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HUMAN CAPITAL BARRIERS TO TECHNOLOGICAL ABSORPTION AND INNOVATION BY ETHIOPIA'S MICRO AND SMALL ENTERPRISES (MSEs)

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ABSTRACT
Ethiopia's private sector is dominated by micro and small enterprises (MSEs), many of them operating informally. Accordingly, a key challenge for the country's science, technology and innovation (STI) policymakers is finding ways to ensure that these small businesses absorb external technological innovations in order to enhance their performance and allow for follow-on innovations. This policy objective has an access to knowledge (A2K) dimension, because Ethiopia's STI policies and strategies stress the need for improved MSE access to public domain patent information as a means to improving technological absorption. However, research by the Ethiopian Intellectual Property Office (EIPO) has found that despite the efforts of the Ethiopian government to foster small-enterprise absorption of public domain technological information contained in patent documents, MSE take-up of such technology tends to be poor (Belete, 2013).

In this piece, the author, former EIPO Director of Intellectual Property Policy and Planning, argues that the government's emphasis needs to be on building human capital in MSEs, in order to improve their capacity to absorb patent information. This argument draws on literature linking technological absorption capacity to human capital levels, along with findings from an Ethiopian government survey of 3,000 MSEs (MUDC, 2013). The author recommends improved MSE collaboration with intermediary organisations such as the country's Technical and Vocational Education and Training (TVET) institutions and industry development institutes.

KEYWORDS
Ethiopia, micro and small enterprises (MSEs), innovation, patents, patent information, public domain, intellectual property (IP) rights, access to knowledge (A2K), technological absorption, absorptive capacity, human capital

INTRODUCTION
Building capacities through improved technology is a key to increasing the competitiveness of enterprises. Technology development can take place within enterprises, or it can be acquired from external sources through transfer of technology. Most new technologies are created in advanced countries, and technological change in the enterprises of developing countries occurs primarily through the international transfer of technology (Keller, 2004; Kim, 1997; UNCTAD, 2007). Foreign technology can be acquired by recipients in developing countries either formally or through informal transfer mechanisms. Foreign direct investment, foreign licensing, and turnkey projects are examples of formal mechanisms. Key informal mechanisms are human mobility and published information, i.e., information published via books, journals, trade literature, standards, and patent filings.

Patent information is present in every sphere of technical and scientific activity, from the simplest to the most complex solutions to technical problems (WIPO, 2005), and publication and take-up of information in patent documents is an important access to knowledge (A2K) dimension that is catered for in intellectual property (IP) rights legal regimes. When a patent for an invention is granted, the invention is disclosed in such a manner that its essence and mode of exploitation will be brought to the knowledge of anyone who wishes to know. This is done in terms of examples, where appropriate, and with reference to the drawings, if any. In some countries, the description is required to disclose the best mode known to the applicant for carrying out the invention (WIPO, 2004). Many national and regional patent offices provide free online access to their own patent collections as well as to selected patent documents from other offices. Thus, searches of patent literature can be conducted free of charge by anyone using such patent databases.

Each year, over 2 million new patent documents are published in several languages in over 100 countries. In total, there are more than 80 million patent documents globally (PRH, 2014). The protection conferred by a patent is limited in time (generally 20 years), and thus most of these 80 million patents are no longer in force and a vast number of inventions can be used freely (EC & EPO, 2007). Furthermore, IP rights are territorial and their validity is limited to the national or regional jurisdiction for which they have been granted. In the case of Ethiopia, very few patent applications are filed and granted in the country. Thus, most of the technology disclosed internationally in patent documents is public domain information in Ethiopia, with no legal requirement to seek anyone's consent to use the technology within the country.

Among the duties of the Ethiopian Intellectual Property Office (EIPO) are dissemination of technological information contained in patent documents, and encouragement of utilisation of this information (FDRE, 2003). The EIPO disseminates the technological information to different user groups, including educational institutes, research organisations, and the manufacturing sector – which is primarily composed of micro and small enterprises (MSEs). The EIPO also provides information and advice relating to online patent searches.

According to the 2014 Urban Employment Unemployment Survey by Ethiopia's Central Statistical Agency (CSA), 33.7% of the urban population in the country was employed by the informal sector, and among these informal-sector employees, only 21% had attended secondary-level education or higher. Among these informal-sector participants,

35% were in one of the following categories: technicians and associated professionals; skilled agricultural, forestry and fishery workers; craft and related trades workers; and plant and machine operators and assemblers. The CSA Survey also found that 31.5% of the informal-sector workers were engaged in manufacturing, construction, mining and quarrying (CSA, 2014). Many of these informal-sector employees were engaged in the MSE sector, with a Ministry of Urban Development and Construction (MUDC) survey finding that around 12% of MSE employees in the capital Addis Ababa, and close to 40% outside the capital, were engaged in informal-sector activities (MUDC, 2013).

Via adoption of the five-year Growth and Transformation Plan (GTP) of 2010 and the National Science, Technology and Innovation (STI) Policy of 2012, the Ethiopian government has prioritised patent information as a means for transfer of foreign technologies to Ethiopian enterprises. The GTP called for technological information contained in 5 million patent documents to be used for technology transfer and adaptation during the plan's five-year period. The STI Policy identified increased use of technological information contained in patent documents as one of the strategies for technology transfer (MoFED, 2010; FDRE, 2012).

There is a strong state focus on development of MSEs through, inter alia, government adoption of targeted strategies for the sector – such as the MSE Strategy of 2011 (FDRE, 2011) – and government establishment of the Federal MSE Development Agency (FMSEDA) and Regional MSE Development Agencies (RMSEDAs).The MSE Strategy of 2011 defines a *micro* enterprise as an enterprise with not more than five employees and total assets not exceeding ETB100,000 (equivalent to approximately USD4,900 at the time of writing in mid-2015). A *small* enterprise is defined as having six to 30 employees and total assets valued at between ETB100,001 and ETB1.5 million (between USD4,900 and USD73,500) (FDRE, 2011).

The Ethiopian Intellectual Property Office (EIPO) has made persistent efforts to promote the dissemination and use of public domain patent information by MSEs. However, EIPO research has found that such information remains an underutilised source of technology for MSEs (Belete, 2013). Thus MSEs are not benefitting from this freely available source of technology for improvement of their products and enhancement of their innovative performance. In this article, I argue that one of the causes of this gap between policy intent and practical reality is the poor technological absorption capacity of MSEs in Ethiopia. I base my argument on literature showing the importance of human capital to technological absorption, and on findings from the aforementioned MUDC survey of Ethiopian MSEs (MUDC, 2013).

THEORISING TECHNOLOGICAL ABSORPTION, HUMAN CAPITAL AND INNOVATION

Cohen and Levinthal (1990) define the absorptive capacity of a firm as the firm's ability to recognise the value of new external information, to assimilate it, and to apply it to commercial ends – with the ability to exploit externally generated information as a critical component of innovative capability. They also suggest that absorptive capacity is largely a function of the prior related knowledge of a firm's personnel, which may include basic skills and knowledge of the most recent scientific or technological developments in a given field.

Subsequent studies have found that assimilation and absorption of technology from external sources depend on technological effort and require skills, effort and investment by the receiving enterprise (Kim, 1997; Lall, 1992; UNCTAD, 2007). Narula (2003) argues that qualified human resources are essential to monitoring the evolution of external technological knowledge, evaluating its relevance, and integrating technologies into productive activities. Thus a firm's absorptive capacities depend on those of its personnel, e.g., on the personnel's levels of education, experience and training. The more education and training an employee receives, the higher his/her individual ability to assimilate and use new knowledge.

In analysing absorptive capacity at firm level, Giuliani and Bell (2004) claim that human capital is important to a firm's capacity to access external sources of knowledge. Similarly, Arnold and Bell (2001) stress the importance of human capital, stating that the ability of companies to learn depends on their internal capabilities, often represented by the number and level of scientifically and technologically qualified staff. Employees with high levels of education are the main contributors to knowhow transfer, because they are in a better position to recognise and value new external technological information. Absorptive capacity can also be developed through the accumulation of experience, and this kind of knowledge established through learning by doing can to some extent be measured by the work histories of employees (Giuliani & Bell, 2004; Vinding, 2006). Zahra and George (2002) consider absorptive capacity as a set of organisational routines and processes through which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organisational capability.

Vanhaverbeke and Van de Vrande (2007) link the notions of open innovation and absorptive capacity, noting that both deal with in-sourcing externally developed technology and engaging in technological collaboration with innovation partners. They claim that insights from open innovation practices in companies provide several clues as to how to enrich the concept of absorptive capacity and improve understanding of how management decisions can strengthen a firm's ability to learn from its external environment. Vanhaverbeke and Van de Vrande (2007) emphasise that developing and improving the absorptive capacity of innovating firms is at the heart of open innovation. As conceptualised by Chesbrough (2003), open innovation is the use of purposive inflows and outflows of knowledge in order to both accelerate internal innovation and, at the same time, expand the markets for external use of innovation. Chesbrough's (2003) conception of open innovation thus assumes that firms can and should use both external and internal ideas, and both external and internal paths to the market, as they look to advance their technologies.

ETHIOPIA'S POLICY AND INSTITUTIONAL SUPPORT FOR MSEs

The policy measures necessary for increasing the absorptive capability of domestic knowledge systems are addressed in a UN Conference on Trade and Development (UNCTAD) 2007 report on least developed countries (LDCs). According to the report, there is first a need for education and training, which increase the pool of relevant human skills. Second, there is a need for incentives to promote the development of technological learning and innovation routines within domestic firms. Third, there is a need for creation of a set of institutions that work to increase knowledge linkages among domestic firms, between domestic firms and foreign firms who have invested in LDCs, and between domestic firms and the rest of the world (UNCTAD, 2007).

In Ethiopia, a number of policy and institutional measures have been established that aim to enhance the growth and competitiveness of MSEs, whose significance has long been recognised. The Investment Proclamation of 1966 provided MSEs with tax relief, and access to land and buildings, public utilities, and other advisory and administrative facilities (IEG, 1966). Another early measure was establishment of the Handicrafts and Small Scale Industries Development Agency in 1977. In 1996, the government adopted its Licensing and Supervision of Micro Financing Institutions Proclamation (FDRE, 1996), principally aimed at enabling MSEs, through micro-finance institutions, to have access to credit facilities, counselling services and income-generating projects. This legislation also provided opportunities and security for informal-sector operators, through enhancing their legality and formalisation.

In 1997, the first federal MSE Strategy was adopted (FDRE, 1997), along with a set of regional strategies. The principal objectives of these MSE strategies were, inter alia, exploitation of local raw materials, creation of productive job opportunities, adoption of new and appropriate technologies, and enhanced development of MSEs, which were seen to have wide-ranging backward and forward linkages. (Backward linkages refer to an enterprise's creation of employment opportunities and markets for raw materials and intermediate inputs, while forward linkages refer to an enterprise's supply of products). In 1998, the aforementioned agencies, the FMSEDA and the RMSEDAs, were established as tools to drive Ethiopian MSE development. The government's Industrial Development Strategy of 2002 included focus on labour-intensive micro- and small-scale enterprises using agricultural products as inputs and having broad linkages with the rest of the economy (FDRE, 2002).

The aforementioned five-year GTP envisaged creation of an environment conducive to the strengthening of existing MSEs and emergence of new ones. Among the GTP targets was provision of capacity building support and training – aimed at imparting entrepreneurial, technical and vocational skills – to 3 million MSE operators. The GTP focused on enabling MSEs to engage in rapid technological transfer; to be present in all cities of the country; and to produce goods and services that were competitive (initially in the domestic market and then, gradually, in the international market). In support, the country's Technical and Vocational Education and Training (TVET) institutes are required to serve as skill and technology centers that capacitate MSEs through technical skill and entrepreneurship training, technology transfer and improvement, and business counselling (MoFED, 2010).

In 2011, the government adopted the revised MSE Strategy (the original Strategy having been adopted in 1997), aimed at enhancing the competitiveness of MSEs, ensuring continued rural development via sustainable growth of MSEs, and making the MSE sector a foundation for industrial development. The Strategy reinforced the call for TVET institutes to play a central role in MSE human resource development and in sourcing technology and technological information for MSEs (MoE, 2008; FDRE, 2011).

ETHIOPIAN MSEs' HUMAN CAPITAL

The MUDC surveyed 3,000 MSEs across 13 urban areas of Ethiopia in 2012, with the results published in 2013 (MUDC, 2013). The MUDC's objective for the survey, the first MSE survey conducted on such a large scale in Ethiopia, was to generate information on growth-oriented MSEs, i.e., on MSEs engaged in production of goods and services in the government's priority sectors, which include construction, agro-processing, and production of textiles, garments, leather and leather goods.

EDUCATION LEVELS

The MUDC survey found that, among the MSE owners/managers surveyed, 38% had high school as their highest level of education, and 33% had only primary school education. Very few MSEs – 7.9% in the capital Addis Ababa and 5.5% in other sample cities – had owners/managers who had attended TVET education. In enterprises engaged in activities such as metalworking, woodworking, construction, and textile and garment production, the majority of owners/managers were found to have attended high school. But in agro-processing, footwear and leather, and urban agriculture enterprises, the majority of owners/managers were found to have attended primary school. In terms of specific years of schooling among the personnel at surveyed MSEs, only 41% (41.6% in Addis Ababa, and 40.8% in the other sample cities) had attended 11 or more years of schooling, meaning that close to 60% of owners/managers had attended only 10 years or less of schooling (MUDC, 2013).

TECHNICAL TRAINING

Across all the MSEs surveyed, about 76% indicated that they had not received formal production skills training. Thus the majority of MSEs had weak relationships with TVET institutes and other training providers. The survey also found that those who had received training complained of the low quality of trainers at TVETs (MUDC, 2013).

EXPERIENCE

The survey found that only 32.1% of the MSE owners/managers had relatively adequate experience in their business areas before starting their enterprises – i.e., more than two years in the business area – while 12% of the owners/managers had only between one and two years of experience. The majority (54.1%) of owners/managers of the sampled MSEs had less than one year of experience in their business areas before starting their present enterprises. Regarding the age of MSEs, it was found that 48.9% of enterprises had only been in existence for one year or less, with another 28.5% of enterprises reporting an age of two to three years (MUDC, 2013).

The surveyed MSEs also reported facing numerous access barriers – e.g., in relation to financing, information, technology and markets – which undermined their innovation capabilities.

CONCLUSIONS

The MUDC survey results, when viewed in light of the aforementioned literature on links between human capital and technological absorption, and in light of the EIPO's findings on lack of Ethiopian MSE take-up of technical information contained in patent documents (Belete, 2013), suggest that the MSE sector's low level of human capital is one of the factors undermining the Ethiopian government's ambitions for technological absorption and innovation by these enterprises.

While the technical information contained in patent documents is readily available, only MSEs with significant levels of human capital can be expected to readily understand and apply such information. With, for example, fewer than 8% of the MSE owners/managers having received training from TVET institutions, and only 32.1% having two or more years of experience in their business areas, a human capital deficiency seems clearly to be present in relation to the demands of assimilation and exploitation of technological information contained in patent documents.

Steps need to be taken to ensure that Ethiopia's TVETs produce the human capital required by MSEs to increase their capacity for technological absorption and, in turn, to increase their levels of innovation and competitiveness. These institutes need to respond more appropriately to the MSE sector's various training needs.

TVET institutions also have a potentially crucial role to play in helping MSEs incorporate patent information into their production processes. TVETs should seek to serve as intermediaries, providing MSEs with technical help and advice in the transfer of knowledge. TVETs can serve as centres for technology transfer and capability-building, and provide support for increased productivity by MSEs through identification of, and provision of potential solutions to, MSEs' productivity gaps.

The building of MSE human capital necessary for innovative technological absorption can also be facilitated through provision of processed patent information for the MSEs to apply to their production processes. TVETs should offer MSEs value-added patent information, e.g., via preparation of patent maps, to guide MSEs in developing innovations within their production activities. Armed with processed patent information appropriate to their business sectors, MSEs would be better able to use the knowledge as the basis for incremental innovations.

The industry development institutes set up by the government in recent years also need to play a pivotal role in transferring knowledge embodied in patent documents to MSEs. There are such institutes in many different sub-sectors, including, for instance, the Textile Industry Development Institute and the Leather Industry Development Institute. Among the key activities of these institutes should be retrieval of sets of patent documents relevant to their specific sub-sectors, analysis of the documents, and extraction and provision of elements relevant to the needs of enterprises in their sub-sectors.

Thus, for the technological absorption capacities of MSEs to improve, it is imperative that the delivery to MSEs by intermediary bodies – the TVET institutions and industry development institutes – is greatly enhanced.

Finally, it is important to note that the interactions between MSEs, TVETs and industry development institutes occur within broader framework conditions and innovation infrastructure, including a range of policies and institutions. Improving MSE access to, and use of, patent information, and improving their innovation performance, thus needs to be viewed from a systems perspective. And policy measures aiming to improve the innovative performance of MSEs must be designed in the context of building a national innovation system.

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