International Technology Transfer Performance:
The Case of Organizations Located in Angolan Provinces

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June 2016
Bio

Carina Alexandra Praça Trino was born on 15 of July 1985, in Lisbon. She started her academic education in Polytechnic Institute of Bragança (IPB – Instituto Politécnico de Bragança) with a bachelor in Chemical and Biological Engineering. Afterwards she attended the Bachelor of Chemical and Environmental Technology and the Master in Chemical and Materials Technology in Tallinn University of Technology, Estonia within the Erasmus program. She graduated in 2009.

In order to add more competences, she obtained the Hazard Analysis and Critical Control Point certificate (HAACP) and the Pedagogical aptitude certificate (CAP). Nonetheless, she continue the link with IPB as a member of the Chemistry Engineering Core during the promotion of the first National Encounter/Debate of Chemical Engineering Students in Portugal.

Regarding to professional experience, Carina started to work in 2009 in the Innovation Center of Trás-os-Montes and Alto Douro (CITMAD), where she was responsible by the CITMAD office in Braganza, supporting the implementation of new business in the region, specially addressing the execution of business plans and applications to European community funds. Presently, she is working in Medidata.Net, a software company based in Porto with projects in Portugal, Angola and Cabo Verde.

In this context, from 2010 until 2014, she was an international consultant in Angola being involved in the implementation of several projects. Carina was in direct contact with the national and local entities from different regions (e.g., Luanda, Cabinda, Lunda-Sul, Benguela and Lobito), with the responsibility to modernize the administrative services.
Acknowledgements

Firstly I would like to express my sincere gratitude to my advisor, Professor Aurora Teixeira for the continuous support of my Dissertation, for her patience, motivation and immense knowledge. Her guidance helped me in all time and incented me to widen my research from different perspectives. I could not have imagined having a better advisor and mentor for this study.

Besides my advisor, I would like to thank Medidata.Net for allowing the execution of this dissertation, for the support and also, by the access to all information needed. I am grateful by the human vision within this company, without their precious contribution it would not be possible to write this research. I am thankful to all my colleagues and friends who provided expertise and information.

Last but not least, I would like to thank the amazing people in my life, to my mother and sister for making me what I am today and to my astonishing husband. I am forever indebted for the unceasing encouragement and attention through this venture.
Abstract

With the current lack of growth in major part of the globe, finding new basis of growth has become a global policy priority. One of the faster ways to achieve competitive advance is through the movement of technological knowledge among firms and sectors, imitating what is already created in more developed countries. However, to ensure the success of the transfer it is necessary to understand the barriers of the adopter country to new technologies and/or knowledge, especially in the case of countries with sharp regional differences.

While the literature has mainly focused on international technology transfer (ITT) across the national borders of developed countries, less attention has been paid to the role of moderate developed countries in fostering innovation and transmission of knowledge into less developed and developing countries. Moreover, extant studies often analyse the transference of technology between countries, most notably those from the OECD, with relevant data availability, given the easiness to treat and compare data. Much less attention has been paid to the diffusion of technology between countries with very distinct technological capabilities and geographically far apart.

This paper fills this gap by addressing the determinants of international technology transfer of the adopter country’s organizations at a regional level.

Based in depth analysis of a technological transfer project from Portugal to different regions of Angola, focused on thirty (30) organizations located in eight (8) provinces and resorting to panel data econometric estimations, we demonstrate that the performance in the process of international technology transfer is significantly dependent on the organizational features, such as the size, the public servants characteristics, distribution of hierarchical levels and the percentage of investment allocated to province. The literacy level of the regions where organizations are located emerged as a significant promotor of successful ITT.

**Keywords:** International Technology Transfer; Developing Countries; Regional Development

**JEL-Codes:** O33; O19; R11.
Resumo

A atual falta de crescimento económico visível na maior parte do mundo fez com que encontrar novas bases de desenvolvimento se tornasse uma prioridade da política global. Uma das formas mais cêleras para alcançar vantagem competitiva é através da transferência do conhecimento tecnológico entre empresas e/ou sectores, adotando tecnologias proveniente de países mais desenvolvidos. No entanto, para garantir o sucesso da transferência é necessário entender as barreiras do país adotante às novas tecnologias e/ou conhecimento, particularmente no caso de países com diferenças regionais acentuadas.

A literatura incide principalmente na transferência de tecnologia internacional (TTI) entre países contíguos ou vizinhos, desta forma tem sido dado menor realce ao papel dos países moderadamente desenvolvidos na promoção da inovação e na transmissão do conhecimento. Por outro lado a maioria dos estudos existentes, analisam a transferência de tecnologia entre países, nomeadamente da OCDE devido à facilidade de acesso a informação relevante e tratamento de dados. Por conseguinte, a transferência de tecnologia entre países com capacidades tecnológicas muito distintas e geograficamente distantes não é alvo recorrente de estudo.

Esta dissertação pretende preencher essa lacuna, abordando os factores que influenciam a transferência de tecnologia de um país moderadamente inovador (Portugal) para organizações públicas em distintas regiões de um país em desenvolvimento (Angola).

Com base numa análise detidada de um caso de estudo de transferência tecnológica de para várias províncias de Angola envolvendo trinta (30) organizações situadas em oito (8) províncias, e recorrendo a dados em painel e estimativas econométricas, demonstramos que o desempenho no processo da transferência de tecnologia internacional depende, essencialmente de características da organização, tais como o seu tamanho, o capital humano, a distribuição dos níveis hierárquicos e à percentagem de investimento alocado às diferentes regiões. O nível de literacia das regiões onde as organizações estão localizadas emergiu como um importante factor de sucesso da ITT.

**Palavras-Chave:** Transferência de Tecnologia Internacional; Países em Desenvolvimento; Desenvolvimento Regional.

**JEL-Codes:** O33; O19; R11.
Index of contents

Bio .................................................................................................................................................................. i
Acknowledgements ...................................................................................................................................... ii
Abstract ....................................................................................................................................................... iii
Resumo ........................................................................................................................................................ iv
Index of Tables ........................................................................................................................................... vi
Index of Figures ......................................................................................................................................... vii
1. Introduction ............................................................................................................................................. 1
2. Literature Review on International Technology Transfer ................................................................. 4
   2.1. Defining International Technology Transfer ..................................................................................... 4
   2.2. Factors that influence ITT ................................................................................................................. 6
   2.3. ITT at the regional level in less developed countries .......................................................................... 8
   2.4. Main gap of the literature ................................................................................................................ 10
3. Methodology .......................................................................................................................................... 12
   3.1. Justification of the method of analysis ............................................................................................. 12
   3.2. Data gathering procedures and construction of data set ................................................................ 14
       3.2.1. Detailing the procedures ........................................................................................................... 14
       3.2.2. ITT performance index ............................................................................................................. 16
       3.2.3. Province’s characteristics ......................................................................................................... 17
       3.2.4. Organization’s characteristics .................................................................................................. 18
   3.3. The econometric approach and specification .................................................................................. 19
4. Empirical Results .................................................................................................................................. 21
   4.1. The institutional context of the international technology transfer: the drive for administrative decentralization .............................................................................................................. 21
   4.2. A descriptive account of the ITT process ......................................................................................... 22
       4.2.1. The SIIGAT Project ................................................................................................................. 22
       4.2.2. Description of the technology .................................................................................................. 25
       4.2.3. The transferor: developer of the technology ............................................................................ 27
       4.2.4. The transferee: provinces of Angola ........................................................................................ 28
   4.3. Assessing the performance of ITT at the regional level ................................................................... 28
       4.3.1. Estimating the ITT performance index ..................................................................................... 28
       4.3.2. Estimation results: a panel data analysis .................................................................................. 30
5. Conclusion .............................................................................................................................................. 33
   5.1. Main results, contribution and implications for science ................................................................. 33
   5.2. Limitations and paths for future research ....................................................................................... 36
References .................................................................................................................................................. 38
Appendix .................................................................................................................................................... 51
Index of Tables

Table 1: Interviews performed .............................................................. 13
Table 2: Summary of the variables, unit of analysis and data gathering methods of the study of SIIGAT project .............................................................. 15
Table 3: Components of the performance index .................................. 16
Table 4: Province's characteristics ...................................................... 17
Table 5: Organizational characteristics .............................................. 18
Table 6: Results of the ITT Performance Index for the whole set of organizations (average values) ................................................................. 29
Table 7: Results of econometric analysis - OLS and panel estimations ............ 31
Table 8: Definitions of Technology Transfer ...................................... 51
Index of Figures

Figure 1: Determinants barriers of International Technology Transfer projects .......... 8
Figure 2: Epistemological position of the research...................................................... 14
Figure 3: Drivers of intergovernmental reform........................................................... 21
Figure 4: The vision of the SIIGAT Project ................................................................. 23
Figure 5: Methodological approach of SIIGAT Project .............................................. 24
Figure 6: Number of organizations, by province which had implemented the SIIGAT Project .................................................................................................................. 25
Figure 7: Connections between module applications that constitute SIGMA .......... 26
Figure 8: Summary of variables identified in this dissertation as impacting on ITT Performance.................................................................................................................. 34
1. Introduction

With the existing lack of growth in the major part of the globe, finding new sources of growth has become a global policy priority (OECD, 2013). Innovation and entrepreneurship are considered the way out of the economic impasse and promoters of global competitiveness and job creation – as well an important mechanism to foster sustainable growth (OECD, 2013; OECD, 2015a).

Innovation presupposes the creation and diffusion of new processes, methods and ultimately products that will translate in economic value (Glass and Saggi, 1998, WBG, 2015; OECD, 2015a). Indeed, most of the existing studies identify development with the creation of new jobs, foundation of new business and productivity growth (OECD, 2015a). Moreover, empirical data confirms that innovative economies are the most productive, resilient, and most adaptive to change and capable to holding higher living standards (OECD, 2013; OECD, 2015a). However, not all countries or regions innovate in the same degree, the ability to innovate depends on countless factors but ultimately relies on the participation of citizens in innovative processes and, the cultural and social barriers as the degree of sophistication of demand and the readiness to accept and recognize the potential of science and technology (Cozza et al. 2011; OECD, 2015a). Therefore, it is normal that firms in developed countries, with high education and training, are better able to innovate, especially regarding technological creations (Constantini and Liberati, 2014).

With globalisation, distances and borders have largely diminished and the competition between firms has become international, and not just within borders – companies must evolve and establish multinational networks to grant competitive advantage (Coelho, Ferreira and Veiga, 2011). The intense competition that characterises globalisation forces firms to acquire essential competencies, such as new technologies and intangible assets even when they do not have the ability to produce themselves, therefore the only solution is to obtain the technology from someone else (Coelho et al., 2011). The literature refers this process - when a firm/sector/entity acquires technology from another one usually more developed, as technology transfer or in cases which other countries are involved, International Technology Transfer (ITT).

It is reductive to say that the technology transfer for itself would grant productivity, but we can say that plays a key role, since, some studies argue (e.g., Keller, 2009;
Constantini and Liberati, 2014), above 90% of domestic productivity growth (GDP) is obtained by foreign technology. To ensure the successful technological implementation, the communication of the corresponding technical knowledge is essential. However, the trading costs for shipping both are relatively high making the technological diffusion decrease with distance (Keller, 2009). Although it is recognised that international relations may enhance economic growth (Keller, 1996; Borensztein, Gregorio and Lee, 1998; Dollar and Kraay, 2004), the technology transfer is mostly concentrated in neighbouring countries or countries with appealing conditions of trade (Dollar and Kraay, 2004; Osman, Rose and Wahab, 2012).

With the financial crisis, firms in developed countries were obliged to look “outside” the common market and find new sources of growth (Glass and Saggi, 1998). At the same time, developing countries with financial capability saw the opportunity to assimilate foreign technology to achieve technological development (Glass and Saggi, 1998; Keller, 2009).

Until 2007 Portugal was a net importer of technology. However, since that period the technological exports increased and started to exceed imports on an annual basis, which resulted in the transformation of Portugal as a net exporter of technology (Coelho et al., 2011). The international trade flow increased not only with neighbouring countries but also with more distant countries, such as Angola in part due to sharing the same language and being part of the PALOP (African countries with Portuguese as official language) countries. According to Banco de Portugal during the year of 2015, around 6.9% of the Portuguese foreign direct investment targeted Angola, ranking in the 1st position of outward investments in non-EU countries (AICEP, 2016).

Angola however, is one of the hardest countries to do business, ranking in 2015 in 181st out of a total of 189 countries of the World Bank Group ranking that measures whether the regulatory environment is propitious to start and operate a local firm. The World Bank report was based on the analysis of many indicators, such as time, cost or norms to open a business, procedures of obtaining construction permits, protecting minority investors, access to electricity, registering property, taxes, credit, enforcing contracts and resolving insolvencies (WBG, 2015).

While the literature tends to concentrate on macro-level factors of the international technology transfer (ITT), the present dissertation intends to go a step further by
exploring the determinants of organizations’ performance on ITT at the regional level. Thus, particular attention is paid to the key factors that influence ITT within the same country (Angola’s provinces) and the success of international projects, involving the transfer of technology from a moderator innovator country (Portugal) to a developing country with high needs of Research and Development – R&D (Angola).

The majority of the studies on ITT focuses on highly developed countries, not on moderator innovators such as Portugal. Moreover, less attention has been paid to the determinants of ITT in developing African countries (OECD, 2015b). One of the biggest concerns in managing ITT is the communication difficulty that could arise due to the cultural differences between the technology transferor and the technology transferee (Berg and Lin, 2001). However, the role of cultural differences in ITT has not been a concern in literature (Berg and Lin, 2001). Several studies (e.g., Dudley, 1974; Keller, 1996; Hipkin and Bennet, 2003; Siggel, 2006; Banerjee and Iyer, 2015) explore the key factors of technology transfer between regions (namely, natural resources, capital, labour, the legitimization of specific domestic policies, etc.), but focusing on interregional differences, neglecting the role of organizations located in those regions.

Summing up, regional issues are not often objected on ITT research especially regarding sub-Saharan Africa. However, experience elsewhere suggests that regional integration is the best way to compete in global markets. It is, therefore, pertinent to analyse the innovative capacity of a region and its international competitiveness using ITT as the engine (Landabaso, 1997; Melitz, 2002; Bernard, Bradford, Eaton and Kortum, 2003; Kasahara and Rodrigues, 2008; OECD, 2015b; Banerjee and Iyer, 2015).

The present study describes a case study of a project (the SIIGAT - Sistema Integrado de Informação e Gestão de Administração do Território – Project), which involved ITT between Portugal and Angola, implemented in 30 public organizations, located in 8 provinces of Angola. Based on data from those organizations and provinces, we resorted to econometric panel models for estimating the determinants of ITT performance.

In terms of structure, this dissertation presents the first section the literature review on ITT. Then, in Section 3 the methodological underpins are briefly described. The empirical results are detailed in Section 4. Finally, Section 5 concludes the study highlighting the main outcomes, limitations and further avenues for future research.
2. Literature Review on International Technology Transfer

2.1. Defining International Technology Transfer

There are numerous studies about International Technology Transfer (ITT). The literature defines TT from different perspectives and from different background areas including economics, anthropology, organizational management, political science, and even more recently management of technology (Osman et al., 2012). Such literature is so vast within different specialties that it does not exists a common agreement on the definition – there are, instead different interpretations and concepts according to the organization objectives, the users, the research area, and other factors (Osman et al., 2012; Bozeman, 2000).

ITT is a field of study quite old in time. Although the term “Technology Transfer” supposedly appears in the 1940s in the United States (Johnson, Gatz and Hicks, 1997), formal studies began in Europe regarding diffusion of technology in the perspective of social scientists and promptly became considered as a crucial subject of research in the major disciplines (Johnson et al., 1997). It has been estimated by scholars (Johnson et al. in 1997; Kumar, Kumar and Persaud, 1999; Bozeman, 2000; Osman et al., 2012) that literatures on TT are so wide and varied that already exceed 10,000 documents.

Such wideness results in various definitions for TT not only according the purpose but also above time. According with Bozeman (2000) and Amesse and Cohendet (2001), before 80 decade the majority research about TT focused on cross-national transfers. So, ITT, particularly that involving TT from developed nations to less developed countries (LDCs), however after the 1980s the inquiry research changed to domestic TT, especially for US authors that wanted to know how to improve national economy, in this context also the definition of TT evolved with time.

Gibson and Smilor (1991) defined TT as disorderly, confused process including persons or groups and may have distinct perspectives on the value and potential use of the technology, also regarding with the view of the concept of technology itself consider that probably people also have different perceptions about it. Reisman and Zhao (1992) described that economists usually interpret technology grounded on diverse properties of knowledge, focusing on elements related to design and productivity, whereas sociologists tend to connect TT to innovation and to view technology as “a design for
instrumental action that decreases the haze of cause-effect relationship involved in achieving the desired end” (Reisman and Zhao, 1992, pp14).

Regarding the tangible results of TT implementation, it can be defined as a transference of knowledge that allow the recipient company to provide a specific service or produce particular product (Baranson, 1970). In this context the TT should occur over for a period of time to allow the transferee (receptor) gather knowledge to generate with high quality standards and with costs effectiveness (Reddy and Zhao, 1990). The knowledge transfer (KT) definition is not clear cut in literature, with the terms TT and KT being treated as similar or even as the same (Osman et al., 2012). Many researchers have tried to clarify both concepts (Kogut and Zander, 1992, 1993). The approach by Sahal (1981, 1982) explains that TT relies on the object transferred; however, it recognizes that it is not sufficient to focus only in the product, being necessary to focus also on the correspondent knowledge, the application of the product, and on all the additional knowledge that it is shared between the transferee and transferor. In its most simple context, TT includes beside the adjacent knowledge, the technological product, the transferor or developer of the technology, the formal and informal channels to achieve the transfer, and the transferee (Johnson et al., 1997).

In TT literature it is common to find the terms of transferor to define the owner of the knowledge and the technology, and transferee to define the one receiving the technology and the knowledge (Khabiri, Rast and Senin, 2012).

From a conceptual view, it is indifferent if the TT transferor is a public or private institution; moreover, to the transferee it does not matter if it that organization is a government of a developing country or a commercial venture; instead, the critical issue is that the development of the occur in one placed and it is transferred to another place so that the user accepts the technology (Johnson et al., 1997). In this vein, TT and ITT are the similar concepts. Nevertheless, they produce different technological activities and may differ in the method applied.

In this line of thought authors as Chung (2001) and Kanyak (1985) understand TT as the transfer of technological knowledge to adjust the local characteristics, with results in the effeciente absorption and, the spread of that know-how, within and across countries. They further describe that TT derives or occurs as a reaction to a perceived want or need by the receptor or buyer for a product or service, so regardless the name – TT or ITT –
the process itself consists in transference of technology and knowledge (Johnson et al., 1997; Chung, 2001).

Summing up, scholars, in general, agree that TT is a intricate process even when it occurs across varied tasks within a specific department of a particular enterprise (Zaltman, Dundan and Holbeck, 1973; Kidder, 1981; Smith and Alexandre, 1988; Chung, 2001). The major part of the studies tend to defined TT as a movement or transmission of knowledge as a process (Osman et al., 2012).

However, it is necessary to understand not only what TT is, but also how it occurs in order to discover the factors that bring successful transfers, and pointing out the reasons that lead TT to different degrees of acceptance not just in cross-countries but also within the same country. Thus, the definition of TT should also include a functional component. In other words, for having a true transfer of technology, a truly effective absorption of the transferred technology happened in the recipient country/ organization (Hayden, 1976; Berg and Lin, 2001).

In the present study, we consider TT as a process from which a company or a country transmits technology or scientific achievements, designs, new technology, and the technical knowledge that can be used in effective performance, in a way that eventually result in a deeper and thorough addition of knowledge for the transferee (Shiowattana, 1991; Chun, 2007).

2.2. Factors that influence ITT

International Technology Transfer is influenced by numerous agents and affect directly the performance of project. Thus, TT effectiveness is ultimately undefined because it is an intricate field with numerous variables and dimensions (Spann, Adams and Sounder, 1995).

According with Berg and Lin (2001) to fully understand TT influencing factors is it critical to analyse not only direct effects but also possible interaction effects among factors such as, the nature of the transferred technology, international experience of the organizations involved and the impact of cultural differences between the transferee and the transferor. Moreover, Pursell (1993) suggests that the use of appropriate technologies influences a innovative TT, since more similar the technological product or appropriate is the technology simpler would be for the transferor to communicate and
teach the use of the product, and easier would be for the transferee to assimilate the knowledge learned (Johnson et al., 1997).

A way of studying whether the appropriateness of technology influences the transfer is to analyse the technology’s characteristics as perceived by individuals, such as complexity, observability, trialability, compatibility and relative advantage (Rogers, 1995):

- Relative advantage. The perception of the technological innovation as an advantage regarding the previous solution;
- Compatibility. The perception of the technological innovation as being coherent with the existing experiences and fill the past needs;
- Complexity. The perception of the technological innovation as being hard to comprehend and use, it is necessary to grant simple solutions to all the users to adopt the technology;
- Trialability. The way the technological innovation may be experimented influence the transferee to rely on the new technology;
- Observability. The perception outputs of the technology innovation.

Using the conceptual view of TT proposed by Johnson et al. (1997), we can group factors/barriers influencing TT and ITT into five categories: Social; Political; Economic; Personal; and Cultural.

Such view assumes that TT starts with the development or improvement of a technology, also combined with the factor that the development occurs as a result of a perceived need for a product that will eventually result in technological activity (Johnson et al., 1997). This activity is expected to improve the human capabilities, through the technical processes and knowledge (Johnson et al., 1997).

To expand the considered points and model appointed by Johnson at al. (1997) to understand the successful factors in a regional perspective, it is necessary to include not only the macro parameters but also the micro parameters. So it is critical to establish a relationship between the barriers to overcome to grant a successful technology transfer.

Figure 1 draws a framework that identifies the TT barriers, involving both dimensions, cross-country, and the regional levels.
2.3. TT at the regional level in less developed countries

Regions are vital and crucial for the long sustainability planning of growth or productivity (Wheeler, 2009). From the perspective of innovation theory, regions, branches and sectors are often as analytical categories for selection environments, however they may fuel integration and innovation in different dimensions (Cooke et al., 2002). In this perspective the diffusion of technology is critical for the sectoral and regional growth patterns (Caspaldi and Sapio, 2008; OECD, 2012), but does not happen at the same pace in every region (OECD, 2012) and productivity growth is not homogenous across countries or regions (Cozza, Argilés, Piva and Baptista, 2012).

The disproportionate innovative efforts by the public and especially by the private sector in regions reinforce the “technology gap” between regions enhancing “cohesion gap” (Landabaso, 1997). Cohesion gap between regions are regional disparities resulted of differences in productivity and competitiveness aggravated by distinct innovation efforts in regional structures of production (Landabaso, 1997).
Technological innovation is probably the most important coefficient to overcame this cohesion gap and to create regional competitive advantage, however to understand this at a level as specific as regional it is necessary to understand the innovation process, including its diffusion across and within regions (Landabaso, 1997; Argilés, 2012). Thereby, less developed regions are often seen as an obstacle on national performance instead than as potential asset to be exploited. For the latter, and in order to overcome the TT barriers in different regions it is required a place-based approach and not the solution of “one-size-fits-all” technology. In short, it is necessary to understand the innovation process in regions (Landabaso, 1997; OECD, 2012). One of the most frequently identified barrier is the difference of human capital between regions (OECD, 2012; Cozza et al., 2011).

Cozza et al. (2011, 2012) studied the transatlantic gap on productivity between US and Europe considered that R&D investments are a crucial part to explain the productivity of the different regions of EU. They concluded that patterns of the different geographical and economy characteristics of the regions are the some of the main causes by the gap on R&D and productivity, not just between US and EU but also regarding EU regions (Cozza et al., 2012).

Other factors such as the expansion of intraregional trade and regional markets could boost incentives for domestic production, allowing job creation to the growing working age population, helping countries and regions, namely from the sub-Saharan Africa, to benefit from ITT (IMF, 2015).

Even though there are certain level of conditions required to join global value chains (WTO, 2014), they can be overcame quickly through knowledge and technology transfer from other countries, occurring mainly by foreign direct investments - FDI (IMF, 2015).

Despite the growth in trade flows seen in recent years, sub-Saharan Africa trade is bellow its potential and regions have a great potential to be integrated into global value chains (GVCs) which can help foster structural transformation, exports diversification and the absorption of technology and knowledge from abroad (IMF, 2015). This is especially important for countries with relatively small domestic markets and regional economic communities such as Africa that did not made much progress in reducing
barriers to trade, suffering from incompatibility of rules, the lack of implementation rules and high tariffs (OECD, 2015b; IMF, 2015).

2.4. Main gap of the literature
International technology transfer (ITT) has become subject of study to scholars only in recent years (Acharya and Keller, 2009). It is considered that this interest is related to its contribution on the productivity of countries, which data proved that often exceeds the effect of domestic R&D (Acharya and Keller, 2009).

However, literature pay less attention on ITT development development perspective, and focused on how it may affect standard economic performances (Constantini, 2014), as for example the issue of the high asymmetry in global patterns of TT and the different impact of TT according with the countries and regions involved (Acharya and Keller, 2009).

According to Berg and Lin (2001), a successful impact of TT, especially in developing countries relies on the selection of a more mature and developed technology combined with a transferor with similar culture and relatively inexperienced. The literature, however, is not clear about the role of similar countries in ITT, disregarding the individual stage of country’s development, in a way that many of the early studies were restricted to explain ITT between developing countries and developed countries (Johnson et al., 1997). Many studies emphasized only the political, economic and cultural differences between the transferor and the trasneree (Johnson et al., 1997), overlooking a regional or more micro view.

In conclusion, information and assessment about ITT projects in developing countries is on great demand (Banerjee and Iyer, 2015). Literature is filled with TT models, influencing factors, governing processes and analysis of contractual arrangements yet the study of sector-wide and regional differences has remained an unexplored area (Banerjee and Iyer, 2015).

The heterogeneity of regions within developing countries deserves a deeper analysis involving different regions and organizations (Bernard et al., 2003; Melitz, 2002; Kasahara and Rodrigues, 2008; Banerjee and Iyer, 2015) Indeed, the potential for innovation and technology absorption in a specific region is influenced or even determined by the dynamic relationship between the political rules, the economic variables, organization and knowledge degree (Cooke and Leydesdorff, 2006). Acharya
and Keller (2009) proposed that more effort is required to disengage the complexity between informal and formal channels of TT.

In the present study we aim at filling this gap. We describe the case of the adaptation and implementation of a Portuguese technology in Angola. Specifically, we seek to understand the barriers and key factors of success of this ITT process.
3. Methodology

3.1. Justification of the method of analysis

The preparation of a research project is a work in process not fully predictable. To adopt a methodology means choosing a path, a global journey – however the route, often requires being reinvented every step – so it is needed not only rules but also creativity and imagination (Yin, 2011).

The goal of the present dissertation is to answer the following question: “Which are the critical factors that influence ITT from Portugal to the different organizations located in the provinces of Angola?”.

Therefore, the overall purpose of this dissertation is to analyze the key factors to success of ITT at a regional level, using the evidence of SIIGAT - Sistema Integrado de Informação e Gestão de Administração do Território –, that is, the Integrated Information and Territory Management System.project. Specifically, we undertake an explanatory research since the objective is to discover which factors are crucial for ITT regarding a practical/real project with no control over behavioral events (Yin, 2015). The exploratory research methods are quite spacious and versatile used to generate clarification about a real situation allowing the data collection to be flexible (Yin, 2011).

According to Yin (2015) it is possible to use four different types of internal information on a case study: documents, statistics, personal interviews and direct observation - all of them were used in this study. The interviews allow expanding the vision of the researcher (direct observation) about the perception of the environment in each public organism and enabled the construction of a performance index to this study. In total were performed 15 direct interviews which were treated inductively and focused in the process and its meaning (Yin, 2011).

Regarding the treatment of data we use a mixed strategy combining statistical (descriptive and inferential) and content analysis, that is, quantitative and qualitative analyses.

The qualitative research can be defined in a broader sense, as a methodology that generate data from the direct observation of the study of people, places or mere
processes from which the researcher aims to establish a straight interaction to understand the activity under study (Godoy, 1995).

Table 1: Interviews performed

<table>
<thead>
<tr>
<th>Name of the interviewee</th>
<th>Function in the project</th>
<th>Purpose of the interview</th>
<th>Date of the interview</th>
<th>Length of the interview</th>
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<td>Gustavo Diogo</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>11/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>José Carlos Marques</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>04/04/2016</td>
<td>00:15</td>
</tr>
<tr>
<td>Manuela Pinheiro</td>
<td>Director of Project</td>
<td>Performance Index</td>
<td>05/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>Orlando Soares</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>05/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>Pedro Ferraz</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>04/04/2016</td>
<td>00:15</td>
</tr>
<tr>
<td>Raquel Coelho</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>04/04/2016</td>
<td>00:15</td>
</tr>
<tr>
<td>Renata Cunha</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>05/04/2016</td>
<td>00:20</td>
</tr>
<tr>
<td>Ricardo Ramos</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>06/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>Rui Figueiredo</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>05/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>Sofia Vale</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>04/04/2016</td>
<td>00:20</td>
</tr>
<tr>
<td>Marcos Lopes</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>04/04/2016</td>
<td>00:10</td>
</tr>
<tr>
<td>Manuel Gonçalves</td>
<td>Consultant</td>
<td>Performance Index</td>
<td>07/04/2016</td>
<td>00:10</td>
</tr>
</tbody>
</table>

Source: Own elaboration.

By applying a qualitative approach in the present study it is possible to value the relationship between the researcher and the object of study, including the situational constrains that influenced the research (Denzin and Lincoln, 2000).

However, this type of studies are often criticized due to the lack of rigor, resulted by the acceptance by the researcher of misleading or biased evidences that influence the meaning of the findings and conclusions (Yin, 2015, Serapioni, 2002). So, although this study has a predominant qualitative nature a mixed approach would be more reliable and complete (Bergin and Stokes, 2006).

The quantitative research aims to explain, predict and control phenomena, concentrating in padrons and laws through the quantification of measures and objective procedures (Almeida and Freire, 2003). The fundamental characteristics of the quantitave method are oriented for the cause of the phenomenon with no concerning about the subjectivity and also, the use of controlled methods (statistics). Although, the most crucial characteristic regarding this approach is the objectivity by distancing itself from the data (insider perspective), since it is oriented for the results it is possible to replicate and generalize the conclusions in opposite with the qualitative method (Serapioni, 2002).
The possibility of generalization, even leading to a departure from singularity (characteristic usually given to case studies) allows knowledge to be valuable and useful in a wider variety of situations (Serapioni, 2002; Yin, 2015).

Figure 1 summarizes the aspects of quantitative and qualitative approaches considered in the methodological procedures of the present research.

![Figure 1: Methodological procedures of the present research](image)

3.2. Data gathering procedures and construction of data set

3.2.1. Detailing the procedures

In the construction of the data set it was used various methods of data collection and analysis, since it is often useful, if not necessary, to use different techniques in the same investigation (Morais and Neves, 2007).

To collect the relevant data we use two main instruments: the interview survey and the documentary analysis. Regarding the documentary analysis, a set of information about the Project (by internal sources) were collected and further examined (materials), as primary source regarding the organizational level (Yin, 2011). Nonetheless, data news, annual reports, financial data and national statistics were gathered to fulfil the province/regional aspect of the analysis.
It was crucial to standardized data definitions and collections procedures to assure consistent presentation of data. Furthermore, considering that each case study varies in its design and must be customized, it was important to regroup the variables of the study to organize the information (Yin, 2011).

The data was grouped in three major categories:

- ITT performance Index;
- Province’s characteristics;
- Organization’s characteristics.

Table 2 summarises the variables, unit of analysis and data gathering methods of the study pursued in the present dissertation.

Recall that we aimed at assessing the performance of public organizations located in Angolan provinces in implementing/absorbing the technological transfer associated with the SIIGAT project whose transferor was a Portuguese company. The process of ITT occurred over the period 2011 to 2014.

<table>
<thead>
<tr>
<th>Group of variables</th>
<th>Description</th>
<th>Unit of analysis</th>
<th>Years of reference</th>
<th>Data gathering method/ source of the data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Number of inhabitants</td>
<td>ln</td>
<td>2014</td>
<td>INE (2016b)</td>
</tr>
<tr>
<td>Population</td>
<td>People over 15 years of age who knows to read and write</td>
<td>percentage</td>
<td>2014</td>
<td>INE (2016b)</td>
</tr>
<tr>
<td>Economic dynamics</td>
<td>Number of firms per 1000 inhabitants</td>
<td>ln</td>
<td>2014</td>
<td>INE (2016a)</td>
</tr>
<tr>
<td></td>
<td>Labour force that is not employed</td>
<td>percentage</td>
<td>2014</td>
<td>INE (2016b)</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>People with access to water and electricity</td>
<td>percentage</td>
<td>2014</td>
<td>INE (2016a)</td>
</tr>
<tr>
<td>Public expenditure</td>
<td>Total public expenditure devoted to education</td>
<td>EUR</td>
<td>2014</td>
<td>Finance Ministry (2014)</td>
</tr>
<tr>
<td>Size</td>
<td>Number of employees</td>
<td>ln</td>
<td>2012-2014</td>
<td>Internal sources</td>
</tr>
<tr>
<td>Employees traits</td>
<td>Employees’ average age</td>
<td>ln</td>
<td>2012-2014</td>
<td>Internal sources</td>
</tr>
<tr>
<td></td>
<td>Total males employees</td>
<td>percentage</td>
<td>2012-2014</td>
<td>Internal sources</td>
</tr>
<tr>
<td></td>
<td>Employees with college degrees</td>
<td>percentage</td>
<td>2012-2014</td>
<td>Internal sources</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>Employees who are chiefs</td>
<td>percentage</td>
<td>2012-2014</td>
<td>Internal sources</td>
</tr>
<tr>
<td>Budget</td>
<td>Total public expenditure devoted to investment</td>
<td>EUR</td>
<td>2014</td>
<td>Finance Ministry (2014)</td>
</tr>
</tbody>
</table>

Note: It includes National Ministries, Provincial governments and Municipal administrations.
The next sections detail the construction of the key variables.

### 3.2.2. ITT performance index

To measure the impact of the technology transfer on the attitude of public servants of the selected organizations and productivity, we compute a “Performance Index”.

This index was calculated considering 4 items (see Table 3) - Autonomy in routine tasks; Enforcement quality in routine tasks; Fast delivery data; and Ability to parametrize the software – relative to which the 15 interviewees (i.e., the 15 consultants involved in the ITT project) attributed a score in 7 points a Likert scale.

This information was gathered by direct interviews to the consultants of the project (15 interviews) and included the inside vision of the author of the present dissertation (who was also a consultant).

#### Table 3: Components of the performance index

<table>
<thead>
<tr>
<th>Group of Variables</th>
<th>Variable</th>
<th>Description</th>
<th>Year of reference</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of technology on productivity of the organization</td>
<td>Autonomy in routine tasks</td>
<td>Consultants’ perception regarding the amount of routine tasks independently developed by public servants in the respective services</td>
<td></td>
<td>7 points Likert scale (1=Poor;7=Excellent)</td>
</tr>
<tr>
<td></td>
<td>Enforcement quality in routine tasks</td>
<td>Consultants’ perception regarding the quality of routine tasks independently developed by the public servants in the respective services</td>
<td></td>
<td>7 points Likert scale (1=Poor;7=Excellent)</td>
</tr>
<tr>
<td></td>
<td>Fast delivery data</td>
<td>Consultants’ perception regarding the time spent on routine tasks after and previously to the software installation</td>
<td>2014</td>
<td>7 points Likert scale (1=Poor;7=Excellent)</td>
</tr>
<tr>
<td>Assessment of the attitude of public servants regarding the technology</td>
<td>Ability to parametrize the software</td>
<td>Consultants’ perception regarding the ability by public servants to parametrize the software in specific data of the organization</td>
<td></td>
<td>7 points Likert scale (1=Poor;7=Excellent)</td>
</tr>
</tbody>
</table>

*Source: Internal sources.*

The analysis focused on the perception of each consultant regarding the absorption of the technology transferred by the public servants employed in the 30 Angolan public organizations (the population of this study), including National Ministries, Provincial governments and Municipal administrations.

Despite the existence of numerous customizable reports that allow the analysis and the control of SIIGAT project, involving milestones systematically segmented into chronological tasks/activities previously determined, it was not possible to arrive at any conclusion concerning the effective performance of the technology transfer by the transferee. Projects are extremely dynamic and depend on group dynamics, interactions and communications which are almost impossible to anticipate (Akinyokun, Angaye

The performing index is thus a simple average of the components of Table 3. It assumes values between 1 and 7, being 1 the lower/poor performance and 7 the best/excellent performance, according to the consultant’s perception of performance of the ITT.

3.2.3. Province’s characteristics

Given that organizations operate in distinct regional contexts, the provinces, it was necessary to control for potential idiosyncrasies of those regions. In fact, albeit the legislation is equal for all the national institutions, the regions of Angola are extremely unequal, endowed with different production structure, population, location, geography characteristics, and economic capacity (Instituto Nacional de Estatísticas [INE], 2016b).

Therefore, in order to properly account, for the impact of ITT at the organizational level, it is relevant to control for the characteristics of province where these organizations are located, most notably, their population, economic dynamics, infrastructure conditions and public expenditure devoted to the province.

Table 4 presents the information organized by groups.

<table>
<thead>
<tr>
<th>Table 4: Province’s characteristics</th>
<th>Group of Variables</th>
<th>Variable</th>
<th>Description</th>
<th>Year</th>
<th>Calculation Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Province characteristics</td>
<td></td>
<td>Size</td>
<td>Number of inhabitants (in ln)</td>
<td>2014</td>
<td>log(Sum of all inhabitants)</td>
</tr>
<tr>
<td>Population</td>
<td></td>
<td>Literacy</td>
<td>People over 15 years of age who knows to read and write (in percentage)</td>
<td>2014</td>
<td>Literate people x 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Firms in activity</td>
<td>Number of firms per 1000 inhabitants (in ln)</td>
<td>2011</td>
<td>N° of firms x 1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unemployment rate</td>
<td>Labour force that is not employed (in percentage)</td>
<td>2014</td>
<td>Unemployed people x 100</td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
<td>Access to water and electricity network</td>
<td>People with access to water and electricity (in percentage)</td>
<td>2014</td>
<td>People with water and electricity x 100</td>
</tr>
<tr>
<td>Public expenditures</td>
<td></td>
<td>Education</td>
<td>Total public expenditure devoted to education (in percentage)</td>
<td>2014</td>
<td>Total expenditure to education x 100</td>
</tr>
</tbody>
</table>

Source: INE (2016a); INE (2016b); Finance Ministry (2014).
3.2.4. Organization’s characteristics

The data covers the period 2010-2014 of 30 organizations. Table 5 exhibits in detail the group of variables for the selected organizations. All the data were gathered in the current national currency of the transferor (kwanza); however, to simplify the analysis the values were converted in Euros and are expressed in percentages whenever convenient. To convert the values from Kwanza (AON) to Euro (EUR) it was necessary to calculate the annual average exchange rate referred to the respective year of the financial data (2014). This calculation was based on the monthly midpoint rate between the buy and sell rate of the Angolan primary market reference.

All the financial data (public expenditure at the province and organizational levels) were based on the maps of Angolan Finance Ministry for the year of 2014. The province characteristics such as, population, economic dynamics, and infrastructure were based on data available from the National Institute of Angolan Statistics (INE), referring the year of 2014 (with the exception on the variable of number of existence companies, since the last data available was from 2011). The microdata concerning organizational characteristics such as employee’s traits, hierarchy, and others covered the period 2010 to 2014 and was provided by Medidata.Net.

<table>
<thead>
<tr>
<th>Table 5: Organizational characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group of Variables</strong></td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Employees traits</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Hierarchy</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Budget</td>
</tr>
</tbody>
</table>

Source: Internal references; Finance Ministry (2014).

1 Only one organization presented data from 2010.
Due to the social and economic reality of Angola, one of the biggest obstacles to the study was the lack of reliable information, namely the size and distribution of the population through the territory and, ultimately, its educational level (CESO, 2015; Montepio, 2015). However, during this research it was published (in March of 2016), the final results concerning the general census of 2014. This allowed to gather trustworthy and solid information since the census had 94.4% coverage and was considered ‘Good’ according with the United Nations classification (INE, 2016b).

3.3. The econometric approach and specification

Econometric analysis through panel data is beneficial when we suspect that the observed explanatory variables are coorelated with explanatory variables not observed, and influence the outcome variable (Moutinho and Hutcheson, 2011) Panel data estimators allow to estimate the effect of the observed explanatory variables if the omitted variables are constant over time (Greene, 2002).

In order to capture the effects of province/regional and organizational characteristics on ITT performance it we consider a panel:

\[ Y_{ij} = \alpha_j + \beta'_j X_i + \gamma'_j Z_{ij} + \varepsilon_{ij} \]

Where, \( Y_{ij} \) is the dependent variable (ITT performance) of the \( j^{th} \) organizations located in province \( i \), \( X_i \) is a vector of explanatory variables for province \( i \); and \( Z_{ij} \) is a vector of explanatory variables for organizations \( j \) in province \( i \). The parameters \( \alpha \), \( \beta \) and \( \gamma \) are the elasticities of the organization and province characteristics with respect to ITT performance.

The specification was estimated by the Ordinary least-squares (OLS) and panel data. The OLS regression is a generalized linear modelling technique used to understand the relationship between each explanatory variable and the performance of ITT.

In OLS it is assumed that the dependent variable is a linear combination of all the independent variables plus one random noise (Alfaro, Chanda, Kalemi-Ozcan and Sayek, 2004).

For panel data regression, it is to commom to use either the fixed or the random effect estimator, depending on the correlation between the cross section effect and the explanatory variables (Greene, 2002).
The Random Effect (RE) Model, where the individual effects ($\alpha, \beta$ and $\gamma$) are random and independent from $X_i$, with a distribution $H$ conditioned by a finite set of parameters, was chosen because it is expected that differences across organizations have influence on the depend variable (Greene, 2002). Also, the Hausman test did not reject the null hypothesis, which means that the chosen variables are uncorrelated with the residuals and the RE model is the more adequate (Alfaro et al., 2004).
4. Empirical Results

4.1. The institutional context of the international technology transfer: the drive for administrative decentralization

In Africa and the world, the decentralization has been the principal mechanism to achieve goals such as the increase of participation of citizens in making-decision processes of governmental administration and the control over local programs for its beneficiaries, increasing the mobilization of resources as foundation for development and as tool for achieving good governance (Owens and Shaw, 1972; CESO, 2015).

The World Bank recognizes different types of decentralization which include administrative, fiscal, market, and political decentralization and also, analysis the conditions by which decentralization arose (WBG, 2015).

Decentralization is the process by which a government transfers the power and responsibilities outside of a central authority to levels below a territorial hierarchy (Crook & Manor, 1998).

Although there is a high interest in the potential of decentralization by being associated with democratization processes in many developing countries, in Angola the regulation of this issue has been undertook since the early 90s (MAT, 2012).

In 2010 several new Laws were launched that focused on the organization of the Public Administration in order to bring the public services closer to the population. The concepts of deconcentration and decentralization of the Administrative Power were introduced in Angola by new National Angolan Constitution in 2010, which determined...
the creation of autonomous local authorities, such as Local Administrations and Provincial Governments (Constituição de Angola [CA], 2010).

However, the national process of organization of the Local Administration of Angola started in 2007 with the promulgation of the Decree Nº 2/07, afterwards revoked in 2010 by Law Nº 17/10 that determined the functional organization of the Public Administrative Services (MAT, 2012). The Presidential Legislative Decree N. º6/10 clarified the corresponding role for each one of them and, ultimately it was defined the coordination of the Local Administration to the Central Administration which resulted in different responsibilities and functions to the Provincial Governments and Municipal Administrations (MAT, 2012). The organization of the Local Administration was not an easy task, so Law Nº 17/10 was revised after only one year by the Decree Nº 39/11, this two Decrees contained the basic elements regarding the decentralization process:

- Created the legal basis that allowed the transformation of municipalities in budgetary units;
- Established planning structures in Provincial, Municipal and Communal organizations and, through the establishment of the Auscultation and Social Bargaining Council (CACS – Conselho de Auscultação e Concertação Social), it was guarantee the participation of the citizens;
- Clarified the functions and responsibilities between the different levels of governmental organisms – Provincial, Municipal and Communal. (MAT, 2012).

These new legislative framework lined up positively with the National Development Plan 2013-2017 that established the National Policy for the “Modernization of the Public Administration and Management”.

4.2. A descriptive account of the ITT process

4.2.1. The SIIGAT Project

The implications of the new national legislation structure obliged to adopt technologically supported working tools that allowed to enhance the performance capacity of the public services.

2 This section is based on information available from internal sources (Medidata.Net).
In this context, the Angolan Territory Administration Ministry (MAT – Ministério da Administração do Território) decided to create the Integrated Information and Territory Management System project, hereafter referred as SIIGAT (Sistema Integrado de Informação e Gestão de Administração do Território).

The SIIGAT Project is an integrated system of collection, processing and information management of the Central and Local Administration, which is part of the process of modernization, technical and technological training for the organization of the Provincial Governments (PGs) and Municipal Administration (MAs) (MAT, 2012).

It is understood as the integration between agencies at Central and Local Level (see Figure 4).

Figure 4: The vision of the SIIGAT Project

Source: Internal references, Medidata.Net.

SIIGAT Project started in October of 2011 with this two performance ranges:

- Local and Regional Authorities – which required the implementation of a technological platform fully dedicated and adapted to the Angolan reality in the management of the agencies of the Public State Administration (MAs and PGs);

- Central Authorities (Ministries) – the access of management indicators that consolidated the information produced by different municipalities, enabling the aggregate analysis of Province/Regional and National realities, thematically and in territorial form.

In terms of implementation in this two types of organizations, the project translates in:

- Local and Regional Authorities – module installation that covers the operating areas of services;

- Central Authorities (Ministries) – central module installation dedicated only to the generation of management indicators produced on the information provided by the
modular system installed in the local and regional authorities. The purpose was to monitor the capacity of action in the municipalities and to provide diverse information all organizations of the State Central Administration in the field of Territorial Administration.

The implementation of the SIIGAT project extends well beyond the mere technological sphere. It encompasses the training and education of human capital of the organs involved, as well as the organization of services, adoption of methodologies, procedures and information circuits that promote the efficient use of the system and the quality of information provided to the core of the project for the production management of aggregate indicators at the national level.

Thus, the SIIGAT approach involves 3 key areas (see Figure 5): Technology, Consulting and Organization.

![Figure 5: Methodological approach of SIIGAT Project](Source: Internal references, Medidata.Net)

The implementation of the SIIGAT project was phased in accordance with the organizational and functional capacity of existing public services and with the priorities of the organizations involved.

The project implementation teams were constituted by experienced people and with knowledge based very multifaceted (different backgrounds and nationalities) - composed of technical experts in specific areas such as Management, Accounting, Finance, Management Team, Human Resources, Information Technology, Organization, Document Archive and Heritage, between others. The mobility of the consultants of the project depends on the areas of training that will be initiated in the organizations and the "know-how" needed for the success of the global project.
The SIIGAT project was aimed to be implemented in the 18 Angolan provinces, namely in state organs of type A (organizations with high development) and in some cases B (organizations with moderate development).

By March 2014, there were 61 State organs analyzed and with the requirements for implementation of this technological project. However, about half (31) had by that date effectively implemented the technology (see Figure 6).

Geographically, the implementation of the technology is presented, also at the national level and at date of March 2014 in the following figure:

![Figure 6: Number of organizations, by province which had implemented the SIIGAT Project](image)

Source: Internal references.

4.2.2. Description of the technology

The SIIGAT (Sistema Integrado de Informação e Gestão de Administração do Território) Project involved the implementation of a technological platform called SIGMA - Integrated Municipal and Local Government Management.

In its initial phase, the development of the SIGMA software was on Data Base Management Systems (DBMS) UNIFY with relational characteristics, however it was not sufficient to prevent the widespread use of programming in C. Therefore, INESC TEC developed a new tool named SAGA - Generation System and Application Management, which allowed to accelerate the development, reduce the amount of

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3 This chapter includes internal references provided by Medidata.NET.
programming code and transport the applications SIGMA to other DBMS (Bouça et al., 1995).

This system is suitable to work with databases in multi-user environment in various usage positions, preventing the repetition of tasks and data. The end user manipulates essentially views, while the application programmer’s work consists in drawing views, and specifying attributes and additional codes (rules and controls) through system views.

The programming and end-use environments are integrated, which is extremely versatile and suited for applications to support municipal management in areas such as: Accounting; Human Resources; Patrimony; Document Management Document Archive; Public Construction Works; and Business Intelligence System (BIS).

The core applications can joint with others by third parties. As such the applications can run separately or integrated sharing the data available - see Figure 7. The Accounting and Human Resources Management modules are usually the first to be installed and implemented in new agencies, being considered the most important for the organizations. BIS was also considered as one of the core applications in this project, especially for the executives use, supporting the decision-making and providing the synthesized information in a simple and efficient way – normally through graphs and user-defined criteria intersection of all information by classifications, stored in a multidimensional and hierarchical structure. The BIS application combined with Accounting and Human Resources Management enabled the analysis of consolidated data.

![Figure 7: Connections between module applications that constitute SIGMA](Source: Internal source by Medidata.Net.)
The SIGMA applications run on multi-post (more than one computer simultaneous) in SQL environment using Database Management Systems Relational but could also run in single-station – the access to control mechanisms ensured the necessary privacy or confidentiality of the information.

4.2.3. The transferor: developer of the technology

In 1986, CCRDN (Comissão de Coordenação e Desenvolvimento Regional do Norte), the Development Steering Committee of the North region of Portugal, and INESC TEC (Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciência), the Systems and Computer, Technology and Science Engineering Institute agreed on the terms for a collaboration to develop a Computing System for the local municipalities of Portugal (Bouça, Faria, Leitão and Moreira, 1995). This system aimed at overcoming the lack of organization and consistent solutions for the municipal management. By that time a group of municipalities of Alto Tâmega (North of Portugal) accepted the challenge proposed by CCRDN and INESC TEC to implement the system, permitting in this way to assess the technology proposed in terms of administrative rationalization and management decision support. The Municipal Computing Project (Projeto de Informatização Municipal - PIM) was born in 1986 and revolutionized the public administration in Portugal (Bouça et al., 1995).

The software developed, SIGMA, involved a set of integrated applications to support municipal management. The growing need of the local public authorities, made SIGMA grow being currently used in the majority of the municipalities in Portugal.

In October 1989 the company Medidata, Engineering and Systems, SA was founded in an university environment to improve and continue SIGMA’s development.

Medidata, SA evolved and, in the late 90’s managed to held the brand SIGMA, originally developed by INESC TEC. The company grew due to the “Boom” of Internet and the awareness by the municipalities of the growing need of modernization. In 2000, Medidata. NET was born as a subsidiary of Medidata, SA to focus on areas such as workflow, document management, intranet and internet.

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4 This section includes internal references/information provided by Medidata.NET.
5 SIGMA is the package with the largest number of applications in Portuguese authorities or municipalities, including key applications for the back-office namely POCAL, Urban Planning, Rates and Licensing Applications, totalling over than thirty applications. Therefore, Medidata provides distinct products for three different ranges, the management and local government, geographic and internet information.
SIGMA applications are currently in use in three countries: Portugal, Angola and Cabo Verde. Due to the versatility of the applications it can be re-programmed to fulfil different necessities and cover different legislative frameworks. The fact that these countries share a common language (being part of CPLP – Community of Portuguese Language Countries).

The SIIGAT was the first project object of international transference and involved the implementation of SIGMA platform in all the regions of Angola.

4.2.4. The transferee: provinces of Angola

The project SIIGAT failed to have the expected projection at the level of Angolan provinces due mainly to budgetary constraints caused by the oil crisis which had a huge impact on the Angolan economy.

Thus, the project was only effectively implemented in 8 Angolan provinces, the transferees: Luanda; Benguela; Cabinda; Biè; South-Cuanza; South-Lunda; North-Lunda; Cuando-Cubango.

4.3. Assessing the performance of ITT at the regional level

4.3.1. Estimating the ITT performance index

The value of ICT projects lie on their ability to assist the public administrations in finding solutions to their problems. Additionally, the success of this type of projects relies not in the end itself but on the means to an end (for example, quality of service delivery) (Gichoya, 2005). Therefore, the group of variables included in the computation of the ITT Performance Index addressed the impact of the technology on productivity and the assessment of the attitude of public servants.

As referred in the methodological section, the ITT performance index is an average of 4 items - Autonomy in routine tasks; Enforcement quality in routine tasks; Fast delivery data; Ability to parametrize the software -, which encompass the perception of the 15 consultants involved in the implementation of the SIIGAT project at the level of Angolan provinces.

This indicator was computed for each of the 30 organizations in study. Table 6 presents the overall average. It conveys that ITT, globally considered, was not particularly successful – 3.46 out of 7.
<table>
<thead>
<tr>
<th>Group of Variables</th>
<th>Variable</th>
<th>Description</th>
<th>Average per variable</th>
<th>More developed provinces</th>
<th>Less developed provinces</th>
<th>Standard deviation per variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Index</td>
<td>Autonomy in routine tasks</td>
<td>Consultants perception regarding the amount of routine tasks developed independently by the public servants on the respective services</td>
<td>4.02</td>
<td>5.00</td>
<td>3.00</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>Enforecement quality in routine tasks</td>
<td>Consultants perception regarding the quality of routine tasks developed independently by the public servants on the respective services</td>
<td>3.79</td>
<td>4.69</td>
<td>3.00</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>Fast delivery data</td>
<td>Consultants perception regarding the time spent on routine tasks after and previously the software installation</td>
<td>3.62</td>
<td>2.00</td>
<td>1.33</td>
<td>1.33</td>
</tr>
<tr>
<td>Assessment of the attitude of public servants regarding the technology</td>
<td>Ability to parametrize the software</td>
<td>Consultants perception regarding the parametrization of the software on specific data of the organization by the public servants on the respective services</td>
<td>2.40</td>
<td>4.33</td>
<td>2.50</td>
<td>0.71</td>
</tr>
<tr>
<td><strong>Global</strong></td>
<td></td>
<td></td>
<td>3.460</td>
<td>3.93</td>
<td>2.98</td>
<td>1.24</td>
</tr>
</tbody>
</table>

*Source: Internal sources.*

We further found that organizations located in higher-developed regions perform better than organizations in lower-developed regions.

The differences of the estimates are sharper for the item “Fast deliver data”, where organizations in more-developed regions present averages of five and six points and organizations in less-developed regions two or three points. The item “Assessment of the attitude of public servants regarding the technology” presents the most similar averages between more and less develop regions/provinces. This item largely contributes to the global average of the performance index, since it received the lowest evaluation. This factor consists on the perceived capability of public servants in the organizations to parameterize or to change parameterization of specific data of the software that enabled the technological platform to behave within the specific criterion of the organization – for example, changes to the initial budget entered in the computer platform. The assessment of the attitude is related to the willingness to work the software entirely, instead of abdicate the tasks of parameterization because they are considered more complex.
In contrast, the “Autonomy to perform routine tasks” is the item which received the highest rating. This sort of tasks involved routine and daily activities such as enter data or remove statistical maps, thus being the most clear and easy to transmit in an ITT.

The item “Enforcement quality in routine tasks” is rated below the autonomy item, since quality of performance is much harder to acquire, being a direct result of practice and autonomy (Parasuraman et al., 1998).

The remaining item, “Fast delivery data”, it is directly dependent on the autonomy of routine tasks, since it is only achieved after the continuous processing of data in the computer platform, the score of this variable is below than the autonomy and, even of that of the quality variable.

4.3.2. Estimation results: a panel data analysis

In order to make a comprehensive assessment of the determinants of ITT performance, we resorted to multivariate econometric models, the OLS and the panel data. The panel regression is the preferable specification for this study.

In terms of goodness of fit, the models are reasonable as evidenced by the F and Wald tests (reject the null hypothesis that the explanatory variables are jointly not significant to capture the variation of the dependent variable) and the value of $R^2$ (60%, in the panel data specification).

The RE panel model shows that the factors influencing ITT performance are mainly variables that characterize the organization in comparison with provincial characteristics. In spite of the diffusion of technology does not happen at the same pace in every region (OECD, 2012; Cozza et al., 2012), our results convey that, with the exception of region’s literacy level, the regional characteristics are not relevant (failed to evidence statistical significance for the standard levels) for ITT performance.

The estimated results for the selected sample show that some characteristics regarding the organization positively influence ITT performance, namely the organization’s size, collaborators’ average age, education and organization’s investment. Only gender and the number of senior technicians in total collaborators failed to emerge as statistically significant.

It was surprisingly that the impact of senior technicians in organizations, although positive, was not statically significant. But the number of top headers (in total
that the decentralization of authority and responsibility, resulting from a decrease of the number of head leaders, increases the efficiency of ITT. This might be related to a better division of tasks and functions in which public servants become more active and aware of their obligations.

Table 7: Results of econometric analysis - OLS and panel estimations

<table>
<thead>
<tr>
<th>Group of Variables</th>
<th>Variable</th>
<th>Proxy</th>
<th>Model I OLS</th>
<th>Model II RE effects panel model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Size</td>
<td>Number of inhabitants (in ln)</td>
<td>0.421</td>
<td>0.421</td>
</tr>
<tr>
<td></td>
<td>Literacy</td>
<td>People over 15 years of age who knows to read and write (in percentage)</td>
<td>2.850</td>
<td>2.850</td>
</tr>
<tr>
<td>Economic dynamics</td>
<td>Firms in activity</td>
<td>Number of firms per 1000 inhabitants (in ln)</td>
<td>-0.117</td>
<td>-0.117</td>
</tr>
<tr>
<td></td>
<td>Unemployment rate</td>
<td>Labour force that is not employed (in percentage)</td>
<td>-2.068</td>
<td>-2.068</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Access to water and electricity network</td>
<td>People with access to water and electricity (in percentage)</td>
<td>-1.221</td>
<td>-1.221</td>
</tr>
<tr>
<td>Public expenditures</td>
<td>Education</td>
<td>Total public expenditure devoted to education (in percentage)</td>
<td>-2.878</td>
<td>-2.878</td>
</tr>
</tbody>
</table>

Size | Size | Number of employees (in ln) | 0.167*** | 0.167*** |
| Age  | Employees’ average age (in ln)   | 0.881**  | 0.881**  |
| Gender | Total males employees (in percentage) | 0.125   | 0.125   |
| Education | Employees with college degrees (in percentage) | 1.235** | 1.235*** |
| Top Headers | Employees who are chiefs (in percentage) | -2.049** | -2.049*** |
| Senior Technicians | Employees who are senior technicians (in percentage) | 0.681 | 0.681 |
| Budget | Investment | Budget devoted to investment (in percentage) | 0.491** | 0.491*** |

Constant | -8.516 | -8.516 |
| Number of observations | 30 | 30 |
| F-stat (p-value)/Wald Chi2 (p-value) | 5.040 | 53.29 |
| Adjusted R-square | 0.652 | 0.525 |
| Hausman p-value* | 1.010 | (0.995) |

Legend: *,**, and *** represents significance at the 10%, 5% and 1% significance level, respectively.
Source: Own computations with Econometric Software – Stata 13.1.

The average age of employees in an organization emerged as statistically significant. Specifically, all the remaining factors being held constant, organizations with more
senior public servants have, on average, better ITT performance and, thus, higher probability of success in TT. The age of the public servants in the organizations is related to maturity and experience to perform daily tasks. Such result was surprisingly as it was contrary to the perception of the project consultants (who had the idea that the older the public servants the worse was the adaptation to new technology).

The highly positive and significant effect of public servants’ education, regardless of the position on the hierarchy, was not surprising and confirms studies performed in other parts of the world (see, for instance, Dollar and Kraay, 2005; Sadr and Farahani, 2012; OECD, 2015a).

According to the econometric estimations, investment by the organizations tend to increase the success of international technology transfer. This result is in accordance with several studies performed in developed and developing countries indicating that the efficient allocation of public expenditures in education and health promotes human capital development, economic growth and, decreases the poverty burden (Schultz, 1961; Swaroop, 1996; Barro and Lee, 1997; Psacharopoulos and Patrinos, 2002; Bynoe, Craigwell and Lowe, 2009; Mello and Pis, 2009).
5. Conclusion

5.1. Main results, contribution and implications for science

This study contributes to the growing literature on the ITT performance at a regional level. It was hypothesized that not only national characteristics but also regional and organizational characteristics influenced the success of ITT.

The 2015 corruption perception index shows that Angola remains with high public sector corruption, which also fuels inequality and exploitation between the organizations (Transparency International, 2015). It is also considered one of the hardest countries to do business due to the political uncertainty. Despite these factors, the European Intelligence Unit considers Luanda, Angola’s capital, as one of the 29 African cities with interest to business (The Economist, 2015). Moreover, Angola remains the first non-EU destination for Portuguese foreign direct investments (WBG, 2015; AICEP; 2016).

The present study confirms the perspective that is necessary to have critical forecasting and business information about a specific region for a successful international technology transference (ITT) and internationalization (Keller, 1996; Judge and Ryman, 2001; Cozza et al., 2011; Argilés, 2012). As a first cut in this matter, this study corroborates that both human capital and technological information are required for ITT, and subsequent continuous growth in less developed countries (Keller, 1996; Argilés, 2012).

Aiming at assessing the main determinants for ITT success, we resorted to exploratory analysis and multivariate econometric estimations. We showed that there were clearly ITT performance differentials across Angolan regions. Such result is in line with some earlier studies by Keller (1996), Landabaso (1997), Cozza et al. (2011), and Argilés (2012).

Most of the variables related to organizations’ structure were statistically significant, unlike the ones respecting provinces’ characteristics. We demonstrated that in order to fulfil an ITT project successfully the transferor must improve the capacity to address the particular contextual characteristics of the target organization and/or department. With exclusion of literacy levels, the characteristics of the ITT recipient regions do not influence ITT performance. Nevertheless, we should not forget the influence of the macro-dimensions over the organisations (see Figure 8).
This study allowed to confirm the theory that ITT success relies on different parameters depending on the institutions involved and their development level. There are some studies (e.g., Pursell, 1993; Rogers, 1995; Mohamed et al., 2012; Kumar et al., 2015), however, that contradict this perspective and consider ITT significantly depended on the appropriate choice of the right technology, especially in developing countries. Indeed, according with some authors (e.g., Rogers, 1995; Berg and Lin, 2001) the appropriateness of technology can be perceived based on several factors, such as the relative advantage from the previous solution.

The indept study of the selected ITT demonstrated that the technology/software transferred increased the performance of the organizations. However, since it was the first technological platform for supporting administrative procedures that was implemented in the organizations it was not possible to establish comparisons regarding other technological solutions.

This study emphasizes that the success of ITT is significantly dependent on the physical capital of public sector organizations, especially those located in lower-development regions, which is in line with some earlier studies by Drucker (1965), Keller (1996), Judge and Ryman (2001); Boddy, Hudson and Webber (2005); Argilés (2012), OECD (2012), Cozza et al. (2011, 2012). So, technology is only successfully transferred in organizations with particular features, such as larger organizations, with highly

Figure 8: Summary of variables identified in this dissertation as impacting on ITT Performance

Source: Own elaboration.
experienced and educated collaborators, and characterized by not marked hierarchical levels. Such results reflect, to a certain extent, the positive relationship between collaborators’ age and knowledge (Faulkner, 1995). The present study confirmed that the prior experience among the individuals affects the ability to received and internalise knowledge and, consequently, ITT (Cohen and Levinthal, 1993; Muzzi and Dandi, 2001; Santoro and Bierly, 2006; Araújo and Teixeira, 2014).

The individual’s insights and skills gained through personal experience and age, are often hard or impossible to transfer or replicate, which constitutes a major boost but also barrier to ITT (Santoro and Bierly, 2006; Sherwood and Covin, 2008; Arvanitis and Woerter, 2009).

Moreover, organizations with lower percentage of top headers revealed higher ITT performance. This can be related to the effectiveness in decision-making, since the actors involved in the transferring process may have different approaches and the power distribution, often leads to indecision and time-consuming (Araújo, 2006). Also, in the opinion of Dalfovo and Rodrigues (1998) the contact of the upper leaders with the computer is few or practically inexistent, which may negatively influenced the ITT performance.

There are quite a debate concerning the influence of the organization’s size on ITT (Gopalakrishnam and Santoro, 2004; Santoro and Bierly, 2006). The present study denoted that size is relevant for the transfer of knowledge, since the ITT performance increased with the number of public servants. Since larger organizations are commonly endowed with more human and financial resources, it seems normal that they can diversify into non-core areas and achieve a better performance (Rosner, 1968; Santoro and Chakrabarti, 2002).

Concerning the education or high skills of the personnel involved in the technology transference, our results are in line with most of extant literature (Vanderbussche et al., 2006; Inklaar et al., 2008a,b; Argilés, 2012) that shows their positive influence on productivity growth and ITT. Therefore the present study is in agreement with the prospect of Klauss (2000), which argued that the challenge of improving performance required resources allocated in the most productive areas.

The cohesion gap was visible in the results, with regional disparities especially in education (level of illiteracy in the organizations), economic (organizational budget)
and number of employees, as suggested in literature review (see Landabaso, 1997; Argilés, 2012). Also, as suggested by Cozza et al. (2012), the performance index was not homogenous across the regions of Angola, which is partly explained by different investments in the provinces, visible through the analysis of the annual budget.

Although the legislation is applicable at national level, it was not understood in the same way in all the provinces (CESO, 2015). Due to recent and profound changes in the national legislative framework, it was not executed in the correct way, especially at the level of the execution of regional budgets (CESO, 2015). The analysis based on data of annual budget execution, which are often less than expected, results in the non-application of financial funds in the provinces and a decrease of public investment.

In this study, the organizations with greater economic power are also the ones that features the best ITT performance. It is possible to assume that it is linked with the greater capacity to employ and renew the workforce with highly qualified skills, ensuring a proper distribution of tasks.

It is very important during technologic projects the efficient allocation of human resources and that these are in sufficient number and with the corresponding skills to assure the new task assignment. Otherwise, the projects are doomed to fail (Boddy, Hudson and Webber, 2005). That is, the economic characteristics affect the structural conditions directly.

Also, the influence of public expenditure for investment shows that it is possible to manipulate the regional objectives at medium/long-term with the execution of policy instruments to target specific measures with social impact. For example, if the priority is to reduce poverty level and increase education it should be increased the per capita expenditure on government administration. (Finances Ministry, 2014). Our results supports the relevance of investments in physical capital for ITT performance.

Our findings validate Keller’s (1996) position according to which the major constrain to ITT performance is the region’s stock of human capital.

5.2. Limitations and paths for future research

As in any other research, this study is not absent of limitations and shortcomings which raised additional questions.
This study is limited because it represents only a short time span - the data was gathered for the period of 2010-2014 which corresponded to Angola’s economic expansion, not covering the less expansionary subsequent period - since 2015 inflation increased and the international oil prices decreased (EIU, 2016). The Angolan growth is expected to be on average just 2.7% in 2016-2020, and the risk of social unrest is rising due to the lack of social, health and educational conditions especially in the most remote regions of the country (EIU, 2016).

Also, the analysis was limited to the public servants in Angola and the findings cannot be generalized to the employees in the private sector of the Angolan economy. It is noted, however, that in Angola the public sector drives the growth and development of the private sector (MAT, 2012).

In order to complement this research, a comparison with other cases of ITT in the regions of Angola would improve the knowledge about the regions.
References


*Discussion Papers, 515.*

[https://web.fe.up.pt/~jpf/research/REVIIMF95.pdf](https://web.fe.up.pt/~jpf/research/REVIIMF95.pdf)


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Lei n.º 39/11, de 29 de Dezembro – Alteração à Lei da organização e do funcionamento dos órgãos da Administração Local do Estado

Lei n.º 17/10, de 29 de Julho – Lei da organização e do funcionamento dos órgãos de Administração Local do Estado (posteriormente alterada pela Lei n.º 39/11, de 29 de Dezembro)


## Table 8: Definitions of Technology Transfer

<table>
<thead>
<tr>
<th>Year</th>
<th>Scholars</th>
<th>Viewpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>Rogers</td>
<td>A process by which an organization adopts an innovation made by another organization.</td>
</tr>
<tr>
<td>1970</td>
<td>Hall &amp; Johnson</td>
<td>A technology system in terms of whether it is embodied in people (person-embodied), things (product-embodied) or processes (process-embodied).</td>
</tr>
<tr>
<td>1970</td>
<td>Baramson</td>
<td>Technology Transfer as a transmission of know-how (knowledge) which enable the recipient enterprise to manufacture a particular product or provide a specific service, defining TT by the results achieved.</td>
</tr>
<tr>
<td>1973</td>
<td>UNCTAD</td>
<td>The act of transferring the needed technical knowledge that has been designed and managed.</td>
</tr>
<tr>
<td>1978</td>
<td>Giech</td>
<td>The transfer of ‘inventive activities’ to secondary users.</td>
</tr>
<tr>
<td>1978</td>
<td>Jeannet &amp; Liander</td>
<td>Technology transfer consists of any element or combination of research, development and engineering transferred across national borders.</td>
</tr>
<tr>
<td>1981</td>
<td>Sherman</td>
<td>The application of technology to a new use or user.</td>
</tr>
<tr>
<td>1981</td>
<td>Sahal</td>
<td>TT relies on the object transferred, however is not sufficient to simply focus in the product but also in the knowledge of its use and application which are embedded in the products, moreover all the additional knowledge that it is shared between the transferee and transferor.</td>
</tr>
<tr>
<td>1983</td>
<td>Derakhshani</td>
<td>An acquisition, development and utilization, of technological knowledge by a country other than in which this knowledge originated.</td>
</tr>
<tr>
<td>1985</td>
<td>Kanyak</td>
<td>The transmission of know-how to suit local conditions, with effective absorption and diffusion both within and from one country to another.</td>
</tr>
<tr>
<td>1985</td>
<td>Rodrigues</td>
<td>An application of new technology to a new use or user.</td>
</tr>
<tr>
<td>1985</td>
<td>Teepstra &amp; David</td>
<td>A cultural system concerned with the relationships between human and their environment.</td>
</tr>
<tr>
<td>1987</td>
<td>Shiowattana</td>
<td>A learning process wherein technological knowledge is continually accumulated into human resources that are engaged in production activities; a successful technology transfer will eventually lead to a deeper and wider accumulation of knowledge.</td>
</tr>
<tr>
<td>1987</td>
<td>Derakhshani</td>
<td>A country’s acquisition, development and use of technical knowledge.</td>
</tr>
<tr>
<td>1987</td>
<td>Das</td>
<td>Technology transfer can be the production of new product (product or embodied technology transfer) and more efficient production of existing products (process or disembodied technology transfer).</td>
</tr>
<tr>
<td>1990</td>
<td>Hoffman &amp; Girvan</td>
<td>Technology transfer needs to be perceived in terms of achieving three core objectives: the introduction of new techniques by means of investment of new plants; the improvement of existing techniques and the generation of new knowledge.</td>
</tr>
<tr>
<td>1990</td>
<td>Williams &amp; Gibson</td>
<td>The process of transferring the knowledge and concepts from developed to less-technically developed countries.</td>
</tr>
<tr>
<td>1991</td>
<td>Gibson &amp; Smilor</td>
<td>Technology transfer as chaotic, disorderly process involving groups and individuals who may hold different views about the value and potential use of the technology.</td>
</tr>
<tr>
<td>1991</td>
<td>Shiowattana</td>
<td>TT leads to a deeper and wider accumulation of knowledge for the transferee, measure TT in results obtained.</td>
</tr>
<tr>
<td>1992</td>
<td>Hayden</td>
<td>The kind of knowledge that can be used as inputs, such as patents rights, scientific principles and R&amp;D, but which must be able to be used to make products.</td>
</tr>
<tr>
<td>1992</td>
<td>Zhaoa &amp; Reisman,</td>
<td>The economists tend to define technology on the basis of the properties of generic knowledge, focusing particularly on variables that relate to production and design.</td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td>The sociologists tend to link technology transfer to innovation and to view technology, including social technology as a design for instrumental action that reduces the uncertainty of cause-effect relationships involved in achieving a desired outcome.</td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td>The anthropologists tend to view technology transfer broadly within the context of cultural change and the ways in which technology affects change.</td>
</tr>
<tr>
<td>1992</td>
<td></td>
<td>The business disciplines tend to focus on stages of technology transfer, particularly relating design and production stages, as well as sales, to transfer.</td>
</tr>
<tr>
<td>1993</td>
<td>Roessner</td>
<td>The movement of know-how, technical knowledge, or technology from one organizational setting to another.</td>
</tr>
<tr>
<td>1993</td>
<td>Levin</td>
<td>A socio-technical process implying the transfer of cultural skills accompanying the movement of machinery, equipment and tools. Transfer of technology is both the physical movement of artifacts and at the same time, transfer of the embedded cultural skills.</td>
</tr>
<tr>
<td>1994</td>
<td>Gibson &amp; Roger</td>
<td>The application of information where the process usually involves moving a technological innovation from an R&amp;D organization to a receptor organization.</td>
</tr>
<tr>
<td>1995</td>
<td>Austio &amp; Laamanen</td>
<td>An ‘intentional, goal oriented interaction between two or more social entities, during which the pool of technological knowledge remains stable or increases through the transfer of one or more components of technology.</td>
</tr>
<tr>
<td>1996</td>
<td>Farhang</td>
<td>Transfer of technologies in cases of manufacturing processes requires not only the transfer of technological knowledge in the form of process sheets, blueprints, products, engineering and technical personnel and materials specification, but also the transfer of know-how of high-calibre.</td>
</tr>
<tr>
<td>2001</td>
<td>Chung</td>
<td>Technology Transfer as the transmission of Know-how to suit local conditions, with effective absorption and diffusion both within and across countries.</td>
</tr>
<tr>
<td>2002</td>
<td>Phillips</td>
<td>The process by which ideas and concepts that move from the laboratory to the market place.</td>
</tr>
<tr>
<td>2003</td>
<td>Mascus</td>
<td>Any process by which one party gains access to another’s technical information and successfully learn and absorbs it into the production function.</td>
</tr>
<tr>
<td>2007</td>
<td>Chun</td>
<td>TT as a process how an organization or a country transfers scientific or technology achievements, new uses for technology, designs, and the technical knowledge that can be used in production.</td>
</tr>
</tbody>
</table>

Source: Adapted by: Sazali and Raduan (2011).