policy implications based on these findings.

Chapter Two: Literature Review

This chapter has three major subsections; the theoretical literature, the empirical literature and the conceptual framework. The theoretical literature lays theoretical foundation regarding related issues including the basic concepts associated with innovation and selected theories of economic growth from the perspective of innovation. The empirical literature, on the other hand, focuses mainly on review of related researches in other countries and in Ethiopia. Finally, a conceptual framework is drawn from the theoretical literature, the empirical literature and the factual situations of the nation.

2.1 Theoretical literature

2.1.1 Basic concepts associated with innovation

This part focuses on the basic issues related with innovation including its definition, its importance, relationship between patenting and innovation, factors affecting success of innovation, lending, factors affecting access to credit and sources of finance for innovation

2.1.1.1 Innovation defined

Innovation is defined by many scholars and organizations in different ways. The 2005 version of the OECD's Oslo Manual defines innovation as the implementation of a new or significantly improved product (good or service) or process; a new marketing or organizational method in business practices, workplace or external relations (World Bank, 2010). The concept of new here may mean new to the firm, new to the market, or new to the world.

Innovation is also defined as: i) the renewal and enlargement of the range of products and services and the associated markets; ii) the establishment of new methods of production, supply, and distribution; the introduction of changes in management, work organization, and the working conditions and skills of the workforce (Aydogan, 2009). This shows that

innovation is not simply a matter of installing devices, but of transforming society and its value systems (Sagasti, 2004 in Juma and Yee-Cheong, 2005)

Innovation activities comprise the generation, use and diffusion of new knowledge, methods, processes, and products within organizations and in the market (South African Innovation Survey 2005 in Aydogan, 2009). Through such diffusion mechanisms, innovation can be the driving force of a nation's economic growth and development, enhancing quality of life, and the improvement of competitiveness of its firms (Oerlemans et al. 2001 in Aydogan, 2009).

In general, innovation is about finding new solutions to existing problems, as well as offering opportunities of new activities (World Bank, 2010). Furthermore, innovation involves a shift in traditional relationships in society mainly through the manufacturing sector as this sector is accounted for the bulk of the surge in recorded licensing agreements in the 1990s (OECD report, 2004)

In this paper, hence, innovation descends from the above definitions but limited to the generation and introduction of only new and tangible products rather than production processes, or marketing methods, which are, in fact, necessary in enhancing quality of life, and the improvement of competitiveness of individuals and firms.

2.1.1.2 Importance of innovation

History tells us that innovation is one of the crucial inputs of growth of nations, industries or firms and has been linked to human life throughout (Schumpeter, 1934; Aydogan, 2009). Much of the improvement in human welfare over the past century can be accounted for technological innovation in public health, nutrition, and agriculture (Juma and Yee-Cheong, 2005).

From ancient to modern times, successful societies have been those that promote, reward, and capture individual creativity and innovation (Gollin, 2008). This is revealed in the argument of Rosenberg and Birdzell (1986 and 1990) that the economic miracle of the Western world can be explained by the marked increase in science to investigate the secrets of nature (Salvadori and Balducci, 2005).

Technological change increases the productivity of land, labor and capital. In doing so, it reduces costs of production and thereby improves the quality of outputs (UNCTAD, 2007). Irrespective of an economic sector in which an individual, a firm or a nation is engaged, they all share one success factor in common, i.e. innovation. What Rwandan coffee, Chinese automobiles, Costa Rican tourism, and Vietnamese IT services reveal is that success is a long-term process that usually involves direct and indirect government action in the context of an innovation system composed of diverse actors (World Bank, 2010).

Innovation is also a powerful force of human nature. It creates new businesses, cultural movements, and social institutions, and destroys, replaces, or leaves behind the old ones. Innovation feeds on the known and converts it into the new (Gollin, 2008).

Various literatures witness the importance and legitimacy of the quest for eruption of innovation and its activities for the fact that it proposes concrete and practical steps that governments and international agencies can undertake to bring science and technology to bear on development (Juma and Yee-Cheong, 2005).

Science, technology, and innovation play an important role in addressing the challenges associated with eliminating poverty and hunger (Juma and Yee-Cheong, 2005). Eradication of extreme poverty and hunger, in turn, is the first of the eight major millennium development goals (UNDP, 2003). Hence, technological advancement reduces poverty by contributing to economic development through creating job opportunities and raising agricultural productivity and by far contributing to the achievement of the MDGs. This shows that the main reason for governments to pay attention to innovation, particularly in the developing world, is that innovation is the key driver of economic development and the principal tool for coping with major global challenges, notably those induced by climate change (World Bank, 2010). Furthermore, if LDCs ignore the need for adopting policies to promote technological progress as a basic source of economic growth, they are likely to be increasingly marginalized within the global economy (UNCTAD, 2007).

In general, the above arguments witness that innovation has been the driving force of changes in human life as financial and human resources a firm, an organization or a nation possesses at any point are limited (Aydogan, 2009).

2.1.1.3 Patenting and innovation

Intellectual property essentially is something intangible, created by the use of mental ability (Gollin, 2008). These properties are most of the time attached with laws that are intended to promote technical ingenuity and cultural creativity by granting private ownership rights.

The term “intellectual property rights” (IPRs) refers to those legal rules, norms and regulations that prevent the unauthorized use of intellectual products (UNCTAD, 2007). IPRs cover a broad range of subjects, inter alia, patents, copyrights, trademarks, geographical indications, industrial designs and trade secrets (UNCTAD, 2007). They are sources of hidden wealth worth trillions of dollars, and they impose hidden costs on the same scale (Gollin, 2008).

Intellectual property rights often have an important impact on stimulating innovation and encouraging technology dissemination. These are enforceable legal measures that confer monopoly rights on innovators for a specified period of time, after which they fall into the public domain and can be freely used by others (World Bank, 2010).

One reason that small enterprises shy away from spending a great deal of money to upgrade technology is that the kind of technology they need can often be imitated, and cannot be effectively protected by patents. As a result, everyone is reluctant to be an innovator, at least in regards to some types of technologies (Nelson, 2003). Hence, to encourage innovation and unlock local capital, individuals and corporations need to feel that their work is protected; where intellectual property rights have been violated; compensation must be provided (Juma and Yee-Cheong, 2005)

Despite the fact that protecting intellectual property rights is a critical aspect of technological innovation, many argue that overly protective systems can constrain creativity. Strong intellectual property rights keep innovation out of the public domain,

increase the cost of technology and create monopolies (Gollin, 2008). However, arguments that favor the necessity of strong property rights state that these rights provide incentive for people to be creative; satisfies principles of moral or natural rights and facilitates investment in innovation (ibid)

Unanimously, despite the degree of strength of property rights may matter, it is inevitable that transfer of innovation demands the availability of optimal level of intellectual property rights.

2.1.1.4 Factors affecting success of innovation

Success of innovation is a function of many internal and external factors. The ability of an enterprise to innovate depends on its access to knowledge from research institutes or technology services centers, access to finance; access to human resources; adequate basic physical infrastructure; firm-level capabilities; inter-firm linkages and collaboration; general business services; demand conditions; and the framework conditions including the investment climate, general cultural propensity towards entrepreneurship and levels of literacy (UNCTAD, 2007)

One of the problems hindering reduction of poverty in the developing world is the absence of adequate infrastructure. Adequate infrastructure is a necessary, if not a sufficient, requirement for enhancing the creation and application of science, technology and innovation in development (Juma and Yee-Cheong, 2005).

The other factor hindering the success of innovation is the uncertainty that many organizations associate with new startups. Because the outcomes of innovation are highly uncertain, however, firms and entrepreneurs are often reluctant to invest sufficiently in R&D, and risk-averse behavior often stifles creativity (World Bank, 2010).

Lack of financing mainly in the forms of inadequate working capital, insufficient equity, difficulties of credit finding, expensive credit costs, ineffective revenue collecting, not being able to utilize incentives, the impact of economic policies on firms in the countries having high inflation and interest rates and limited opportunities for benefiting from capital markets are all hindrances of success of innovation (OECD report, 2006).

Lack of finance for new startups emanates from different underlying factors. The close relationship between the banks and incumbent firms, indeed the co ownership of the banks and firms by the same family groups, effectively prevents the entry of potentially successful firms into the industry. This eliminates the pressure on the existing firms to innovate, which to a large extent explains technological stagnancy in the developing countries (Aydogan, 2009). The barrier to access to finance can be associated with a market failure. Risk and informational asymmetries create capital market imperfections and a firm's lack of reputation and collateral become crucial elements (Balling, Bernet & Gyan, 2009).

In general, technological catch-up and innovation in LDCs require the co-evolution of the above mentioned important issues. These are: improvement in physical infrastructure, human capital and financial systems, along with improved technological capabilities within enterprises and more effective knowledge systems supporting the supply of knowledge and linkages between creators and users of knowledge. Improving physical infrastructure, human capital and financial systems is absolutely vital because many LDCs are at the very beginning of the catch-up process and have major deficiencies in each of these areas (UNCTAD, 2007).

2.1.1.5 Lending and factors affecting access to credit

It is obvious that innovation and production require investment. However, as Schiner (1997) says, because the cash inflows from production lag behind the cash outflows of investment, investment requires finance. Hence, the time gap between investing and getting returns of cash flow should be covered by a bridge called credit. For healthy function of an economy, access to credit plays an important role in providing future monetary resources forward at a reasonable cost.

Financial services are useful as intermediate inputs in processes of market enlargement and integration and as tools in inter temporal resource allocations and the management of risk. They also aid in the accumulation of human and physical capital and in other ways of upgrading productive opportunities (Shaw, 1973; Gonzalez-Vega, 1993 in Gajanan, 2005).

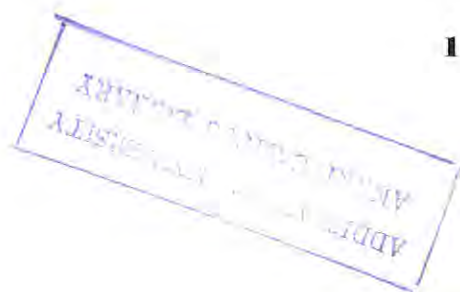
Unlike all the mentioned advantage of access to credit, innovative nascent entrepreneurs are financially constrained for three main factors according to Mahagaonkar (2010). The first factor is information asymmetries, which arise if the firm has better information about the returns occurring from their investment in intangible assets than do potential investors. Hence, external finance may be expensive, if available at all, because of adverse selection and moral hazard problems. It is likely that information asymmetries are higher for nascent entrepreneurs who do not have any established track record (Mahagaonkar, 2010 and Planes et al., 2001).

The second factor involves the fundamental uncertainty inherent in knowledge and new ideas. Uncertainty inherent in the innovative process renders the decisions by potential investors to be based on subjective judgments, which may or may not coincide with the assessment by the nascent entrepreneur. This implies that innovative activity may be burdened with difficulties in obtaining finance, even at the prevailing market interest rates. (Mahagaonkar, 2010 and Planes et al., 2001)

The third major constraint for innovative nascent forms to be denied to access to credit is the propensity for knowledge to exhibit, at least partly, characteristics and properties of a public good, that is, it is non excludable and non rival in use (Mahagaonkar, 2010 and Planes et al., 2001)

Hence, uncertainty, knowledge asymmetries, and the potential nonexclusive nature of investments in intangible assets make it difficult to evaluate the expected value of an innovative firm, especially of an innovative nascent firm (Audretsch & Weigand in Mahagaonkar, 2010).

While there is an intuitive reluctance on the part of traditional lenders to lend to firms without collateral and track records, this disadvantage is largely offset by policies that are well targeted to the special problems of SMEs and by the efforts of private financial institutions to develop this market segment as a profitable business line (OECD report, 2006).



In general, the basic cause that lending to poor household will fail is that the costs of doing so are too high; risks are too great, saving propensities of these households are too low, and just a few households have much to put up as collateral (Edith, 2009). Furthermore, opportunity cost of repayment of extra unit of money is more difficult and challenging to the poor than their rich counterparts.

2.1.1.6 Sources of finance for innovation

Finance for innovation usually comes from internal sources (cash flow), but when substantial investment is required, external investment may be needed (World Bank, 2010). The main sources of finance for technological innovation are banks and other financial institutions, individual private investors and public funds (Juma and Yee-Cheong, 2005).

However, due to the highly uncertain nature of such projects, outside investors may not have confidence in entrepreneurs' ability to manage risky ventures, or they may find it difficult to identify good projects. Long-term perspectives may give way to "short termism." This myopia in the innovation market warrants government intervention and the use of public money to provide grants and incentives to innovating firms and entrepreneurs (World Bank, 2010)

Banks and financial institutions can play an important role in fostering technological innovation. But their record in this field has been poor in developing countries. Reforming some banking and financial institutions would allow them to help promote technological innovation (Juma and Yee-Cheong, 2005)

Capital markets and venture capitalists have played a critical role in creating small and medium-size enterprises in developed countries. Venture capitalists do not just bring money to the table; they help groom small and medium size start-ups into multinational institutions. Bringing venture and other forms of risk capital into developing countries could help create new businesses and improve their sustainability. (Juma and Yee-Cheong, 2005)

To sum up the above arguments, sources of finance for innovation (for already established firms) come, from banks, from governmental and nongovernmental organizations, from formal and informal lenders and the like.

2.1.2 Selected Theories of economic growth from the perspective of innovation

Many economic theories recognize the role of technology and innovation as engines of economic growth despite the fact that the degree of importance of these factors differ from time to time. For the purpose of review, the Schumpeterian, the neoclassical and the endogenous growth theories are dealt in order in this paper.

2.1.2.1 The Schumpeterian Theory

According to one of the classical economists, Joseph Schumpeter (1934), the most important aspect of economic growth is that the duration and life span of technological inventions is too short in that when a product or technique is improved, the new good or method tends to displace the old one. Thus it is natural to model different quality grades for a good of a given type as close substitutes. Taking the extreme assumption that the different qualities of a particular type of intermediate input are perfect substitutes; hence, the discovery of a higher grade turns out to drive out the lower grades completely. For this reason, successful researchers along the quality dimension tend to eliminate or destroy the monopoly rentals of their predecessors, a process labeled as “creative destruction” by Schumpeter (1934). Thud the probability and speed by which an invention becomes a communal property increases as no monopoly hardcore is created. This further enables economies to benefit from inventions at a higher rate.

According to this theory, there are three sectors in this economy: producers of final output, R&D firms, and consumers. Producers of final output demand intermediates from research firms, and they, again, use varieties of intermediate inputs. At each point in time, the knowledge that exists to produce an array of qualities of each type of intermediate good becomes diversified (Barro and Martyn, 2004)

Researchers invest resources to improve the quality of existing intermediate inputs and a successful researcher retains exclusive rights over the use of his/her improved intermediate good so that he/she can sell the intermediates at the monopoly price to the producers of final output. The researcher who has a monopoly power over the use of the latest technology receives a flow of profit until the second invention arrives and the products are displaced, which in fact increases the turnover of technology and innovation flow in an economy (Schumpeter, 1934).

If we assume, in the Schumpeterian theory, that the latest innovator is a different person from the previous innovator, a research success terminates the predecessor's flow of profit. Therefore, in considering how many resources to devote to research, entrepreneurs consider the size of the profit flow and its likely duration. This further shows that competition to benefit from profits of inventions necessitates inventors to invent every time (ibid).

To wind up, according to the Schumpeterian theory, profit motives of inventors that produce intermediary inputs and firms that produce final products increase the rate by which new ideas are invented. This is because of the fact that there is a growing consensus that innovation is the key driving force behind economic growth, standards of living, international competitiveness, and regional development (Acs and Verga, 2002)

2.1.2.2 Neoclassical Growth Theories

The main argument of neoclassical counterrevolution is that underdevelopment results from poor resource allocation due to incorrect pricing policies and too much state intervention by developing nations' governments. This argument further illustrates that the third world is underdeveloped not because of the predatory activities of the first world and the international agencies that it controls but rather because of the heavy hand of the state and lack of economic incentives that infuse the economies of developing countries (Todaro and Smith, 2009).

This theory was expanded from Harod- Domar formula by adding a second factor, labor and a third independent variable, technology. However, unlike the predecessors, the

Solow's neoclassical growth model exhibited diminishing returns to labor and capital separately and constant returns to both factors jointly. Hence, exogenously determined technological progress was the residual factor explaining long term growth of economies. The link between aggregate production i.e. gross domestic product, stock of capital, labor and exogenously determined productivity of labor can be formulated in the theory as,

$$Y = K^{\alpha} (AL)^{1-\alpha} \quad \text{Where,}$$

Y= Gross Domestic product

K= Stock of capital

L= Labor

A= productivity of labor (grows at an exogenous rate)

The functional relationship between these variables in the equation shows that, output growth results from one or more of the increase in quality and quantity of labor, increase in capital and/or improvement in technology.

Technological progress results from new and improved ways of accomplishing traditional tasks such as growing crops, making cloths, or building houses. This technological progress might be labor saving, capital saving or neutral. Out of these classifications, neutral technological progress occurs when higher output levels are achieved with the same quantity and combination of factor inputs. Simple innovations like those that arise from the division of labor can result in higher total output levels and greater consumptions for all individuals (Todaro and Smith, 2009).

To summarize, a new technological change that, say, doubles total output in neoclassical growth theory, is conceptually equivalent to doubling of all productive inputs, which further shows that taking all factor inputs constant, improvements in technological invention results in increase in output despite the fact that technology is exogenously determined (Todaro and Smith, 2009).

2.1.2.3 Endogenous growth theory

The endogenous growth theory, tries to explain economic growth by the accumulation process itself, that is, by the model's intrinsic production factors, without using external, exogenous factors (Herrera, 2006). This theory seeks to explain the factors that determine the rate of growth of GDP that is left unexplained and exogenously determined in the Solow neoclassical growth equation.

According to the endogenous growth theory, the potentially high rates of return on investment offered by developing economies with low capital-labor ratios are greatly endowed by lower levels of complementary investments in human capital, infrastructure, or Research and Development. Where complementary investments produce social as well as private benefits, governments may improve the efficiency of resource allocation. They can do this by providing public goods or encouraging private investment in knowledge intensive industries where human capital can be accumulated and subsequent increasing to scale generated (Barro and Martyn, 2004).

Among the many differences of the endogenous growth theory from the neoclassical growth theory, the focus of the former on the role of externalities in determining the rate of return of capital investment is paramount. Investments in physical and human capital can generate external economies and productivity improvements that exceed private gains by an amount sufficient to offset diminishing returns, the net result being sustained long term growth (Todaro and Smith, 2009).

In general, according to the formulation of endogenous growth model, technological knowledge is a key factor in the production function that results in long term growth of nations. Furthermore, externalities to endogenously determined technological progresses are key drivers of success of economies. This process necessitates the fact that for an economy to benefit from technological spillovers, it should be initiated from within i.e. it should have an innovation component in it.

2.2 Empirical Literature

2.2.1 Researches in other countries

Despite the fact that there is lack of econometric evidence to support the basic factors beneath the success and failure of innovations and allied facts, the forthcoming facts and evidences reveal the experience of different countries.

The rapid economic transformation of Southeast Asia and the Asian Pacific is attributed to three critical elements according to many scholars. These features are critical in achieving the goals throughout the world: The first element being the expansion of basic infrastructure, including roads, schools, water, sanitation, irrigation, clinics, telecommunications, and energy (Ericsson, 2005; Juma and Yee-Cheong, 2005).

The second factor affecting the rapid economic transformation of these countries was the widespread and development of small and medium-size enterprises that supply goods and services to the agriculture and natural resources sectors. Developing these enterprises requires developing indigenous operational, repair, and maintenance expertise and a pool of local technicians. Without this base, indigenous industries cannot scale up and the economy cannot benefit from technology (Feldman and Ian, 2007).

The third element was governments' support and funding to establish and nurture academies of engineering and technological sciences, professional engineering and technological associations, and industrial and trade associations. These human resource and supporting institutional frameworks spur sector wide innovations in development processes (Ericsson, 2005; Juma and Yee-Cheong, 2005).

In China, small and medium size enterprises were the engines behind the postwar industrial upgrading of the economy. By serving as suppliers to multinational corporations and foreign buyers, small and medium-size enterprises gradually acquired both the process and product technologies that enabled the economy to upgrade its technology. (Gibb and Li 2003 in Juma and Yee-Cheong, 2005).

In Taiwan, Work ethics, the high propensity to save, the emphasis on education, the early adoption of an outward-looking development strategy, land reform, the crucial role of foreign aid in the early stages of development, and the favorable international economic environment have all been emphasized, in various degrees, as among the most important factors contributing to its economic success (Nelson, 2003). However, high technology and innovation growth in the country, particularly in firms, was the main catalyst for its remarkable economic success.

As late as 1961, Korea suffered from almost all difficulties facing most poor countries today (Nelson, 2003). However, the country has grown rapidly since then. This rapid economic progress may be attributed to many economic, social, and technical factors. The most important of all may be technological capabilities, which is a combined outcome of various economic, social, and technical inputs. It is the ability to make effective use of technical knowledge in production, investment, and innovation (Ericsson, 2005; Nelson, 2003).

In India, small-scale industry sector accounts for 40 percent of the country's industrial output and 35 percent of its direct exports. It has achieved significant milestones for India's industrial development. Within that sector, clusters, which have been in existence for decades and sometimes even for centuries, play an important role (World Bank, 2010)

In general, the above arguments reveal that innovation is one of the necessary conditions for development success of a nation. Hence, in most countries, support to innovators has become an important policy task. This support is ensured by various institutions that provide specific and relevant services for entrepreneurs and firms. In industrialized countries, the business services infrastructure has been in place for several decades and has considerably improved its offer, with a focus on professional, mature, and highly segmented services (Ericsson, 2005; World Bank, 2010)

The Netherlands has observed that the general quality of business knowledge is good but that companies, especially SMEs, do not fully exploit it. The government therefore established knowledge vouchers, also called innovation vouchers, as a special incentive for linking SMEs to knowledge providers. The knowledge voucher is a coupon that

entitles SMEs to a number of free consultancy or research visits to large, knowledge-intensive organizations (companies, research institutes, educational institutions). The vouchers have been a success, and many firms have used them (World Bank, 2010).

In South Korean republic, in the 1980s, the government used various means to bring about effective linkages between the public R&D institutes and industry. The schemes were also aimed at facilitating university involvement in the projects, but have produced only limited results. In some cases, large firms, however, tend to shy away from receiving public support in recent years in order to keep their R&D activities confidential; thus the programs now largely support small and medium-sized firms (Ericsson, 2005; Nelson, 2003).

In Taiwan, firms' own R&D efforts, assistance offered by local research institutions, technology cooperation with foreign partners, foreign consultants, and reverse engineering techniques such as imitation or improvement of existing foreign products are the five major sources of technology for manufacturing firms. Under such circumstances, the role that the government plays in technical advance is critical, for government policies are closely involved with R & D activities, government-sponsored research institutions, regulation of technology cooperation with foreign partners, and the protection of intellectual property rights (Nelson, 2003).

Hence, at the policy level, the government of Taiwan has adopted: a strong education policy; fiscal and financial policies to encourage and indeed to require business enterprises to do R&D; a policy to establish government-controlled research organizations and institutes, and to support the development of high-tech industries; a policy to engage in technological alliance with foreign partners to develop needed technology; and technology policies to allow Taiwan to better react to the globalization of the world's economy (Nelson, 2003).

In Brazil, explicit policies for industrial technology development have followed the broader industrial policies of the Government. The acquisition of foreign technology through arms-length technology transfer, capital goods imports, and direct foreign investment has been strongly influenced by the government objective of minimizing the

outflow of foreign exchange and promoting import substitution. Similarly, financial incentives to foster R&D and boost the engineering consulting capabilities of national enterprises were focused on import-substituting activities or national producers that were competing in areas dominated by multinational producers (Nelson, 2003).

In Turkey, allocation of free land, income tax withholding and support of energy discount, insurance premium allowance have been provided for both the domestic and foreign investors through industrial zones and small industrial sites established by the Ministry (OECD, 2006).

Specific financial assistances and financial policies have played a major role in the success of many nations despite the fact that some, though insignificant, have failed to make their financial reforms effective. For example, Countries such as Egypt, Israel, Jordan, and Morocco have introduced public guarantee instruments in cooperation with the banking sector to meet the borrowing requirements of young firms. But these efforts are not sufficient to meet the region's entrepreneurship financing needs, especially since start-ups require funding for the period during which they do not generate enough revenue to cover expenses (World Bank, 2010).

In South Korea, A program called The Compulsory Lending Ratio provides that nationwide commercial banks should allow more than 35% of total loans to the SMEs. In addition, local or regional banks have to provide more than 80% of their total loans to these SMEs which are involved in technological activities (Nelson, 2003). Furthermore, the government's R&D subsidy has played an important role in encouraging innovative firms. This subsidy on national projects increased significantly from USD17.7 million in 1982 to USD 69.4 million in 1987. The government's R&D subsidy to the private sector through NRPs also increased from U S\$ 6.7 million U S\$ 22.8 million (Nelson, 2003).

Tax incentives were also major indirect mechanisms in making funds available for corporate R&D. In Korea, tax incentives were given in many ways: the most important being those tax incentives that aimed at promoting corporate R&D investment: reduced tariffs on import of R&D equipment and supplies, the deduction of annual noncapital R&D expenditures and human resource development costs from taxable income,

accelerated depreciation on industrial R&D facilities, and the exemption of real estate tax on R&D-related properties (Nelson, 1003). The preferential lending offered by state controlled banks and public funds were the other most important mechanism for funding corporate R&D in South Korea (Nelson, 2003).

In Taiwan, The government has adopted a number of measures to encourage business firms to intensify their R&D efforts. On the taxation side, the Statute for Encouragement of Investment (SEI) stipulates that the R&D expenses of a firm shall be deducted from the taxable income of the current year, and for equipment bought for the purpose of conducting R&D with a service life exceeding two years, accelerated depreciation is allowed.(Nelson, 2003)

By 1987, the government put aside NT\$ 20 billion, which is given to firms in the form of loans. These loans have been used for the installation of machinery necessary for the production of the items selected. Any qualifying firm can receive a 10-year loan with a maximum loanable amount of 80% of the total capital needed or 65% of the total expenditure required for the investment. Furthermore, a preferential interest rate, 1.75% below the prime rate of the Bank of Communications, is also charged (Nelson, 2003)

In Brazil, Financial incentives have been the main instrument for encouraging the development of technological capabilities at the firm level. Since 1973, FINEP (Agency for Financing Studies and Projects) has used subsidized loans, risk-sharing instruments, and, to a lesser extent, equity participation to foster national firms' technological activities (Nelson, 2003).

In Canada, The federal government supports SMEs directly in a number of ways. For example, Enterprises with annual income less than C\$400,000 face a lower rate of the corporate income tax (Klyuev, 2008). In addition, under the Canada Small Business Financing Program, the government of Canada may guarantee 85 percent of a loan under \$C250, 000 for eligible purposes (Klyuev, 2008). The Business Development Bank of Canada (BDC) offers financial services, consulting services, subordinate financing and venture capital to small and medium-sized enterprises involved in industrial activities (Klyuev, 2008). Nonetheless, a survey in 2002 by Ipsos-Reid (reported in CFIB and

others, 2002) reveal that only 20 percent of Canadian firms mentioned access to financing and cost of borrowing as barriers to growth. This percentage was considerably lower than for taxation, market environment, and human resource issues (Klyuev, 2008).

In general, literatures above witness that innovation is one of the most significant elements of success. In consequence, many governments have been providing various incentives to innovators and innovative activities to stir up the economic success of their respective nations. Financial supports, in various ways, were the major incentives these countries used to provide despite the fact that there are insignificant financial incentives that failed to hit their targets.

2.2.2 Researches in Ethiopia

The basic challenges of innovation in developing countries like Ethiopia as compared to developed ones include: low demand, low level of human capital, low physical infrastructure and communication means, low institutional capacity and set up, challenges of economic structure. In addition, the capacity of these countries to innovate depends, on one hand, on foreign sources of knowledge and technology and, on the other, on the country's capacity to absorb, adapt, and diffuse innovation. International trade rules and practices and intellectual property agreements strongly influence countries' ability to attract partners and foreign investments, benefit from technology transfer through increased trade opportunities, and stimulate local innovation (World Bank, 2010).

Specific problems associated with success of innovation include financial pitfalls. This is because; the formal banking system in the country is focused on collateral based short-term credit which needs the collateral to reach over 100 per cent of a typical loan's value. The demand on collateral is a problem for small scale innovative firms that may have the potential to grow but whose main assets may be intangible (Ericsson, 2005; World Bank, 2010).

Another problem, according to the World Bank investment climate survey, is that SMEs in Ethiopia have less access to infrastructure and land and believe themselves to be worse affected by corruption than larger firms. It is also very costly to register a new firm, and

there are long delays in other typical start-up activities including electricity and telephone connections, which are likely to hamper the birth, growth and flexibility of innovative firms (World Bank, 2010)

Lack of information support systems, especially on design, technology, best practices, market potential and partnership opportunities, be it for the purpose of investment, technology transfer or market access is also another impediment facing small scale innovative firms in the country. The cost of searching and accessing relevant information is high for small enterprises in Ethiopia (IKED, 2006).

Shortage of technical skills, in particular in designing and precise machining is another major problem facing these firms. Despite the fact that some enterprises have training programs, the majority of SMEs, especially for small-enterprises, training their own workers is not an option because of the high costs involved and the high turnover of technical staff. Hence, in a skilled labor shortage economy, training at the firm level involves a high level of risk (IKED, 2006).

Relative weak intellectual property rights protection system is also a major pitfall for success of innovative firms in the country. A review by UNCTAD (2002) shows that intellectual protection system in Ethiopia, particularly the legal procedure, is still weak and cumbersome. However, some of the enterprises that complained about the lack of a proper patent rights enforcement system were in many instances themselves abusers of such rights. Two of the more dynamic and innovative enterprises, for example, claimed that they are discouraged from introducing new products because of rampant copying/imitation by other enterprises and the lengthy process of bringing abusers of intellectual property rights to justice. Curiously, however, the accusers themselves proudly claimed they had obtained designs illegally from abroad during visits to trade fairs or business trips and have copied and supplied final products in Ethiopia without the knowledge of the original designers (UNCTAD, 2002).

Absence of proper and effective standard setting and quality control mechanism is also considered as one of the limiting factors of success of innovation. The existing quality control system is in dire need of upgrading to be brought in-line with the standards in

competitor countries. Some of the innovative enterprises visited by the review team of UNCTAD had to rely on foreign expertise for quality control, which is a costly and time consuming process (UNCTAD, 2002).

The world bank's (2010) report portrays that Ethiopia stands 140th out of 140 countries in an innovation index, which is based on the countries' performance over three indicators i.e. the number of patents granted by the U.S. Patent and Trademark Office; the number of scientific and technical journal articles as well as the amount of royalty payments and receipts (World Bank, 2010). In addition, resident and non-resident applications to the national patent office are scarce, and in the past ten years there have been no applications from Ethiopian nationals to the US patent office, compared to almost 200 from Kenya and nearly 1,300 from India.

To windup, innovative firms in the country are tied up with a number of internal and external problems including, but not limited to, low human capital, low technical skills, low physical structure and communication means, low institutional capacity and set up, information asymmetry, market imperfection, poor intellectual property rights protection, financial pitfalls and others.

2.3 Conceptual Framework and Hypotheses

The conceptual framework for this study is drawn from the theoretical and empirical literature as well as situation analysis of the study area. The theoretical and empirical literature discussed so far reveal that success of innovation is affected by availability of access to finance, availability of basic infrastructures, access to training and availability of conducive policy environment. Hence, based on the above literature perspectives, an integrated conceptual model is developed below to support the research hypotheses.

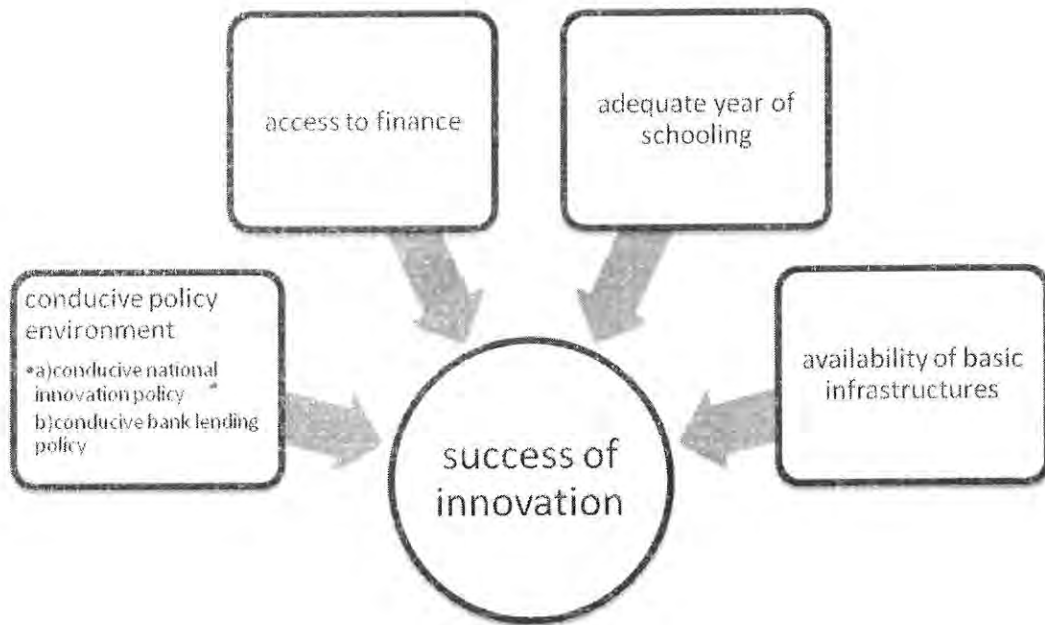


Figure 1: Schematic description of the conceptual framework

Figure 1 above portrays that success of innovation is a function of: access to finance, adequate year of schooling, availability of basic infrastructures, availability of training and presence of conducive innovation and financial policies.

2.3.1 Research Hypotheses

By considering evidences from empirical and theoretical literature, as well as from the above conceptual framework, the following hypotheses were developed which are tested in the study;

- H1: The availability of access to finance positively affects the probability of the inventions to be operational.
- H2: Level of education is positively associated with the probability of the invention to be operational.

Chapter Three: Research Methodology

This chapter mainly focuses on the overall methodology of the study and description of the study area. Method of data collection, procedure of data collection, questionnaire design and method of data analysis are all included in the chapter. Finally the econometric model used in identifying the factors that influence the success of innovation and definition of variables used in the Probit equation are dealt in the chapter.

3.1 Description of the Study Area and Research Methodology

The study does not have a confined specific geographical area as a subset of the country; rather, it encompasses all patented inventors throughout the country; the innovative policies of the nation as part of the policy of science and technology and the lending policies of selected banks in the country. Hence, the samples taken and the documents analyzed are from the nation's perspectives as a whole rather than from the point of view of a specific geographical area.

So long as the type of data used is concerned, the study has employed both primary and secondary data types in order to produce a richer and more complete result. Survey questionnaire was used to identify the basic causes that impede the success of patented innovators. The questionnaire includes questions related to durations of innovations since they were patented, reasons for their delay, impacts of financial constraints, reasons for denied access to loans from banks (if any), and the like. Furthermore, in-depth interview with selected innovators, bank experts working in loan area and policy units and concerned government organs in the area of patenting and science and technology were made.

Secondary data regarding past trend of bank loans, i.e. outstanding and disbursed loans by sector from 2006 to 2010 fiscal years was obtained from the archive of National Bank of Ethiopia.



3.2 Methods of Data Collection

3.2.1 Sample size and sampling method

The study employed a convenience sampling method in the quest to find respondents of the entire survey questionnaire. Concerning the way respondents were chosen, the entire list of inventors with the corresponding telephone addresses was taken from the Ethiopian intellectual property office. Once this was done, each registered/patented innovator was telephoned. However, it was too difficult to find everybody in the list: some of them have changed their addresses, some of them are in remote areas of the country, and some of them were nowhere to be found. Hence, the researcher contacted those respondents who were easily accessible. After the potential respondents were carefully scrutinized, a sample of 40 individuals, out of a total population of around 70, were taken and responded to the entire questionnaire from both operational and non operational cases.

Furthermore, in depth interview about criteria that make loan applicants be eligible for credit access, policy inclusion and exclusion of innovations and startups were made purposively with three selected bank professionals working as credit analysts in three different banks. The selection of these interviewees was based on pre established relationship of the researcher so as to obtain the necessary information as majority of credit policies of banks are confidential to be disclosed freely. In addition, government officials were interviewed regarding policies and procedures in the areas of innovation, patenting and science and technology.

3.2.2 Questionnaire design and data collection procedure

The innovation success survey comprises 22 different questions which were expected to answer one of the research questions developed by the researcher, factors impeding success of innovation. The questions were translated into Amharic, (operational language of the study area). The questionnaire was distributed to 40 minor inventors found in Addis Ababa. During the process, the respondents filled each question with the researcher briefing each of them.

The total number of utility models/minor inventions registered was around 100 during the time the survey was taken. However, the total number of inventors for these inventions was not greater than 70. Hence, the sample size taken, 40, is around 60% of the total number of inventors in the country; which implies that the sample size taken is a fair representative of the entire population.

3.3 Method of Analysis

3.3.1 Descriptive Analyses

Desk review of credit policy of selected banks and interviews with selected bank professionals were used to understand the current practice of bank lending in the country. Furthermore, trend analysis was made on data obtained from National Bank of Ethiopia regarding the annual disbursement and outstanding loan of each economic sector. Comparison of each year's outstanding loan and loan disbursement by sector was made with nominal GDP of the country: the data of which was obtained from MoFED and National Bank of Ethiopia.

In identifying factors that influence the success of innovations, details of the respondents and the variables in the survey were described. Characteristics of the respondents, impediments of innovative works, reasons for denied access to credit (for those respondents who are denied to access to credit) and reasons for not requesting bank loan (for respective respondents) are, among others, described most.

3.3.2 Econometric Model used in identifying factors influencing the success of innovation

The study employed a combination of frequencies, ratio analysis, regression analysis, and cross tabulation on data from survey questionnaires to identify determinant factors of success of innovations.

The dependent variable in the analysis of the determinants of success of innovation is whether the patented innovative works are operational or not. The variable is

dichotomous by its nature in that it takes values of zero and one depending on whether that particular invention is operational by now or not respectively. The model specifies a functional linear relationship between the probability of a qualitative dichotomous variable and various explanatory variables. The general expression of the dependent and explanatory variables is specified as under.

$$Y = f(X_{11}, X_{22}, X_{33}, \dots, X_{ji})$$

Where:

- ✓ Y is the dependent dummy variable showing whether a particular invention is operational or not,
- ✓ X_{ij} is j's explanatory variables to i's individual.

Therefore, the explanatory variables influencing success of innovation can be expressed using both qualitative and quantitative variables. As the dependent variable is dichotomous, the Probit model is used to specify the functional relationship between the probability of this dichotomous variable and the corresponding explanatory variables.

The specific estimate of the Probit model for the above function can be expressed as:

$$Y^* = X_i^T \beta + U_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 D_1 + \beta_5 D_2 + U_i$$

Where:

- ✓ Y^* is the estimate of the dependent variable i.e. whether a specific invention is operational or not
- ✓ X_{i1}, X_{i2} and X_{i3} are continuous explanatory variables in the equation i.e. age, family size and year of schooling of the respondent
- ✓ D_1 and D_2 are dichotomous explanatory variables that take values of '1' and '0' depending on predetermined attributes shown below. In this particular equation, "type of invention" and "access to finance" are categorized in this group.
- ✓ $X_i^T \beta$ is the index function of the whole observation
- ✓ U_i is the random error term for observation i

The marginal probability effects are the partial effects of each of the above explanatory variables on the probabilities that the observed dependent variable is operational ($Y_1=0$) or not operational ($Y_0=1$)

A. The marginal probability effect of a binary explanatory variable equals

The value of $\Phi(X_i^T \beta)$ when $X_{ij}=1$ minus the value of $\Phi(X_i^T \beta)$ when $X_{ij}=0$

Hence, the marginal probability of $X_j = \Phi(X_{1j}^T \beta) - \Phi(X_{0j}^T \beta)$.

B. The marginal probability effects for continuous explanatory variables

The marginal probability of any of the aforementioned continuous explanatory variables can be expressed as the partial derivation of the index function of the whole observation with respect to respective continuous explanatory variable.

Hence, the marginal probability effect of X_j will be,

$$\frac{\partial \Phi(X_i^T \beta)}{\partial X_{ij}} = \frac{d\Phi(X_i^T \beta)}{d(X_i^T \beta)} \frac{\partial X_i^T \beta}{\partial X_{ij}} = \phi(X_i^T \beta) \frac{\partial X_i^T \beta}{\partial X_{ij}}$$

Where,

$$\phi(X_i^T \beta) = \frac{d\Phi(X_i^T \beta)}{d(X_i^T \beta)} = \text{the value of the standard normal probability}$$

distribution at $X_i^T \beta$, and

$$\frac{\partial X_i^T \beta}{\partial X_{ij}} = \text{the marginal index effect of } X_j$$

3.4 Definition of variables used in Probit Equation

The variables used in analyzing the basic impeding factors beneath the success of innovation include:

- I. **Age (age of the respondent):** is a continuous variable showing the years of the inventor (particular respondent) at the responding time.
- II. **Family size (Family size of the respondent):** is another continuous variable mentioning the number of family members engage under that particular inventor.
- III. **Operation of the invention:** is a dummy variable addressing whether a particular invention is operational or not as of the responding period. It takes a value of '0' if a particular invention is operation by now and '1' if the invention is not operational. This variable is the dependent variability which is expressed in terms of other variables in the equation.
- IV. **Educational level:** is a continuous variable stating the number of years spent starting from Grade one up until the patenting period of the particular respondent.
- V. **Type of work:** is a dichotomous dummy variable containing 0= the invention being directly used for consumption and 1=the invention being intermediary work for other sectors.
- VI. **Credit accessibility:** is a variable enumerating whether a particular inventor, be his/her work operational or not, has got credit access or not. The question to get data on this particular variable is different from others. If a respondent answers 'yes' to whether 'credit access can develop/enhance that particular work or not', this means that the reason for not being successful is the lack of access to credit. Hence, unlike other variables, yes obtains '1' and no obtains '0'.
- VII. **Nature of the invention:** is related to whether the nature of the work has influenced the inventors to begin/ develop their works. '0' refers to no

difficulty related to nature of work and ‘1’ refers to the fact that nature of work has affected the functionality of the invention.

The success of innovation, in general, is a function of the variables summarized below.

Table 1: Expected Signs of variables

S. no	Variable	Type of variable	Value assigned	Expected sign	Remark
1	Age	Continuous		Positive	Continuous variables take given values
2	Family size	Continuous		Negative	Continuous variables take given values
3	Educational level	Continuous		Positive	Continuous variables take given values
4	Type of Work	Discrete	0-consumption good 1-intermediary good	Positive for consumption goods	
5	Finance Accessibility	Discrete	0-no credit access 1-got credit access	Positively related with accessibility to credit	

Chapter Four: Results and Discussion

4.1 Introduction

This chapter contains four major subsections; each of them containing respective sub subsections. The first part focuses on discussion of innovation policy of Ethiopia in comparison with some selected countries. This part also concentrates on patent laws and regulation of the country. The second subsection mainly shows the lending trend of banks in Ethiopia from the point of view of sectorial share of outstanding loan and annual loan disbursement in comparison with the trend of growth of the nominal GDP of the nation. The third point dealt in this section is the current practice of banking lending in the country. Finally, factors affecting the success of innovation are dealt in the final part of this chapter.

4.2 Policy Document Analysis

4.2.1 Innovation policies of Ethiopia in comparison with other Countries

The innovation policy of the country, as part of the policy of science and technology, was initiated in 1993 under the transitional government of Ethiopia and is yet operational without any change. This policy focuses on the following four areas:

- ☞ To assist appropriate methodologies for the application of biotechnology in the fields of agriculture, health and industry
- ☞ To organize and support the development of facilities, manpower, workshops, support centers and the publication of journals in order to promote and coordinate biotechnology activities and their diffusion
- ☞ To support training and skill development in microelectronics especially in computers and the establishment of institutes to back up the effort
- ☞ Support the effort to promote awareness, knowledge and application of new and emerging transport and communication technologies specially of those of

telecommunications and new materials (FDRE, Science and Technology policy, 1993)

The policy, however, was criticized by participants of various stakeholders in 2010 for many reasons at the policy reformulation conference held at Adama, including that:

- ❧ The policy was too general in its contents
- ❧ Emphasizes on research and research results dissemination than coping and innovating technologies.
- ❧ Do not recognize the role of business enterprises, particularly SMEs and
- ❧ Focuses only on supply side of the necessity of innovation. In addition, the policy is too narrow to include contemporary innovation practices of developed countries that mainly focus on demand side of the quest for upraising and distribution of innovation activities. (conference hand book, 2010)

Unlike the aforementioned policy directions of the country, the innovation policy of South Korea in the initial development stage includes the massive import of foreign capital goods. This activity became a major source of learning through reverse engineering by Korean firms. The inflow of foreign capital was facilitated through; the slight overvaluation of the local currency, tariff exemptions on imported capital goods, and the financing of purchases by suppliers' credits, which carried low interest rates relative to those on the domestic market, all worked to increase the attractiveness of capital goods imports (Ericson, 2005).

In the case of the manufacturing sector, general guidelines gave priority to technology that promoted exports, developed intermediate products for capital goods industries, or brought diffusion effect to other sectors. The technology transfer promotion through procurement of turnkey plants and capital goods led to massive imports of foreign capital goods at the cost of retarding the development of the local capital goods industry (Kim, 2007).

The Korean government in later years of development i.e. around the 1970s reversed its FDI policy, tightening its control. South Korea was one of a few countries with

restrictions on FDI when technology was not a critical element. In addition, the development of local consulting engineering firms was promoted by the Engineering Service Promotion Law of 1973, which stipulated that most engineering projects should be given to local firms as major contractors with foreign partners as minor participants (Ericson, 2010)

In general, the innovation policy of South Korea not only stimulates the demand side of technological learning through industrial policy instruments but also gives rise to the supply side of technological capability through technology policies.

Major policies and programs to promote sub national innovation system in china include high industry-academy-research partnership. The construction of technology Innovation Park and the enhancement of high venture were also the major policy changes in the country to increase the involvement of innovation in all aspects of the production processes (Boeing, 2010).

The basic supply side technology instruments of Germany include; direct institutional support, indirect financial support for innovative firms, direct project funding to these firms and joint support of innovation activities by different stakeholders. In addition, the policy instrument of the demand side of innovation enhancement includes indirect sector specific support and developing related infrastructures (Nascimento, 1997).

Currently, the ministry of science and technology of Ethiopia has prepared draft policy that includes innovation policy in it. The policy is supposed to consider the drawback of the previous policy and the contemporary needs of what an innovation policy should owe. As per interview with a government official, the policy directions of the draft policy include but are not limited to the:

- ☞ Expansion of the flow of technology through foreign direct investment
- ☞ Promotion of the development of domestic technological capabilities for the effective absorption of foreign technologies
- ☞ Setting national priority programs for transfer of major technologies

- ❧ Using intellectual property and standards information as sources of foreign technology.

However, despite all these efforts, the national policy of the nation is not yet clearly defined and publicized.

4.2.2 Patent Laws and Regulations in Ethiopia

The federal Negarit Gazeta of the federal democratic republic of Ethiopia, in its proclamation no 123/1995, concerning inventions, minor inventions and industrial designs stipulates that a minor invention that possesses novelty and industrial applicability shall give rise to a right to protection in favor of the author thereof. Thus, the right shall be evidenced by a utility model certificate issued by the Commission. In addition, the grant of the certificate shall confer the exclusion right to exploit the minor invention and prevent third parties from exploiting the minor invention without the authorization of the certificate

This particular proclamation also demarcates the things that are protected and not protected by utility model certificates i.e. minor invention patents. Hence, among other: changes in the shape, proportions or material of a patented object or of one that is public property, except where such a change alters the qualities or functions or the object thereby producing an improvement in its use or the effects of its intended functions shall not be protected by utility model certificate. In addition, the mere replacement of elements in a known combination by other known elements having an equivalent function, which does not thereby produce an improvement in its use or the effect of its intended functions, shall not be protected by utility model certificate. Furthermore, minor inventions which are contrary to public order or morality (Federal Negarit Gazeta, 1995).

After reviewing all that an application is out of the above domain, the ministry of science and technology shall undertake a formal examination and decide to allow or refuse the grant of utility model certificate/ minor invention patent. Where the ministry decides to grant utility model certificate, it shall issue a utility model certificate to the application.

A utility model certificate is granted for a period of five years, which may be renewed for a further five years period provided that proof is furnished that the minor invention is being worked in Ethiopia. Application for renewal of the certificate shall be filed, with the ministry within 90 days prior to the expiration of the period of protection upon payment of the prescribed fees.

4.3 Trend of Bank Lending in Ethiopia

With three state owned and fourteen private bank (as of July 2010) in the country, share of total domestic outstanding loan of Ethiopia is much lower than even majority of developing countries. For example, the average domestic outstanding loan of the country as percentage of the national GDP in 2005 was 25.32 as compared to 34.76% in Brazil, 31.76% in Qatar and 26.95 % in Zimbabwe (CSA, 2009)

The total loan of the country that all private and public banks injected in to the economy at a single fiscal year stood at ETB 28.9 billion as of June 2010 as compared to ETB 12.4 billion in 2006 with a magnificent average annual growth rate of around 2.7% in between these years (2006 to 2010). On the other hand, the nominal GDP of the nation grow from ETB 131.6 billion in 2006 to over ETB 407 billion with an average annual growth rate of 24.4%. In addition, the total outstanding loan of the nation reached over ETB 44.8 billion in 2010 as compared to ETB 21.6 billion in 2006 with an average annual growth rate of 24.4%.

Table2: loan to GDP comparison

ETB. ‘000,000

Fiscal year	Total domestic loan	Loan disbursement during the year	Total Nominal GDP	Loan disbursement to nominal GDP ratio	Domestic loan to GDP ratio
2006	21,596	12,402	131,641	9.4%	16.4%
2007	25,610	15,559	171,989	9%	14.9%
2008	35,987	27,255	248,065	10%	14.3%
2009	38,577	25,477	336,106	7.6%	11.5%
2010	44,830	28,905	407,184	7.1%	11%

Data source: NBE and MoFED (respective years)

The above table can be reformulated in the following trend Figure.

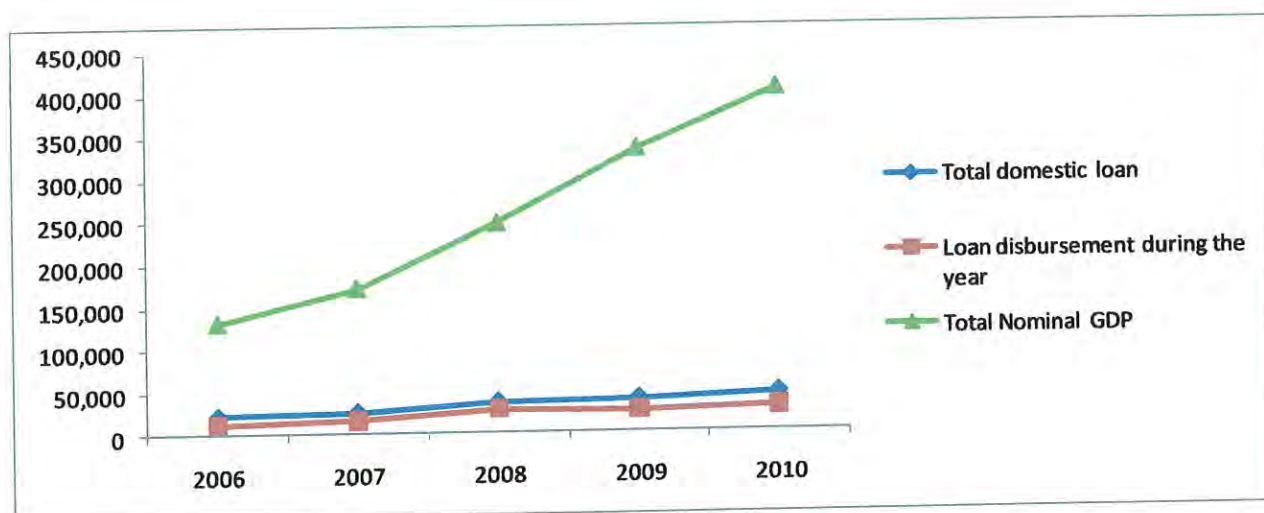


Figure 2: Trend growth of total Domestic loan, annual loan disbursement and total nominal GDP (2006 to 2010)

Data source: National Bank of Ethiopia (respective years)

Figure 2 shows that the difference between the trends in nominal GDP and loan disbursed is like opening a scissor. The implication is that the rate of growth of the nominal GDP of the nation is growing much higher than that of the total loan that banks of the nation injected in respective years.

The total loan that the country's banks inject into the economy compared to each year's GDP is declining from time to time; the basic reason, according to bank professionals interviewed is the credit cap that was imposed by banks in 2008. In addition, the unbalanced growth rate (magnitude wise) between growth of nominal GDP and growth of loan disbursement per annum can be considered as the other factor for diminishing proportion of domestic loan to nominal GDP ratio. The trend of growth of the nation's outstanding loan to respective nominal GDP is shown in figure 3.

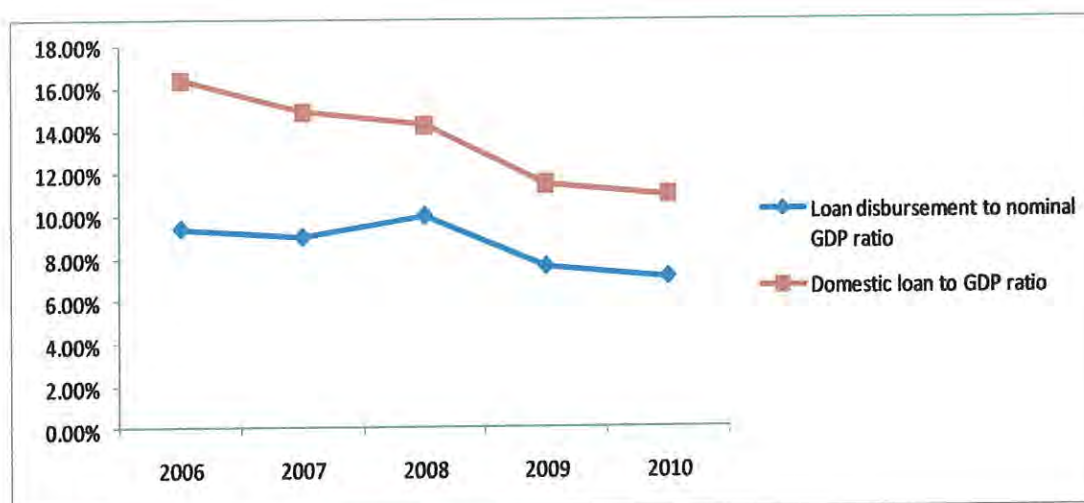


Figure 3: Growth trend of ratio of annual outstanding loan to nominal GDP and annual loan disbursement to GDP ratio

Data source: National Bank of Ethiopia (respective years)

The total domestic loan to nominal GDP ratio of the country declined from 9.4% in 2006 to 7.1% in 2010: noting that the annual loan disbursement, outstanding loan and annual nominal GDP of the nation are all measured in each year's price not at a fixed price level.

4.3.1 Trend of Sectorial Share of Outstanding Loan

Sectorial share of outstanding loan, in this context, is the total amount of outstanding loan contained in one economic sector i.e. the total amount of loan that all banks in the country injected but remained undue and uncollected. Taking this definition in to account, sectorial share of loans in the country shows that domestic trade and service contains the highest share of outstanding loans in the country containing an average of **nearly 27% share of each year's outstanding loan balance**. Loan granted in this sector still remains the highest proportion despite the fact that its share is declining from time to time.

From a definition in chapter 2 that inventions are most of the time contained in the manufacturing/ industrial sector (OECD report, 2004), reviewing the share of loan granted to this sector is paramount. The average share of loan granted to the manufacturing sector in the period covering 2006 to 2010 is 14.5%; next to 26.7% for

domestic trade and service, 20.5% for import and followed by 13.3% for building and construction, 9.5% for agriculture and 8.6% for export.

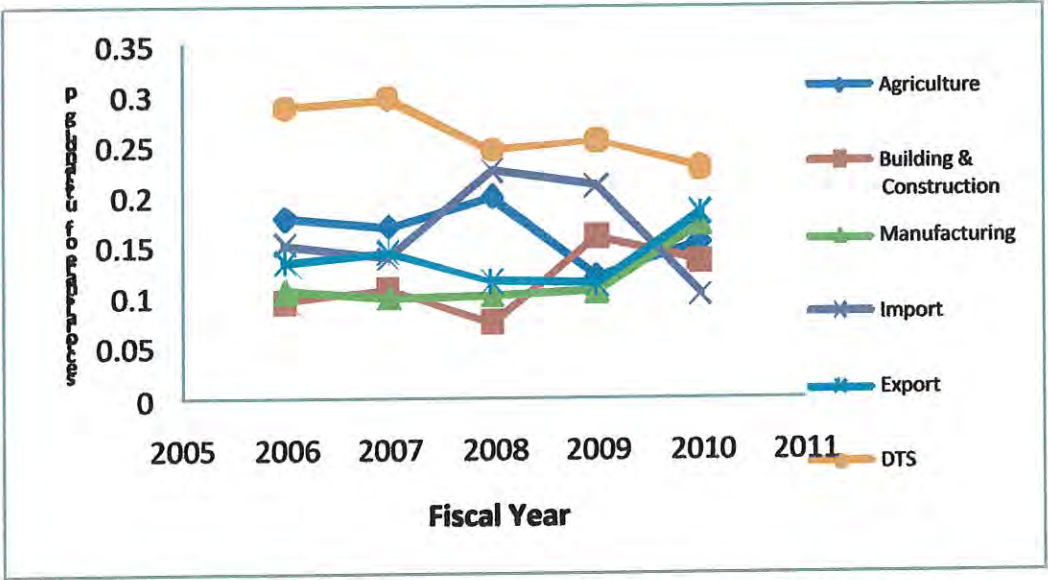


Figure 4: Growth trend of outstanding loan by sector (2006 to 2010)

Source: National Bank of Ethiopia, respective periods

Figure 4 shows that the share of the outstanding loan of the manufacturing sector has been at a diminished stage despite recent trends (in the past two years) show promising increase as compared to other sectors. The implication of the trend shown above is that much emphasis is given to domestic trade and service and import sectors as compared to the manufacturing sector. The basic reason for this, according to interviewed bank professionals, is that these sectors are highly characterized by low level of market uncertainty as compared to the manufacturing sector. In addition, products and services of these sectors are highly demanded by ordinary people than what the products of the manufacturing sector can be demanded.

4.3.2 Trend of annual Loan disbursement by sector to GDP of the Nation

As pointed out so far, the annual sectorial loan disbursement is the amount of loan that banks of the nation inject to a particular economic sector within a given fiscal year.

Hence, the total share of annual loan disbursement by banks remains below 10% of GDP of the nation. Out of this contribution, the total loan disbursed to the manufacturing sector consists of only 1%; following the comparative loan disbursed to; domestic trade and service (2.32%), import (1.47%) and export (1.19%).

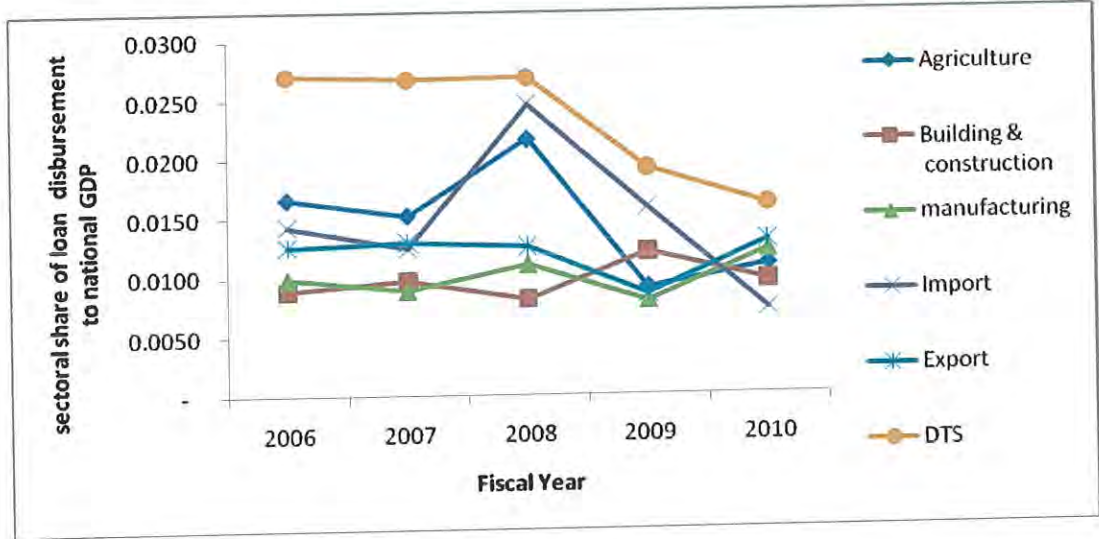


Figure 5: Growth trend of loan disbursement by sector (2006 to 2010)
Data source: National Bank of Ethiopia (respective years)

Despite the meager contribution of loan disbursed to the manufacturing sector compared to the GDP of the country, figure 5 depicts that the contribution of the sector is increasing since the past two years. The reason for lower loan disbursement to the manufacturing sector compared to other sectors descends from the previous fact that the products of the manufacturing sector have higher market related risks as compared to other sectors; which in fact is one of the traits that banks consider while analyzing credit applications.

4.4 Current practice of Bank lending in Ethiopia

Because it is unethical to disclose the credit policies of banks and the words of credit experts, the anonymous policy of selected banks and interview with experts is analyzed below.

Credit policy of one private bank shows that for a loan applicant to be successful, he/she should be licensed to a particular business and should be engaged in that business for at least one year: in other words, the license should be one year old. In addition, a loan applicant should bring: at least two periods' balance sheet and income statement, contract or similar other documents that show the applicant's past record, management profile, building collateral and others.

Interview with loan officer of the bank from which the aforementioned requirements are fetched witnessed that these requirements are normal and clients have the awareness. However, fulfilling these requirements does not guarantee the eligibility to obtain loan from the bank. Past credit history, profitability and liquidity of the business, location and quality of the collateral offered are other solid requirements that determine credit eligibility of the applicant. Furthermore, established relationship of the client with that particular branch/bank is also a considerable parameter.

Interview with two credit analysts from other two banks coincided with the above interviewee in that almost all requirements are similar. However, one of them pointed out that a work experience of only six months is enough if all things are in order and in line with the bank's priority concerns. Interview with all of them witnessed that, on average, the collateral value to be held to secure the credit facility should be at least 110% of the loan to be requested/approved. The building collateral should have a title deed and an approved plan. This gives assurance to world bank report (2010) which stipulates that the formal banking system in Ethiopia is focused on collateral based short-term credit which needs the collateral to reach over 100 per cent of a typical loan's value (World Bank, 2010). Hence, the demand on collateral is a problem for small scale innovative firms that may have the potential to grow but whose main assets may be intangible.

One interviewee from a government owned bank witnessed that there are rooms, at policy level, whereby newly entrant firm/company/individual can be eligible for loan even in the absence of track record of work experience, loan repayment history and loan settlement history. The current booming of the demand for credit by already booked clients, however, highly denies an open arena for such new entrants. This fact coincides with the arguments of Aydogan discussed in Chapter two, that the close relationship between the banks and incumbent firms and the co ownership of the banks and firms by the same family groups, effectively prevents the entry of potentially successful firms into the industry. This eliminates the pressure on the existing firms to innovate, which to a large extent explains technological stagnancy in the developing countries (Aydogan, 2009)

The policy documents of these banks and the words of interviewed loan officers and credit analysts witnessed that the export business is most of the time the lending concern of banks. This is because the export business generates foreign currency to that particular bank and increases the respective foreign currency reserve. When the foreign currency reserve increases, the bank's capacity to withstand foreign currency request of importers increases; which in turn increases the import commission obtained and the profitability of the bank thereof. However, it is known that majority of the export items of the country are primary agricultural products upon which no value addition is applied. Hence, export of primary agricultural products is the major priority concern regarding lending in the country's banks.

Loan granted to the manufacturing sector in the country, on the other hand, is mainly in the form of working capital that is used for purchase of respective raw materials and other intermediaries not in the form of investment such as introducing different technology, according to the respondents.

In general, what all respondents and credit policies witnessed is that it is unthinkable to grant loan in the absence of collateral. Responses of the interviewees witnessed that the basic reason for high dependence on collateral is the attached uncertainty with new entrants regarding their production performance, marketing strategy and loan repayment history. This idea strengthens the arguments of Mahagaonkar discussed in chapter two

that fundamental uncertainty inherent in knowledge and new ideas renders the decisions by potential investors to be based on subjective judgments and for banks to shrink their loans to potential new entrants (Mahagaonkar, 2010).

4.5 Analysis based on data from the respondents

The first part of this section is the descriptive analysis of data obtained from the survey questionnaire. It describes the characteristics of the respondents and other variables in the survey. The second part focuses mainly on regression analysis of determinants of success of innovation and the respective significance tests.

4.5.1 Descriptive analysis

4.5.1.1 Characteristics of the respondents

In identifying the factors that affect the success of innovation, a total of 40 sample respondents were identified to fill the entire questionnaire. The respondents were all males having a minimum of 22 and a maximum of 49 years of age; the average year of the respondents being 34 years. The family size of these respondents ranges from one (i.e. living alone) to a total number of seven families; the average family size being three. The number of school years ranges from a minimum of eight years to a maximum of 19 years, with an average schooling age of 14 years.

Table3: Individual characteristics of the respondents

	Minimum	Maximum	Mean	Standard deviation
Age of the respondents	22	49	34.4	7.66
Year of schooling of the respondent	8	19	13.93	2.08
Family size of the respondents	1	7	2.9	1.99

Source: own survey, 2011

Table 3 shows that majority of the inventors are inside the working age and are well educated. They have lower family burdens as depicted in the lower average family size

that they registered. This implies that majority of innovations are innovated at middle age people who have lower family burdens and good educational back ground.

According to data obtained from the survey, 37.5% i.e. (15 out of 40) respondents are patented in production of direct consumption goods and the rest, 62.5% i.e. 25 out of 40 respondents are engaged in production of intermediary inputs for other sectors. Out of these respondents, only the works of five of the respondents i.e. 12.5% are functional. The remaining 35, i.e. 87.5% are not functional for various reasons that will be dealt soon.

Table 4: Type of work versus whether inventions are operational or not

No	Type of work	Non operational inventions		Operational Inventions		Total	
		No	%	No	%	No	%
1	Production of consumption good	12	30%	3	7.5%	15	37.5%
2	Production of intermediary good	23	57.5%	2	5%	25	62.5%
Total		35	87.5	5	12.5%	40	100%

Source: own survey, 2011

The analysis on factors affecting success of inventions was done separately for those operational and non operational inventions. In the first part, questions were raised about the triggering factors of inventions to inventors whose works are operational. The only source of finance for those respondents whose works are functional is pocket money. In one or another way, these respondents are constrained by various constraints in their way to expand and develop the capacity of the work they are patented in. Out of the five respondents whose works are operational, four of them responded that their major constraint is shortage of finance in the form of working capital while one of the respondents agreed that the expansion of his work is impeded for lack of training in the area he is engaged in.

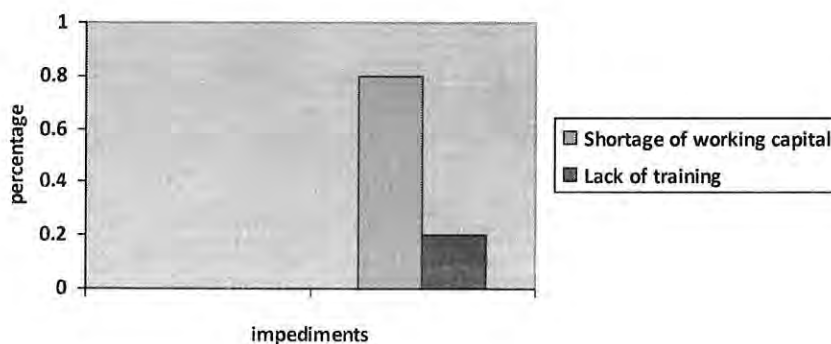


Figure 6: Impediments of operational inventions

Source: own survey, 2011

To tackle their financial pitfalls, all of the respondents, whose works are operational, have visited at least one bank in the country. However, only one of them has got loan. The only person to get loan out of 40 respondents has a reason attached for his eligibility in that he was benefited from a credit guarantee scheme to handicapped innovators by a foreign aid organization. The rest of the respondents, whose works are operational, witnessed that they were marginalized to get loan for lack of collateral, lack of past credit history and lack of financial statements. The invention of the respondent, who obtained credit facility, was not used as collateral. In addition, the fund granted to him was too little to solve his financial problems.

Similarly, questions were also forwarded about impeding factors of inventions to inventors whose works are not operational. Consequently, out of the total respondents whose works are not operational, 97.1% responded that finance related problems are attributed to the inability of their work to be operational at the moment. Only one of them witnessed that lack of particular job oriented training is his major impediment in his struggle to make his work operational.

Table 5: Impediments of inventions which are not operational

	Number of respondents	
	No	%age (from total non operational inventions)
Shortage of working capital	34*	97.1%
Lack of training	1	2.9%
Total	35	100%

Source: own survey, 2011

Table 5 depicts that out of those inventors whose inventions are not operational, 97.1% witnessed that finance related problems are accountable for not being operational. Only 2.9% responded that lack of job related problem is the major impediment for success of their invention. However, not stated in the table, five respondents out of all respondents constrained by finance related problems stated that absence of working place as a co-impeding factor for success of their inventions. The above arguments imply that finance related problems are the major impeding factors for the lion share of those inventors whose inventions are not operational.

From the total respondents whose works are not operational and are constrained for financial problems, 58.8% have requested at least a third party financial assistance in different forms while the rest i.e. 42.2% have never tried any financial assistance in any form from third party.

Table 6: Financial need and request for third party assistance

Inventions	requested third party assistance		Do not request third party assistance		Total constrained by financial shortage	
	No	%	No	%	No	%
Operational	5	12.5%	0	0%	5	12.5%
Non Operational	20	50%	15	37.5%	35	87.5%
Total	25	62.5%	15	37.5%	40	100%

Source: own survey, 2011

The survey shows us that 62.5% of the total respondents i.e. 25 out of 40 have requested bank loan in their way to develop/ start their work. Unfortunately, as was pointed out so far, only one of them has got credit access in an extraordinary way. The above description implies that, despite the fact that considerable amount of inventors request

financial assistance from other sources, these sources are reluctant to lend loans to these nascent individuals/firms/industries for reasons that are discussed below.

Out of the remaining 24 respondents who desire to have access to credit and requested bank loan, two of them failed to get loan because of lack of collateral, five of them failed to get loan because banks are not aware of their works, 17 of them i.e. 70.8% failed to get loan because they are missing either collateral, financial statement, or credit history in any combination.

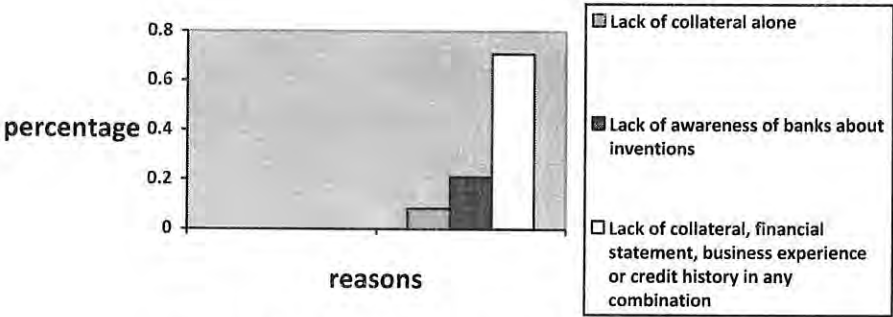


Figure 7: Reasons for denied credit access

Source: own survey

From the entire sample, 15 of the 40 respondents, i.e. 35% of the entire sample size have never requested bank loan. Questions were also raised to these respondents regarding the reason that they do not demand to get bank loan. eight of them i.e. 53.3% (of those who do not want to get bank loan) do not have any information about bank loan, six of them i.e. 40% do not want to work with banks for other social and religious factors, one of them responded that he did not request bank loan for an unspecified reasons. The religious factors include that, those Muslim inventors who do not want interest bearing loans, failed to request bank loan as there are no Muslim banks in the country.

Table 7: Reasons for not requesting bank loan

No		Number of respondents	
		No	% (of who didn't request bank loan)
1	Lack of information about bank loan	8	53.3%
2	Do not want to work with banks	6	40%
3	Others	1	6.7%
Total		15	100%

Source: own survey, 2011

The aforementioned table reveals that information asymmetry and social factors do have considerable impact on individuals' preference to request bank loan.

In another scenario, out of the total sample size taken, 24 of them respondents (i.e. 60% of the total) have replied that they have contacted at least one sponsor in need of assistance to start/develop their work. However, none of them were successful in obtaining the right assistance to their work. Three of them responded that the requested sponsors lowered their stake; four of them responded that the contacted sponsors are selective to withstand their work; 14 of these responses witnessed that the awareness of sponsors is too low in addressing innovative works and three of them responded that it was impossible to get assistance from sponsors for a combination of two or more of the above reasons.

Table 8: Reason for not getting sponsorship

No		Number of respondents	
		No	% (of those who requested sponsor assistance)
1	Stake of the inventor lowered	3	12.5%
2	Selectiveness of sponsors	4	16.7%
3	Low awareness of contacted sponsors about inventions	14	58.3%
4	More than two of the above reasons	3	12.5%
Total		24	100%

Source: own survey, 2011

With regard to access to finance, 35 out of 40 respondents (i.e. 87.5% of the sample size) responded that, leaving other things constant, access to finance alone can solve capacity or entrance problems of their invention. The rest (12.5%) of the respondents responded that access to finance alone cannot solve the overall entrance and capacity problems.

Rather, job related training and availability of land alongside the necessary infrastructure with adequate supply of finance can solve their inherent problems. These arguments inevitably imply that access to finance has a huge impact in deciding whether a particular invention can be operational or not. This is depicted in table 9 below.

Table 9: Access to credit versus operation of inventions

	access to finance alone can enhance or develop invention		Access to finance plus other factors can develop/enhance invention		Total	
	No	%	No	%	No	%
Invention is operational	1	2.5%	4	10%	5	12.5%
Invention is not operational	33	82.5%	2	5%	35	85%
Total	34	85%	6	15%	40	87.5%

Source: own survey, 2011

4.5.2 Regression results on Determinants of success of Innovation

To determine the key factors that explain the probability of inventions to be operational, a binary probit model was used. The estimation of the binary probit model was done using STATA software program. Though the primary interest of the study is only to evaluate the effects of the explanatory variables on the dependent variable, it also shows the coefficient and marginal effect of each independent variable.

Table 10: Probit regression

	Coefficient	Standard error	Z value	Significance value
Age	0.08	0.079	1.02	0.31
Educational level	0.12	0.225	0.53	0.6
Type of work	0.902	1.02	0.88	0.38
Family size	-0.05	0.26	-0.2	0.844
Access to finance	-2.95	1.08	-2.72	0.006*
Constant	-2.495	4.196	-0.59	0.552

Source: own survey

**significant at 1% level of significance*

As can be seen from table 10, the variables such as age of the inventor, educational level of the inventor, type of work that the inventor is engaged in and family size were not found significant to affect success of innovation.

Out of the hypothesized determinants of success of innovation, access to finance was found to be significant at 1% significant level. In all significance tests i.e. in Pearson's

chi-square tests, continuity correlation, likelihood ratio, linear-by-linear tests, the significance value is so low that it is displayed as .000, which means that it would appear that the two variables i.e. operation of inventions and access to finance are, indeed, related.

Table11: Marginal effect after Probit

	dx/dy	Standard error	Z value	Significance value
Age	0.005	0.006	0.92	0.359
Educational level	0.008	0.013	0.61	0.545
Type of work	0.078	1.01	0.93	0.35
Family size	-0.0034	0.018	-0.19	0.85
Access to finance	-0.717*	0.208	-3.43	0.001

Source: own survey

Table 11 shows that with a discrete change from having access to finance to being denied access to finance, the probability that the invention becomes operational reduces by 71.7%. The variable has a negative sign and is significant at 1%, indicating that inventors having less/no access to finance are most likely to be stagnant or malfunctioned. The study is consistent with many studies that the capacity of inventions is hindered by lack of finance. As was discussed in chapter two of this thesis, lack of financing is mainly manifested in the forms of inadequate working capital, insufficient equity, difficulties of credit finding and expensive credit costs, which are all hindrances of success of innovation in developing countries (OECD report, 2006). The study, however, contradicts with a survey in 2002 by Ipsos-Reid (reported in CFIB and others, 2002) that only 20 percent of Canadian firms mentioned access to financing and cost of borrowing as barriers to innovation growth, which was in fact considerably lower than for taxation, market environment, and human resource issues (Klyuev, 2008).

The survey clearly indicates that failure of inventions to be operational is primarily the direct result of lack of own finance as all the respondents who have their own pocket money are functional by now. This is shown from the fact that source of initial capital for 100% of all the respondents whose works are functional by now is pocket money. In addition, the survey also indicated that all the respondents whose works are not

operational by now witnessed that their works could have been operational by now had they had their own source of finance.

The survey also indicated that despite lack of finance was found significant in hindering the success of small scale patented innovators, not all inventors whose inventions are hampered for financial pitfalls visited third party financial assistance including loans from banks. It has been described so far that, 37.5% of the respondents have never requested bank loan for different reasons. Some of these respondents who didn't request bank loan failed to do so because of religious reasons not to work with banks. This is mainly manifested in Muslim inventors who do not want to work with interest bearing loans. Others failed to request because of information asymmetry regarding bank loan. In addition, there are also unspecified reasons for not requesting bank loan.

Absence of own source of startup capital leads an inventor to look for another source of finance given that the success of the invention is hindered for financial shortages and that the applicant is out of the domain of those inventors who do not want to work with financial institutions for the aforementioned reasons. In this particular survey, out of the total 40 respondents, 62.5% of the sample size have requested bank loan though failed to get financial assistant because of various reasons.

The first and foremost reason for inventors not to get bank loan is lack of reputation and track record of business experience and loan repayment history. As was discussed in chapter two, the fundamental nature of knowledge and new ideas to be new for good will and reputations is the basic cause for firms not to get bank loan (Mahagaonkar, 2010).

The other reason for firms/inventors to be denied to access to credit is the degree of attention that banks give to innovation and the subsequent low awareness level given to the sector by these financial institutions. As was described so far, 8% of all respondents who wanted bank loan failed because of the lower attention given to the sector by banks. On the other hand, interview with bank professionals, witnessed that the formal lending is inclined towards already established trade sectors than new startups and inventions. The basic reason for such an inclination, according to these professionals, is not lack of

awareness as what the respondents say. However, lending to such sectors has high risk for a profit oriented bank to be involved in, as loan repayment is entirely related to work experience and past loan repayment experience according to these professionals.

From the entire survey, 68% of those respondents who requested bank loan failed to get loan because they are constrained by two or more of the factors; lack of collateral, absence of financial statement, business experience or credit history in any proportion. However, majority of the factors mentioned to deny credit access are associated to being new entrant according to professionals interviewed. Hence, absence of financial statement, lack of business experience and lack of credit history can be solved when a firm/an inventor gets experience.

Chapter Five: Conclusion and Policy Implication

This final chapter of the thesis, chapter five, mainly focuses on conclusion of the results of the study and presents the associated policy implication based on these findings. The conclusion and policy implication part of the thesis is put in sequence right on.

5.1 Conclusions

The concern of innovation in many countries has been increasing from time to time and has been found the major back bone and springboard for attaining sustainable economic development. The increase in life expectancy of many countries, the provision of means of production at adequate level, the competitive advantage and efficiency of many firms and the preference of many consumers are all associated with the appropriateness and timelessness of innovative works.

Following the tremendous advantage that innovations give to the development of many firms, industries and nations, many governmental and nongovernmental organizations have been providing various assistances to innovative works. At national policy level, many countries have included innovative concerns alongside the policy of science and technology. In Ethiopia, the national innovation policy as part of the national policy of science and technology has been initiated in 1993 by the transitional government of Ethiopia and is yet functional since then. However, the policy lacks many contemporary elements that should have been included. In general, innovation policy of the country is; too old and far from revision; too general in content; focuses mainly on supply side of innovation than adding the demand side like other developing countries and failed to incorporate recent policy concerns of many developed and developing countries.

Trend of past lending practice of banks in the country shows that the country's banking system in general and lending trend in particular is yet at a questionable age. Lion share of the total loan that all private and public banks inject in to the economy at any point in time is contained in domestic trade and service sector. The sector, however, is characterized by lower or no value addition on it. This shows that the concern of banks to value additive works including innovative focused works has been lower.

Past trend of bank lending also shows that in recent years, the share of the loan granted to manufacturing and export sectors to the total amount of loan disbursement and to total amount of outstanding loan has been increasing as compared to previous periods. However, loan granted to the export sector is mainly manifested in loans which are granted to export of primary agricultural products where innovative wisdoms are not included. Hence, recent growth in the proportion of loans granted to the manufacturing sector may be one indication that the concern of government and banks has inclined towards innovative works as many innovative works are contained in the manufacturing sector. Nonetheless, despite the prevalence of better proportion of loan granted to the manufacturing sector, the figure is yet meager when compared with other sectors.

Current practice of bank lending in the country, like the trend of lending, is inclined towards 'conventional' lending practices where collateral to the extent of 110% of the loan approval limit is mandatory. In addition, experience in a particular business and borrowing experience, providing financial statement and having a workable contract at hand are the other mandatory requirements that banks on average expect from a loan applicant. Detail requirements for loan eligibility include that building collaterals should be situated in a marketable location, the business should be profitable and liquidity position of the company should be at a sustainable level.

While bank requirements in the country, on average, require the provision of marketable collateral, profitability, business and borrowing experience, new entrant inventors possess none of these elements in adequate amount. Needless to say, the only properties of these firms/individuals are intangible intellectual assets which are not considered as assets by many organizations including banks. Hence, they are marginalized from bank loans, for they lack the basic requirements that a loan request demands.

In identifying the basic factors that affect the success of innovative firms and individuals, the researcher hypothesized that age of inventors, educational level of the inventors, family size, type of work and finance accessibility could affect the success of inventions. However, it was found that none of the above variables, except access to finance, affect

success of inventions. Nonetheless, access to finance was arguably found the primary determinant of the functionality of inventions.

Though it was found that access to finance could solve the threat of many inventions to be operational, many inventors are reluctant to visit banks in their way to start respective inventions for various artificial barriers. Social factors including religious dogmas forbidding interest bearing bank loans; information asymmetry and other related barriers are some of the factors that aggravate the reluctance of inventors to bank loans.

As was mentioned so far, inventors who wanted bank loans in their way to overcome financial pitfalls for the startup of their inventions failed to do so because they lack; collateral, business and borrowing experience, financial statement, active projects at hand or two or more of these factors in any proportion. Hence, lack of access to finance in any way is found to be the most important determinant factor for the probability of firms/individuals to be operational.

All in all, the malfunctioning of innovations and utility models are the direct descendents of malfunctioning of the financial sectors that arise from artificial barriers of lending in the sector. While innovative works are believed to be the solutions for many economic and social problems in many countries, these works are less recognized and supported by governmental and nongovernmental organizations of many developing countries in general and Ethiopia in particular. Hence, paving the way to empowering and enhancing inventors and inventions leads to a sustained economic development.

5.2 Policy Implications

It has been pointed out that innovation is one of the success factors to the development of many individuals, firms, industries and nations. Corollary to this statement is that the more a nation encourages innovative works, the more it becomes successful. However, when the success of inventions is hampered, it will directly hamper the sustainability of the growth of respective economy. Hence, breaking the bottlenecks of innovation successes is necessary for innovations to play their part in sustaining the economy as a whole. In the context of Ethiopia, the contribution of inventions can be improved if some of the barriers are removed and incentives are given. Based on the findings of the research, the following points are the basic policy implications that many sectors of the national government should undertake.

- ❧ Revision of the national policy of innovation should be made on regular basis so as to enable the country entertain the contemporary needs of innovation and innovation activities. Participating various stakeholders in the process may increase the wholeness and credibility of the policy. Furthermore, creating of national innovation system may enable the country define innovative activities in its own contexts.
- ❧ Encouraging and enhancing the power and prestige of science and technology minister so as to increase its accreditation capacity of genuineness of inventions so that the accredited certification can be used as collateral for loans that inventors request from banks.
- ❧ Banking regulatory organs should ensure the separate possession of banks by respective borrowers, as it was found that such dual possession effectively prevents the entry of potentially successful firms into the industry.
- ❧ Encouraging financial institutions that support innovative works and enabling them to free some of their credit quotas to innovative manufacturing works.

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Annex

Research questionnaire
Addis Ababa University
Institute of Regional and Local Development Studies

I am conducting a research as part of the M.A. Degree program I am attending at the university. The topic of my research is **“innovation and conventional lending practice of banks in Ethiopia: perspectives from patented innovators”**. The questionnaire is meant to obtain information about the basic causes that impede innovators from being successful.

I would like to assure you that your words and responses are highly confidential. They will be used only for the research purpose.

Thank you in advance for all your kind cooperation!

1. Age _____, Sex _____,
Educational level _____,
Business type _____,
Family size (in number) _____
2. How long have you been since your idea was patented?
 - A. Less than one year
 - B. One to two years
 - C. two to three years
3. Is your business operational?
 - A) Yes B) No

If your answer to question number 3 is “yes”, answer questions 4 to 14 below

4. When was it operational?
 - A) Immediately after it got patented
 - B) One year after it got patented
 - C) Two years after it got patented
5. What is the amount of startup capital needed (in Birr)?

6. What is the source of the startup capital

- A. Banks
- B. Microfinance institutions
- C. Relatives
- D. Money lenders
- E. Others (if any),

7. What is the amount of production per month?

8. What is the unit price of the product that you produce?

9. What is the amount of net income per month?

10. Are there any challenges that you come across after your invention was converted in to action?

- A) Yes B) No

11. If your answer to question no '10' is 'yes', what are the basic challenges?

- A. Lack of finance for working capital
- B. Lack of training
- C. Others, if any

12. Have you got any credit facility after you come in to action?

- A. Yes B. No

13. If your answer to question number '12' is 'yes', was your business used as collateral?

- A. Yes B. No

14. If your answer to question number '12' is 'no' what is the basic cause that you didn't get credit facility?
- A. I do not want credit facility for my own reasons
 - B. I do not have collateral to secure the loan
 - C. I do not have past credit history
 - D. I do not have financial statement
 - E. Banks do not like to finance ideas like mine.
 - F. Others, if any
-
-

If your answer to question 3 is "no", answer questions 15 to 16 below

15. what are the basic reasons that impede you to come into action
- A. financial problems
 - B. lack of training
 - C. difficult nature of my business
 - D. others, if any
-
-

16. If the basic reason that impedes you not to come into action is financial constraint, have you ever tried of finding any financial source apart from your own contribution?

- A. Yes
- B. No

17. If your answer to question number 16 is "yes", what are the financial sources that you were looking for?

- A. Banks
 - B. Microfinance institutions
 - C. Relatives
 - D. Others (if any),
-



18. Have you ever visited any of the banks in the country to get loan in order to make your work to come into the ground?

A. Yes

B. No

19. If the answer to question number 18 is "no",

What is your reason for not going in to banks?

A. I have no idea about facilities that banks render

B. I think that I do not fulfill requirements of banks

C. I do not want to work with banks

D. Other reasons, if any

20. If your answer to question number 18 is "yes", why did you fail to get loan? (there can be more than one possible answer)

A. lack of collateral

B. lack of credit history

C. lack of financial statement

D. lack of confidence in my work by banks

E. any other

21. Have you ever tried of getting sponsors or entrepreneurs that can help you interpret your works in to reality?

A. Yes

B. No

C. I have no any idea

22. If your answer to question number 21 is yes, what response did you get?

- A. They magnified their stake and diminished mine?
- B. They are selective in sponsoring works like mine
- C. Others

23. What possible solutions do you suggest so that your case and similar others can come into action so that you will benefit?

..../.

Thank you very much

Declaration

I, the under signed, declare that this thesis is my own original work and has not been presented in any other university. All the sources of the material used for this thesis have been duly acknowledged.

Declared by:

Name: Sewale Bitew

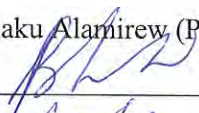
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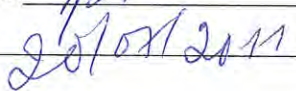
Date:  _____

Confirmed by:

I confirm that this thesis has been submitted with my approval as the supervisor of the same.

Name: Bamlaku Alamirew (PhD), Advisor

Signature:  _____

Date:  _____

Addis Ababa