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MESTRADO

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TRABALHO FINAL DE MESTRADO

DISSERTAÇÃO

DUAL USE INTELECTUAL PROPERTY & TECHNOLOGY TRANSFERS UNDER THE SCOPE OF EXPORT CONTROLS

MARIA PAULA BASTOS DA SILVA BAPTISTA

MARÇO - 2013

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ORIENTAÇÃO:

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ABSTRACT

There are multiple ways of transferring technology and knowledge, either via tangible or intangible techniques. Knowledge and technology to be transferred can be embodied in goods, services, people, and organizations, and can assume several forms. It can also be passed on in training, any flow of tacit knowledge, any electronic transfer or any tangible media that can store tangible or intangible information. The transfer itself can occur between individuals and organizations, and is not confined within the borders of any country. The aim of this dissertation is to raise questions about the knowledge by the exporting companies of the existing export regimes that apply to technology transfers and to inquire, at this point, if technology transferees are aware of the need to comply with the rules identified by the several non-proliferation multilateral regimes.

Acknowledgments

I would like to thank Professor Doutor Mário Caldeira for accepting the challenge of orienting this dissertation, which addresses issues related to the non-proliferation of Weapons of Mass Destruction, still quite unknown to the general public, to several companies, and some organizations from the academic world, but well known by the international press and the Wassenaar Arrangement state members.

I would like also to thank SiliconGate and their CEO – Eng. Felisberto Lima, for taking the time to answer to my inquiries and questions.

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1. Introduction

Technology and advances in technology are one of the key items to drive progress. Progress is by definition movement towards a goal, or it can be a general and conceptual idea that the world or specific countries are evolving towards a better future, better quality of life, and access to technology by the common citizen in any field, general and specific scientific improvements that are usually translated as well into quality of life, social progress, democracy, etc.

Throughout the times, advances in technology, and technology itself, have been driven by either military or commercial purposes. During the last century, and throughout the cold war, technology was driven by military goals. Since the end of cold war, by the end of the last century, commercial purposes have taken the lead in driving technology forward. And since the beginning of the new century we all have witnessed the spread and escalation of global terrorism based mostly on religious fundamentalism.

Undoubtedly the dissemination of research and technology not always in a controlled way has contributed to the spread of these bursts of terrorism. Nowadays we can search and access almost any subject in the World Wide Web, which contributes positively towards progress, but as always it can be misused, placing in danger entire (civilian) populations.

Knowledge, research and associated technology are spreading across the world, and no longer are confined to industrialized countries or to borders. However

applied research and technology transfers are subject to specific export rules, and these need to be protected by legal mechanisms to promote security and non-proliferation issues allowing companies to profit from their own investments.

1.1 Purpose

The main motivation of this paper is to bring awareness into the export controls legal framework, the intangible goods and technology controlled under this framework, within privately owned companies and public institutes and companies that are not yet knowledgeable, while contributing to the pursue of the non-proliferation objectives. Physical controls are ensured by enforcement checks performed in customs and at borders. But these checks are only carried out on tangible shipments.

The aim of this paper is to focus on the knowledge of the exporting companies carrying out technology transfers that are subject to export regulations. This case study will show how a startup company operating in a very demanding market, such as the semiconductor intellectual property market, is behaving towards the compliance with the applicable regulation.

1.2 Research Questions and Objectives

The research objectives of this dissertation are:

- To describe how technology transfers are subject to export regulations;

- To alert private companies, startups and mature organizations, as well as government institutions, including universities, research institutes and related organizations developing applied research, that technology transfers are subject to export controls;
- To describe the importance of knowing and complying with export controls, while alerting for possible violations of the export controls.

The research question of this dissertation is:

- How can companies comply with export controls and regulations when performing technology transfers?

2 Literature Review

2.1 The Export Controls Background

Export controls in particular on weapons and military commodities[1] were initiated still during the end of the 19th century and beginning of the 20th century, on the Hague Conventions during 1899 and 1907. It was initially intended to control occurrences of armed conflicts and the potential injuries and the destruction caused by the conflicts. These conventions banned the use of the known chemical weapons of the time: «dum-dum» bullets[2] and other poisonous weapons. By 1925 another convention, where the Geneva Protocol

[1] For an explanation of the meaning of *commodity* referred please check the glossary in Appendix E.
[2] For an explanation of the *dum-dum bullet* referred please check the glossary in Appendix E.

was signed, also banned the use of asphyxiating, poisonous and similar gases, as well as bacteriological methods of warfare (Mallik, 2004).

As the Yale Law Journal mentioned, in 1949, the international commerce was never completely free from governmental regulation even then and still though the theoretical advantages of free trade as referred by A. Smith in The Wealth of Nation (Yale Law Journal, Jul. 1949). Nations had always erected barriers designed to report advantages to protect the domestic markets of local economic interests. As mentioned at that time, controls on exports were only employed in rare instances, in war or in emergencies, to maintain materials at internally and to conduct commodities in approved directions. These were first imposed as a war-time measure in 1940, and although other war-time measures were abandoned, export controls were maintained, at the time due to the European Recovery Program (Yale Law Journal, Jul. 1949).

By 1949 the Coordinating Community for Multilateral Export Controls (COCOM) was established by the US and its allies, with the purpose of denying dual-use[3] and military useful technologies, as well as dual-use equipment, to the USSR and the countries belonging to the soviet bloc. If the dual-use technology and equipment were diverted it would strengthen the military potential of the so called enemy. The state members of the COCOM were Australia, Belgium, Canada, Denmark, France, Germany, Greece, Italy, Japan, Luxembourg, the

[3] For an explanation of the meaning of *dual use* referred please check the glossary in Appendix E

Netherlands, Norway, Portugal, Spain, Turkey, United Kingdom and the United States (Mallik, 2004).

By 1992, COCOM had 17 participating states, some of them coming from the former Soviet bloc, which had collapsed together with the Berlin wall. By that time, the measures and controls defined by this organization were harming some of the newly joined countries that had previously been subject to sanctions. It was decided to establish a cooperating forum having the main objective: grant easy access to advanced goods and technology by the Eastern European countries, establish procedures to prevent diversion of dual use items and technologies to military or unauthorized users, assist the Eastern European countries to establish their own export controls and provide a mechanism for further cooperation on export control matters (Mallik, 2004).

In 1996 the Wassenaar Arrangement (WA) on Export Controls for Conventional Arms and Dual-Use Goods and Technologies replaced the former organization. The purpose of multilateral export control regimes is to regulate goods and technology transfers with potential military applications, introduce a licensing system on exports, establish a database for sharing information regarding a better coordination of controls, identity countries of concern and prevent the diversion of dual-use technologies to these countries (Mallik, 2004).

Export controls under the scope of the WA rely on the controls defined by the participating state members. The WA members cooperate to identify the items, technologies and commodities that are subject to controls. These are gathered

into different lists: the Munitions list and the Dual Use goods and technology lists. These lists are reviewed annually in Vienna by the participating members, removing unnecessary items from the lists and adding new items according to the appropriate technology advances (Mallik, 2004).

The WA acts as a harmonization framework concerning the list of commodities, items and technologies to be export controlled. The participating members, through their national policies and legislation, ensure the control on the exports. Member states, such as the US and Japan, have their own national export regulations, which contains the conversion of the WA control lists into the national legislation, while defining additional controls if required, including licensing mechanism and penalties for non-compliance entities (Mallik, 2004) (Wassenaar Arrangement, 2012).

The European Union (EU) state members share the same export regulations and general framework, but it's up to each state member to define how the licensing mechanism is performed, additional controlling mechanisms and penalties in case of non-compliance.

2.1.1 Dual Use Regulations

Parkhe (1992) refers that export controls are used by governments to: promote foreign policy objectives, enhance national security, prevent the export of short-supply materials and attain nuclear non-proliferation. The author refers that a study from 1987, analyzes the costs on the foreign policy export controls to

businesses, which the author suggested that the burden imposed by these should be minimized. Also the fall of the Soviet Union and the abandon of the Warsaw Pact by Eastern European countries, led to liberalization on the export controls. Some business leaders believed that an extensive control on exports that holds back the trade on advanced technology would harm trade among allies, since western advantages in technology relied on open communication, free markets and exchange of technology and information (Parkhe, 1992).

The controls and export regulations, by the end of last century, were different, and had different interpretations, which benefited companies from countries with more liberal trade and export control policies due to sales and revenue increase (Parkhe, 1992).

According to Harada (2010), during the cold war era the armed forces and the military applications promoted and funded the majority of the R&D in the semiconductor industry. Acquired and used the bulk of semiconductor components in the market, while controlling these types of exports. Nowadays it's the commercial product applications that drive the semiconductor business (Harada, 2010). Despite the opinion of Harada it is possible to notice changes in the export regulations and controls that took place after the end of cold war. Export controls and regulations are seen as an enemy-oriented foreign policy that changed with time, resulting in short-term advantages and long-term drawbacks. The export controls have evolved as agreements between allies, although maintaining the same objective of controlling the enemy technological

and military capabilities through technology controls and export regulations for technology transfers (Mallik, 2004).

Also the motivation and objectives on export controls have changed from the cold war age. The worldwide spread of terrorism and religious fundamentalism changed dramatically how security and vulnerability are seen, while extremist acting as criminals have no respect or liability to any national or international law or regulation. The author also refers that these terrorist actions are only possible since states have erroneously provided training, funds, arms and technology knowledge to the radical activists, in the context of other conflicts, and these actions have contributed to the efficiency of terrorists acts (Mallik, 2004). The misjudgment on supplying these countries and their radical activists with the knowledge and technology that was later used in terrorist acts, either abroad or in their own countries, is an obvious breach and failure on the implementation of the defined export controls. (Mallik, 2004)

The Wassenaar Arrangement (WA), as other international export control regimes, defines in its control lists what is restricted and what can be shipped without the need of an export license, and there are penalties for violation of regulations. But it's up to the participating states to seek, through their national policies, methods to ensure that transfers of these items do not contribute to the development or enhancement of military capabilities contributing to Weapons of Mass Destruction (WMD) proliferation. The criteria for considering an item as a dual-use item controlled under this multilateral regime (either

goods or technology), is important for the conception, development, production, use or enhancement of military capabilities (Wassenaar Arrangement, 2012).

Together with the continuous technology advances, there is the need to keep the control lists updated. The WA state members meet regularly, for updating these lists that are later converted into national regulations of each state member (Wassenaar Arrangement, 2012).

Aligned with WA export control regime, the EAR and the EU Council Regulation, as well as its state members translate and have adopted, on a regular basis, the information defined at the WA level, including the control lists, translating into their own set of national legislation the lists and defining the scope of the export regulations, including licensing and enforcement measures (EAR, 2012), (REGULATION (EU) No 388, 2012)

Trading dual-use items provide considerable commercial and strategic benefits for the individuals and states involved, as Wetter (2009) refers, therefore there is always someone that is willing to take the risks (Wetter, 2009).

The US, namely through the Bureau of Industry and Security (BIS), and some EU state members have defined specific export enforcements bodies that track illegal or unauthorized exports. When discovered, violations to the export regulations are subject to several enforcement actions (BIS, 2010) (BAFA, 1986). The failures of non-proliferation regulation and measures have occurred partially due to vulnerabilities detected in the use of delineated trade controls

(Wetter, 2009). The detection of violations regarding transfers of tangible dual use goods in the EU since the 80's, reveal that the threats are coming from individuals residing and companies established in the EU together with the low awareness from customs officers of dual use products and its end-uses, specifically in WMD proliferation (Wetter, 2009).

Wetter (2009) believes that the international non-proliferation objectives will only be effective if severely enforcing export controls are defined together with effective law enforcement that will allow that offenders are brought to justice. Subsequent to the discovery of violations, some EU state members have intensified their export control local legislation and the enforcement system, resulting in one of the most effective export control systems existing nowadays, taking from the number of investigations that result in prosecutions (Wetter, 2009).

The local export controls and local enforcement measures are not alike in all the EU state members. There is a gap and risk between the likely numbers of export violations occurring in trade activities and the number of prosecutions produced. Consequently, all state members need to review the effectiveness of their national trade control systems and enforcement measures to contribute to the non-proliferation objectives. And the UN Security Council Resolution 1540 (United Nations, Resolution 1540 - 2004) empowers UN member states to act proactively, defining and maintaining effective national law enforcements to

prevent dual-use export violations and the WMD proliferation (Wetter, 2009), (REGULATION (EU) No 388, 2012).

Although the US federal executive departments, the Department of State or Department of Commerce, through the BIS, or both, must grant approval to export sensitive military and dual-use items, publicly reported criminal cases show that individuals can bypass this requirement and illegally export restricted items (US GAO, 2009). To assess the efficiency of the US export controls, and the threat of diversion, United States Government Accountability Office (GAO) was asked to conduct undercover tests on tangible shipments, where they would attempt to purchase dual-use and military items from manufacturers and distributors in the United States, and attempt to export these without the detection of domestic law-enforcement officials (US GAO, 2009).

Generally and according to the EAR it's not mandatory to check end-users and end-uses if the destination is a US national destination, except for few items; therefore there is always the risk of exporting to unauthorized destinations or users, violating the US export regulations (EAR, 2012) (US GAO, 2009)

GAO found that sensitive dual-use and military goods and technology can be easily and legally purchased from manufacturers and distributors within the United States and illegally exported without detection (US GAO, 2009). Using a bogus front company and fictitious identities, GAO purchased sensitive items that are known to be found in countries at war, such as Iraq and Afghanistan. GAO was also able to export a number of dummy versions of the acquired items

shipping through mail to a country that is a known transshipment point for terrorist organizations (e.g. Dubai or Singapore) and usually where foreign governments attempt to acquire sensitive technology (US GAO, 2009).

In its study, GAO observed that due to the large volume of packages being shipped overseas, and large volume of people traveling overseas, enforcement officials within the United States cannot search every package and person leaving the country to ensure sensitive technologies are not being exported illegally (US GAO, 2009). As a result, terrorists and foreign governments that are able to acquire sensitive military and dual-use technologies through domestic purchases face few obstacles and risks when exporting these items. Again GAO in its study was not only able to purchase controlled items but, in two cases was able to illegally export controlled goods without detection (US GAO, 2009) .

On the other hand, and according to Wetter, effective international cooperation within WA and EU state members is essential for preventing, detecting and investigating unauthorized exports of dual-use goods. Without cooperation, it will be difficult to collect sufficient evidence to initiate a prosecution, let alone to secure a conviction. Member States, including their enforcement authorities, should be represented in international forums at which export controls on dual-use goods are discussed and make full use of the opportunities that such forums offer (Wetter, 2009).

Other authors as Harada also support that the access to sensitive technology should be a multilateral effort. For instance, the dry etch[4] technology, which is used in the production on semiconductors, namely to produce *nanometric* lines on the most complex semiconductors, is a restricted export control technology and the systems that use these are also under restricted classifications, and subject to licensing. On the other hand, the foundry[5] Shanghai's Advanced Micro-Fabrication Equipment (AMEC), based in China, which develops products using this restricted technology in 65/45/28-nm, has notorious advantages over its direct competitors. While most direct competitors in the US need to wait up to six month for an export license, AMEC, which is not subject to export control regulations or any multilateral regime regarding dual-use items since it's based in China and China is not part of the Wassenaar Arrangement, can produce and deliver controlled products faster and even without the use of an export license, not even checking the end-user or end-use as defined by most of the regulations (Harada, 2010).

Harada (2010) also refers that the lack of coordination among US agencies, together with the lack of interdepartmental coordination by Wassenaar Arrangement state members, harms national and consequently international

[4] For an explanation of the meaning of dry etch technology referred please check the glossary in Appendix E

[5] For an explanation of the meaning of *foundry* referred please check the glossary in Appendix E

security, on export controls for conventional arms and dual-use technologies (Harada, 2010).

Furthermore, one of the Department of Defense concerns is that with advanced semiconductor technology China is now able to update and develop modern weapon systems. By using advanced technology, China will be able to introduce commercial off-the-shelf integrated circuits that contain kill-switch circuitry, known as semiconductor Trojan horse, as being one of the most dangerous of sleeper cells and irregular warfare. According to Harada, the Central Intelligence Agency (US government) and Israel have already used this type of microchips containing kill switch circuits in the former Soviet Union and in Syria. The first attacked failed to work as designed resulting in an explosion and destruction of a Siberian natural gas pipeline. The second attack using commercial off-the-shelf microprocessor turned off Syrian radar, thus enabling Israeli jets to bomb a suspected Syrian nuclear facility (Harada, 2010).

And due to the advances of semiconductor technology the smaller the technology node is (the smallest feature on an integrated circuit) the more difficult it is to detect kill switches (Harada, 2010).

Wetter (2009) suggests on her book that effective intelligence-based monitoring systems should be established to identify suspicious activity, and a centralized risk management system should be established and effectively used. Customs officers should be equipped with the information, guidance and training they need in order to identify suspicious cases (Wetter, 2009).

Most authors refer to the transfer of tangible items within the scope of goods and technology. But there are other forms of transfers, namely technology transfers.

2.2 Technology Transfers

Exports are assuming a different scope, not only the physical aspect of shipping a tangible item subject to customs control, but also as intangible transfers, through intangible shipments such as technology or knowledge transfers from one country to another, or even physical shipments of media containing intangible products. As referred in the *Favorita Papers* (Auer, 2005), the WA US representative mentioned on her paper to the Wassenaar Arrangement called *United States Paper on Intangible Transfers of Controlled Dual-Use Technology and Software in The Wassenaar Arrangement* (Muldonian, 2005), that the EAR already considers several types of transfers: transfers to foreign nationals (called also as deemed exports) and electronic transfers, including over the internet or from one server to another, including servers in a cloud, as being subject to export regulations.

The German WA Representative also explained in his speech that technology exports are treated like any other type of exports under the scope of the Wassenaar Arrangement: export licenses are issued or denied according to the "Elements for Objective Analysis" and according to national laws of each member, also taking into consideration the destination country, the end-use

and end-users. He further states that the German Government has in the past organized seminars, which dealt with intangible technology transfers (e.g. the transfer of know-how orally or via e-mail). And that based on the results of the seminar, the WA elaborated common standards for these modern-world phenomena (Auer, 2005).

Also the EU export regulations refers that the transmission of dual-use items or technology through any electronic media or mean includes making it available in any electronic or oral transmission to a destination outside the EU or to individual persons and partnerships outside the Community is considered an export, and is subject to the EU regulation (REGULATION (EU) No 388, 2012).

Also according to the Nuclear Technology Note (NTN) and to the General Technology Note (GTN), the only exemption to the export regulations concerning technology is fundamental or basic research, since the objective of scientific basic or fundamental research is to make the results public (REGULATION (EU) No 388, 2012) (EAR, 2012).

As defined by the World Intellectual Property Organization (WIPO), the term "transfer of technology" in the context of intellectual property and patents may be comprehended in a narrow or broader sense. Broadly stated, the transfer of technology is a series of processes for sharing ideas, knowledge, technology and skills with other individuals or institutions, or through acquisition of ideas, knowledge, technologies and skills (e.g., in the context of B2B, companies and public/private research institutes, etc.) (WIPO, 2010). The narrow sense is used in

the context of transferring technologies from the public sector and universities to the private sector, where the term "transfer of technology" is sometimes a synonym to "technology commercialization" whereby basic scientific research outcomes from universities and public research institutions are applied to practical, commercial products for the market by private companies (WIPO, 2010).

As defined by the WIPO organization (WIPO, 2010), technology transfers increase the stock of knowledge of the receivers, which forms the basis for further development of technology, producing new products, processes or applications. For the receiver, the vital factor is the assimilation of a new technology which will result in improving market competitiveness. According to WIPO, the technology transfer consequence is the dissemination and further creation of knowledge and technology in society.

Acquiring technology developed by other bodies or organizations, also known as Commercial off the Shelf (COTS), is also a valid option, with fewer risks associated, if the company is not able to develop on its own. A technology transfer may occur by transmitting (orally), shipping in any form or by placing technical information, software or the technology necessary for the development, production and use by any party outside the country or applicable group of countries (EAR, 2012), (REGULATION (EU) No 388, 2012). As technology becomes more complex and develops in cross-cutting areas, which goes beyond the traditional fields of technology, it requires companies to

cooperate with other companies containing other areas of expertise, in order to develop products (WIPO, 2010).

Companies in the semiconductor industry tend to progressively integrate and combine 3rd party licensed design units, also called as Silicon IP or IP cores, in their proprietary designs, as the complexity of integrated circuits evolve and significantly increase. The integration of COTS licensed IP cores has become indispensable in the semiconductor industry since it allows companies to reduce development costs and gain time (Greenbaum, 2011). Semiconductor IP cores represent the functionality of a hardware device. Depending on the type of core chosen the licensing company can transfer it electronically (e.g. deposit in a cloud, upload in a specific server or transfer by FTP to the licensing company or foundry server waiting to be downloaded by the licensor or the foundry) in a variety of formats (Greenbaum, 2011).

Licensor companies design and develop discrete functional units, called the IP cores, and these will be integrated and combined into other designs to create a complete integrated circuit. Examples of semiconductor IP core comprise microprocessors, memory components, blocks for implementing USB or HDMI functionality, etc. The life-cycle of integrated circuits, ASICs and IP cores have several phases, and for each phase there are specific deliverables that may need to be sent to customers or suppliers anywhere in the world for review or for obtaining input. Usually, the cores begin as software models, afterwards are converted into machine-readable format and later into a graphic blueprint

format. The cores can be licensed and delivered to customers or suppliers at different stages of the life cycle described (Greenbaum, 2011).

Another important way of transferring technology is by reverse engineering, as technology may be transferred by studying and examining technologies used in acquired products, although this type of transfer requires that the receptor has the capacity to understand the part of the transferee to explore, understand and imitate the embedded technologies (WIPO, 2010).

As Mallik refers, multinational companies, with transnational suppliers, production centers and financial support, are responsible for more than half of the world's industrial output, either tangible or intangible. And Government agencies are no longer able to exert the same level of control over technological development or technology acquisition. Due to the financial pressure that companies are subject to and to the economies of scale, products are now developed in modular designs for using in off-the-shelf products and components saving on R&D costs, while moving the production, maintenance, and other related activities to developing nations at lower costs (Mallik, 2004).

Technology transfers and technology acquisitions can occur by transferring the ownership of the item itself, such as a product licensing, patents transfer or *Mergers and Acquisitions* (M&A) activities. In such cases, the tangible assets inherently involve both implicit and explicit technological knowledge and even the intangible assets. On the other hand the progress has driven to new means of data sharing, such as the use of data centers, shared services and

infrastructure in general. It is common to find several types of services and products on a cloud. Companies are using these services as cost effective and productivity measures. As defined by the National Institute of Standards and Technology, from the U. S. Department of Commerce (NIST), cloud computing is a model for enabling ever-present, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell, et al., 2011). In other words, allows the sharing of information, knowledge and technology on a shared infrastructure that can be located anywhere, are subject to export controls. Sharing technology and services such as cloud computing services are subject to advisory opinions issued by the BIS (Pratt, C. Randal, 2009), (Pratt, C. Randall, 2011), on the grounds that exporting technology and software through a cloud is considered an export. But there are some nuances, such as providing services via *a cloud* are not actually subject to any released regulation from the EAR yet. Although the EAR has already released an advisory opinion on this matter, the EU hasn't yet issued a ruling or has not suggested any opinion on how to consider services and technology transfers on cloud computing.

Also public domain technologies, as in the scope of patents application, that will be made available under technical publications (WIPO, 2010), are not subject to Export controls, since the knowledge or technology under a patent application

is disclosed or opened to the public. With the disclosure of technology in the scope of a patent application, the technology, the specific product applications or the embedded knowledge are now considered publicly available information and therefore no longer subject to the EAR or the EU regulations (EAR, 2012) (REGULATION (EU) No 388, 2012).

The existing dual-use regulation define a more general support structure for controlling activities related to the export of dual-use products in the EU, its implementation or execution is left to each member state. Therefore, different controls are used under the same regulation framework. These differences can vary not only from different understandings of the control list entries and the 'catch-all' provisions, but also for different types of available authorizations, and even different demanding requirements for the issuance of export licenses. These differences from state member to state member accentuate even more the difficulties to impose general export compliance methods within the EU (European Commission, 2011), (Wetter, 2009).

Dual-use exports, including technology transfers are regulated and the controls are mandatory in the EU and in other WA state members. These controls are especially related with security and non-proliferation issues, although trying to maintain the competitiveness of EU industry and services. In this sense, the handling of export controls can produce business losses due to the fact that an export license may not be issued and therefore the transfer cannot occur. Or can refrain profits and earnings depending on how quickly an export license is

issued, allowing a certain business to speed up the product or technology transfer, obtaining an advantage over the competition. So the WA state members, namely EU, have also to promote an equivalent basis of implementation on their state members to allow not only a standard implementation of the general export control framework, but also to allow an improved methodology that will allow a more promptly adherence to the changing world and the resulting technology (European Commission, 2011) (Wetter, 2009).

2.3 Export Compliance Framework

In this sense what is required for companies to comply with export regulation and its controls when it comes to technology transfers?

- **Awareness and Training**: In order to comply with regulations and controls one has to be aware of its existence. Every licensing entity in each governament and in each EU state member as well as WA state members need to promote awareness and training on applicable regulations and export controls (US Bureau of Industry and Security, 2012), including fines and penalties available for non-compliance (BAFA, 2009) . Each licensing entity has to reach and broadcast efectivelly each awareness and training session that they promote. Especially when it comes to intagible transfers, inlcuding technology (Duarte, et al., May, 2009) and know-how transfers (BAFA, 2005).

- **Individual control**: According to (Duarte, et al., May, 2009) these controls are to be carried out on an individual basis first, as a citizenship exercise, and based on an internal compliance program (EAR, 2012), (Fitzpatrick Associates, May 2004).
- **Nomination of a person responsible**: As part of the internal compliance program and also required by some WA state members in their applicable regulations. The nomination has to be done by the top management as the recognition of the importance and commitment to export compliance. The major duties for the appointed person include managing the compliance with the applicable national and international regulations comprising the definition of legal and operation procedures to comply with controls, supervision of roles and duties in order to assure compliance, as well as assuring internal communication and the broadcasting of key related information, assuring that key personnel receives the appropriate compliance training, while providing relevant training to other company positions as well .
- **Definition of an internal compliance program**: is one of the responsaibilities of the appointed person. The objective is to lay down all written instructions that key personnel use for exporting, delivery technology and intangible products, while checking for end-uses, end-users and country or countries of destination (BIS, 2012). This program likewise describes the recording keeping procedures acting in accordance

with the applicable national legislations, which change from state member to state member, either EU or WA.

- **Penalties and fines**: through the use of higher penalties and fines companies are encouraged to pursue complying with regulations and export controls (Duarte, et al., May, 2009), (DJEI, 2011), (BAFA, 1986), (Fitzpatrick Associates, May 2004).
- **Enforcement measures, Audits and Inspections**: Using also enforcement measures, such as spot checks, physical inspections and visits to companies made by customs and enforcement officials. Enforcement measures also include dialogue with exporters to ensure awareness of and compliance with existing laws and regulations (Fitzpatrick Associates, May 2004). A powerful mean to broadcast the compliance is to advertising the penalties in case of non-compliance (BIS, 2010).

3 Methodology

This work is based on a case study of a start-up company, which uses technology transfers as a mean to supply the intangible products, as well as to deliver product intermediate deliverables to customers, suppliers and partners worldwide.

The qualitative research approach applies since there are several topics to explore regarding the object of analysis and there were no formal theories to

explain the behavior of the case study participants, while studying them in their environment (Trochim, 2006).

Purpose of Research	Descriptive / Explanatory
Research Approach:	Induction / Theory Building
Strategy:	Case Study - single case study
Time Horizon:	Cross-sectional
Primary data collection	Semi-structured Interviews, and informal meetings
Secondary data collection	Company site, company documents, news on media

This case study is a mixture between descriptive and explanatory research. The purpose of the research is to explain the observed phenomena, problems and behaviors, identifying causal factors and results of the observed phenomena. While descriptive research is focused on producing precise observations, while examining the reason and causes for a particular phenomenon (Bhattacherjee, 2012). The case research approach chosen is induction, since it is the process of drawing conclusions based on facts or observed evidence (Bhattacherjee, 2012) and is also theory building, since the chapters will follow the logic defined for complying with export controls and regulations (Yin, 2003). And as mentioned by Bhattacherjee (2012) the case study can be used in a positivist manner for theory testing or in an interpretive way for theory building.

This research is based on the single case description due to the specific characteristics of the case study. The purpose of this dissertation is to bring awareness of the export controls that organizations are subject to. The first step is to understand if the studied organization is aware of the existence of the

export regulations and having this knowledge if it is complying with the regulations and export controls.

3.1 Research Strategy

The single case study was selected as the research strategy for this study due to the characteristics of the unit of analysis: a Portuguese start-up company (SiliconGate), developing and licensing IP Cores (or SIP), while delivering products and technology almost exclusively via technology transfers, while doing business and dealing with customers, partners and suppliers all over the world. This company, although privately held, has strong affiliations with a private research institute owned by a public university, therefore being an excellent candidate to test the research design. The studied company has a unique situation since it is a privately owned startup with a partnership with INESC-ID, a non-profit institute dedicated to advanced research, whose mission is to perform technology transfers, while supporting technology based startups to which they also provide technical support. INESC-ID is privately owned by INESC and the Instituto Superior Técnico, which also belongs to a public university - Universidade Técnica de Lisboa.

Yin (2003) and Saunders (2009) refer that single cases are the most appropriate method if the situation under analysis is a rare case (Yin, 2003), (Saunders, et al., 2009)

3.2 Data Collection and Observations

The types of data used in this dissertation range from private data provided by the company, the information available on their web site, news and other references available on specialized media, interviews as referred in B. Appendix - Semi-Structured Interview and information provided by the company members in previous conversations.

3.3 Semi-Structured Interviews

Interviews help the trustworthy and valid data collection process that is essential for the research questions and objectives (Saunders, et al., 2009). Semi-structured interviews are non-standardized data collection, which have a list of topics to focus on (Saunders, et al., 2009).

The interview was preceded by an email requesting a meeting to take place, and to describe the research framework of the dissertation, its objectives and the methodology used.

The interview was planned to be conducted in person, but due to several constraints in the agenda of the interviewee, it was conducted using a chat session. Upon gathering the data from the interview session, the information collected was sent by email to the interviewee for review. More details about the semi-structured-interview can be found in B. Appendix - Semi-Structured Interview.

Available on *Vimeo* is another semi-structured interview that occurred two years ago with another collaborator of SiliconGate working in another office. This interview was done by a member of UPTEC (Parque de Ciência e Tecnologia da Universidade do Porto) where one of the offices of SiliconGate operates. UPTEC is as a startup incubator. The interview focused on a different objective, which was to understand if the company is enjoying the services provided by the incubator, but it is still very useful since it provides a descriptive background on the startup company creation, its capabilities and market positioning, as well as affiliations with other institutes. The interview transcript is available on C. Appendix - Transcript of SiliconGate Interview - available on Vimeo.

3.4 Validity and Reliability

When using a case study it is important to use multiple sources of data. (Saunders, et al., 2009). The research must also focus on five items: the Construct validity which is given by the using several sources of evidence, by establishing a chain of evidence and by having, for instance, the research participants review the case study report. Internal validity is given by explanation building while the external validity is given by the usage of theory in single cases. The reliability is assured by demonstrating that if the data collection procedures are repeated and the same results are attained Yin (2003).

4 Case Study

4.1 Case Description

The case description is presented in Appendix A .

4.2 Summary of the Case Study Analysis

On the interview made with the CEO of SiliconGate several questions about the knowledge of the export controls and regulations were made. The answers were that the company was not familiar with the export controls but is planning to proceed with an assessment to check the status and compliance with regulations. Several other questions were made to understand if any effort was done to assure that the current practices, with or without knowledge of specific export controls, were being done and that would support the implementation of a future compliance programs within SiliconGate. All those questions referring either the knowledge of export regulations or concerning the implementation of an export compliance program were answered negatively. An interpretation of these answers, since the CEO and other members of the company were exposed to export controls in the previous company, is that they are aware of the existence of export controls, but not familiar with the actual controls and regulations applicable to the company products and related technology transfers (TT) activities.

Furthermore the end-use and end-user checks, which will ultimately, reveal if company is complying with non-proliferations efforts are not being executed.

However, since the order tracking records are kept then it will be easier to check for possible compliance violations in order to avoid these in the future transfers.

As mentioned by the CEO, the non-compliance issues are due to the fact that the company is still a startup that has been focusing in other areas of higher priority from a business point of view, such as product definition, market specialization and business growth.

In the interview the CEO also referred the next step would be to trigger a gap analysis assessment to check the compliance status to the applicable controls, and consequently the definition of an internal compliance process, together with the appointment of a responsible.

From the point of view of awareness and training, the national licensing entity is from time to time inviting companies through incubators and other official mechanism aiming to reach to companies, either mature or startups, and inviting them to free training awareness (Duarte, et al., May, 2009) but still this company did not answer to these initiatives and therefore the message is not achieving its goal. And also this company is not aware of the penalties in case of audits or inspections made by the applicable licensing entities and enforcing agents.

5 Conclusion

The purpose of this dissertation is to bring awareness to export compliances issues to companies as well as to public research institutes that their intangible

products, applied research results and technology transfers are subject to export controls. Furthermore, the means by which these are transferred to suppliers, partners, customers or other parties and any reexports are also subject to export controls. All the appointed items on page 22, the Export Compliance Framework, are part of the mandatory framework that companies and institutes have to comply with. The awareness and training is a shared responsibility not only from companies performing technology transfers but also from the national entities, since their efforts to bring awareness to companies, especially performing technology transfers has not been very effective.

Following this objective a high-tech startup company, with tight connections to a private research institute linked to a public university, was contacted with the aim of checking the export controls awareness, and its compliance to export controls. The company is specialized in developing IP cores for the mobile power management.

Due to the nature of the product portfolio it is unlikely that the products that the company develops have a restricted classification, as referred in the applicable regulations control lists (REGULATION (EU) No 388, 2012). Nevertheless the destination country, end-use, and end-user are not being screened or checked against the lists of sanctioned entities, either issued by the UN or the EU. And again these checks are part of the internal compliance program that this company is not complying with. However, since the order

tracking records are being kept then it will be easier to check for possible compliance violations, in order to avoid those in the future transfers.

In the interview the studied company clearly states that doesn't have an internal compliance program, never has matched their list of products or nominated a responsible to ensure the export compliance. On the other hand the national entities have to change national legislation in order to increase the penalties to higher values and defined strict enforcement measures, such as audits and inspections to secure the compliance on exporting companies, namely in the scope of technology transfers. Other EU state members have higher penalties and enforcement groups performing audits and inspections, so the exporters are encouraged to follow the export compliance regulations and controls, otherwise defined penalties will hurt their business (BIS, 2010), (BAFA, 1986), (Wetter, 2009).

The applicable regulation also refers the catch-all clause restricted by end-use or end-user will imply the need for an export license even from CGEA countries or other EU state member under specific conditions. On requesting the license to the applicable national authorities the license may be denied inhibiting the product delivery from occurring and producing possible revenue damages.

The examined company needs to execute the assessment that the CEO was referring to in this interview, in order to check any possible violation to the export controls and to classify all products against the classified list of products.

The findings of this case study show that for companies to comply with export controls, it is required to have prior knowledge on the regulations (BIS, 2010), (Duarte, et al., May, 2009) (Wetter, 2009). But still, even this company whose members have been exposed to a compliance policy and applicable procedures is still not enough to assure compliance with mandatory regulations (BIS, 2010). Therefore export regulation awareness is the first step to assure export compliance but also companies, regardless of their maturity status and size, need to approach the national licensing entities in order to gain knowledge on the applicable regulations and to understand how to comply with the applicable set of regulations (BIS, 2010) (BIS, 2012).

It is interesting to note on the interview carried to the current CEO of SiliconGate that, even though the team had previous been exposed to export training and daily activities, which were part of an internal export compliance, that the company and himself were not familiar with the export controls. It is also important to point out that the SiliconGate was formed in 2008 and before this some of SiliconGate entrepreneurs, received export compliance awareness training with MIPS, as part of the company policy. And while in 2009 an awareness session was executed by the local export licensing entity on dual use

items – DSL – had send out invitations[6] to the awareness session to several companies and incubators, including INESC-ID, SiliconGate partner.

5.1 Research Limitations

Throughout the literature review refers several types of technology transfers and export controls were mentioned. However the focus of this paper is specifically on export controls that apply technology transfers in the semiconductor industry, namely on the licensing companies that are developing silicon intellectual property and the methods that these companies use for transferring the licensed products, the intermediate product deliverables and technologies to customers, suppliers, partners or any other defined party to the transaction.

Many companies exporting tangible dual use items will eventually be blocked by custom agents if shipments are not following or complying with export regulations. But the challenge is and will always be how to assure compliance for companies performing technology transfers? The answer has to be related with intensifying penalties in a consistent way throughout the EU and WA state members, while broadcasting not only the enforcement checks and audits, but also the impact that penalties have in companies where export violations have occurred. The penalties aggravation is a discourage method that will hurt

[6] The head of the DSL – Dra. Maria Luísa Nobre, referred the way the invitations to the awareness session were sent out during a break session of the (Duarte, et al., May, 2009)

companies producing in the majority of cases the expected results (Wetter, 2009), (Harada, 2010).

5.2 Further Studies or Research

From a learning experience point of a view, it would be interesting to execute a study also on how national and international export authorities can reach effectively national or international technology companies either mature or startups that are not familiar with export controls in order to avoid any violations.

From an export compliance perspective, it is also interesting to check how changes in regulation and fines can improve the focus on the compliance.

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A. Appendix - Case Study Description

Founded in 2008, SiliconGate Lda. is a privately held company, based in Portugal. SiliconGate is a startup operating in the semiconductor industry, with 11 to 50 employees.

The entrepreneurs of SiliconGate came from another company called Chipidea, Microelectrónica, S.A, also a Portuguese founded company, which had been acquired initially by a Silicon Valley IP processor architectures and core company, named MIPS Technologies, Inc. During the integration phase of both companies the export controls were introduced to all the members of the local company.

On a second restructuring phase and also due to some poor financial performance of the recently acquired company, it was decided to phase-out some product lines, including the power management. During this phase-out phases the future founders of SiliconGate, which are all engineers decided that that was the right timing and market opportunity to create a company that would work in that vacant market niche, from the withdraw of former Chipidea IP power management cores.

«A SiliconGate resultou da união de um grupo de pessoas que tinham sido dispensadas da MIPS com um grupo de investigação que trabalhava em Power Management & Test no INESC-ID. Na realidade somos mais uma "spin-off" do INESC-ID, pois alguma da tecnologia e das ideias que usamos foram desenvolvidas no âmbito desta união a qual mais tarde foi contratualmente enquadrada. Mais tarde, quando se vislumbrou o início de sucesso o INESC-ID passou ainda a deter uma quota da SiliconGate como reconhecimento adicional por esta colaboração/"spin-off".»

«Numa fase inicial se tivéssemos sido uma "spin-off" da Chipidea teria facilitado muito, mas não o sermos também teve vantagens, pois obrigou-nos a muito mais esforço de investigação e a posicionar-nos muito acima da competição em termos de desempenho dos nossos cores. Só

assim conseguimos entrar no mercado. Agora temos a vantagem de sermos o segmento "high performance" algo que não existia antes neste mercado.»

Floriberto Lima, SiliconGate CEO, taken from an email exchanged.

«The SiliconGate resulted from the union of a group of former MIPS employees, whom have had been laid-off, with a research group working in Power Management & Test in INESC-ID. In light of these issues, we can be seen more closely as a "spin-off" of INESC-ID, since some of the ideas and technology that we have been using come from the development work conceived by this partnership, which was later placed in contract. Later on when success was initially recognized to SILICONGATE, the recognition of the partnership and/or spin-off was celebrated by giving to INESC-ID holding interests. »

«Initially if we had been a "spin-off "of Chipidea it would have facilitated our work a lot, but not being so also had advantages, since it forced us to develop a bigger research effort and position ourselves way above the competition, in terms of our cores' performance. And only then we were able to enter the market. Now we have the advantage of being in the "high performance" segment, something that did not exist before in this market niche. ".»

Floriberto Lima, SiliconGate CEO, taken from an email exchanged.

SiliconGate develops Silicon Intellectual Property (SIP) and subsystems or platforms, which are specialized in a particular area of Silicon IP, the mobile power management. The company develops a standard portfolio of SIP products that are advertised in specialized websites. However customers can approach SiliconGate looking for a specific IP product based on the existing portfolio but with specific features and/or performance.

The product life-cycle of an IP core has several phases, and most of these are sequential.

As any other product development logic, IP cores can be developed in an R&D strategy and for these the new product requirements are gathered from several

sources, including the market requirements, competitor's analysis, from the internal roadmap information, business strategy, etc. and previous developments benefiting from the reuse of previous products or product releases. For customer specific strategy products the requirements are mainly originated from the customer.

The initial phase, which can be called *Top Level Specification*, is where the Product datasheets and the high level model are generated. Also the other top level definitions such as the *Top Level Symbols, Schematics* and *Cell IDs* are also outlined.

These will contain more details as the circuit diagrams together with the symbols that will be used on the schematics are detailed in each phase. And the *Cell ID* will contain information about the symbols, the schematics, the requirements for *simulation test benches*, together with the verification and simulation results.

In this initial phase the *High Level Model* based on the defined requirements, is developed typically using Hardware Description Language (HDL). The HDL is used for describing the logic of the device and this representation does not detail the electronic components of the device that implements the logic, thus the abstract logic described using HDL can also be implemented by an extensive variety of circuits (Greenbaum, 2011). More details on the output of this phase can be found in Figure 1 - IP Core development phases (based on the description of (Greenbaum, 2011)).

The next design phase is called *Block Design* and is where the HDL model description is combined, using EDA tools, with specific libraries, which contain the characteristics of individual electronic components. These libraries contain information about

proprietary manufacturing processes and are provided by each foundry. During the *Block Design* phase are also generated the *schematics* and the *layout* for each block. The schematic will contain the representation and all devices in a block together with its connections, while the layout contains the planar geometric shapes of each block, which correspond to the patterns of metal, oxide, or semiconductor layers that will make up the components of the integrated circuit. The schematic and layout steps will also provide information for developing the verifications and simulations according to the performance requirements of each block and the whole circuit. In this steps it is also required to plan for power and timing limits and related constrains before initiating the model simulations.

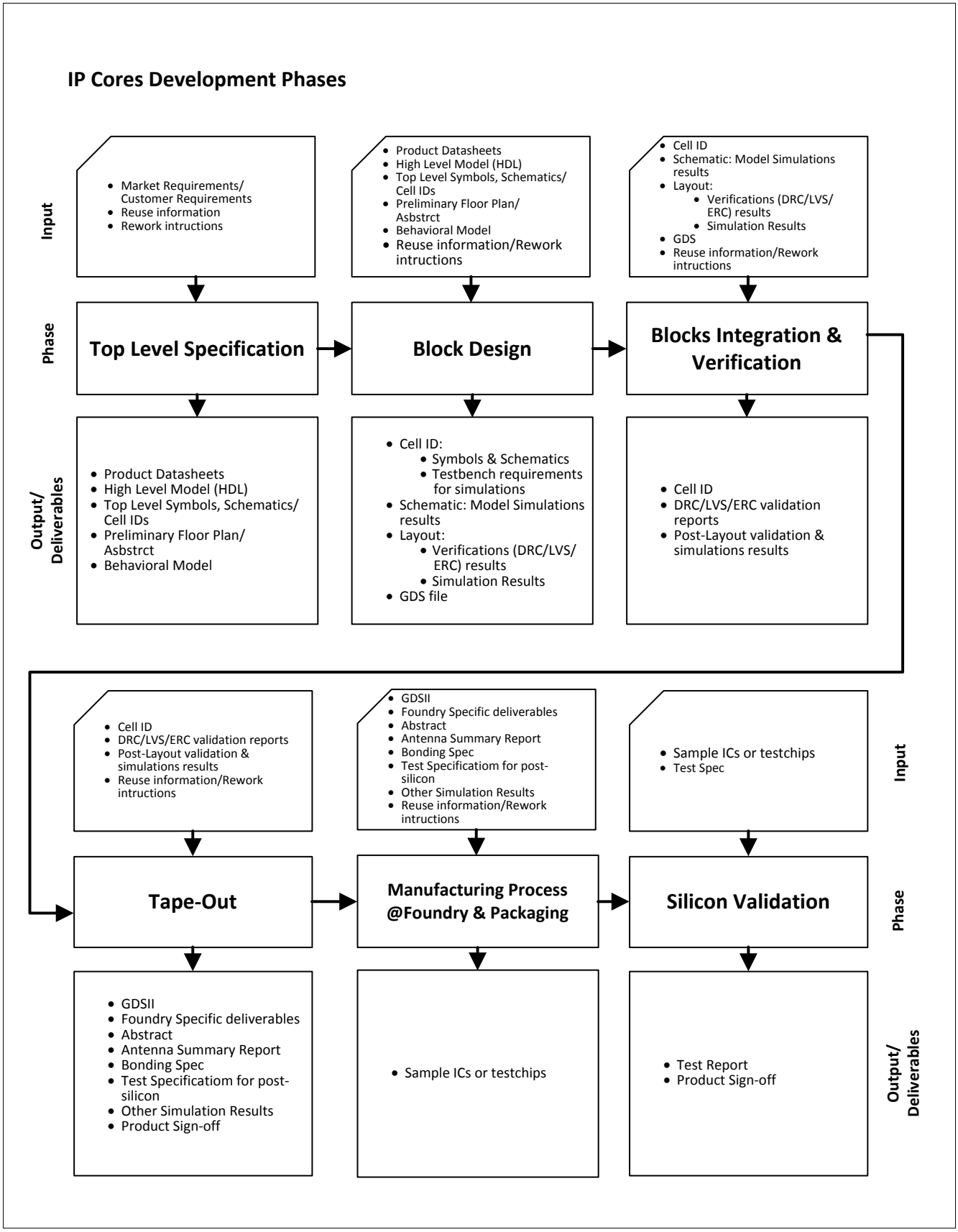

Figure 1 - IP Core development phases (based on the description of (Greenbaum, 2011))

The next phase is the block integration and verifications, which corresponds to place all individual blocks that have been developed and connecting. Similarly all simulations and verifications have to be repeated in order to ensure that the performance of the circuit blocks running together is according to the specifications. After this is guaranteed the Tape-Out will follow. The tape-out is the delivery phase to either a customer or to a foundry for prototype manufacturing. Together with the GDSII file that contains the information of the developed circuit, it is required to prepare also other foundry specific reports and deliverables. The output of the last manufacturing process is silicon wafers that are then cut into small parts, the dies, each containing the IP core. In order to test physically the circuits diagrams it is necessary to place these into a package that allow the connection to other devices to proceed with the verification and validation tests that will demonstrate the achieved performance of the circuit.

The next phase is for testing the samples ICs, also called test chip, according to a defined test battery and to examine the results with the core requirements and this phase is called the Silicon Validation.

The IP cores can be licensed to fabless integrated circuits manufactures and SoC integrators at different stages of the development process described (Greenbaum, 2011) or can be licensed on a R&D strategy after the core is fully developed and tested. Regardless of the development strategy, deliverables of different phases can be sent either to customers, foundries or even other 3rd parties.

Also if the product being developed is a customized product milestone deliverables of any phase can be sent to the customer via TT, for review purpose and as a validation measure. Since The company is working in a worldwide environment a transfer of any deliverable, either for standard or customized products is considered an export and therefore subject to export controls.

According to the information made available in previous conversations and in the interview, the company is not performing any activity towards the compliance with the export controls.

B. Appendix - Semi-Structured Interview

The semi-structures interview was preceded by an email requesting the interview to take place, describing also the framework of the dissertation, the research objectives, the methodology used and any relevant operational question.
The interview whenever possible will be conducted in person. Due to the physical location of some of the interviewees which may be stationed in other cities or even in other countries, the interview will have to be conducted by phone or using a chat session. Upon finishing gathering the data of each interview session, the information collected will be sent to the interviewee for review purposes. Also when all information regarding the case study is collected and analyzed, the case study conclusions will be shared with all participants.

Email sent to the interviewee

Email subject: Interview phase as part of the master dissertation on the topic Dual Use IP & Technology Transfers under the Scope of Export Controls.
From: Paula Baptista
Sent: Friday, May 25, 2012 12:18 AM

To:
Subject: Interview phase as part of the master dissertation on the topic Dual Use IP & Technology Transfers under the Scope of Export Controls
Dear Floriberto,

Throughout the times, advances in technology, and technology itself, have been driven by either military or commercial purposes. During the last century and throughout the cold war technology was driven by military goals. Since the end of cold war, commercial purposes have taken the lead in driving technology forward. Since the beginning of the new century we all have witness the spread and an escalation of global terrorism based mostly on religious fundamentalism.
Undoubtedly the dissemination of applied research and technology not always in a controlled way has contributed to the spread of these bursts of terrorism. Nowadays we can search and access almost any subject in the www, which contributes positively towards progress, but as always it can be misused placing in danger entire (civilian) populations.

Knowledge, research and associated technology are spreading across the world, and no longer are confined to industrialized countries or to borders. However applied research and technology, including its transfers, are subject to specific export rules, and these need to be protected by legal mechanisms to promote security and non-proliferation issues, protect patents, trade secrets, developed by privately held companies, public entities and individuals from others to exploiting their invention and allowing them to profit from their investment.

Controlling the exports is a necessary procedure, since these can prevent the development of WMDs and other misuses of commercially developed products or components, chemical or even biological substances by countries where life is not cherished. But on the other hand the export controls and the applicable legislation cannot prevent or endanger commercial companies from doing business. There has to be a balance between the export controls and the misuse of products. And the balance can be achieved if companies are aware of the «red flags» in specific transactions as well as the applicable regulations in the scope of export controls.

The main motivation for paper is to bring awareness into the export controls legal framework, and the goods and technology controlled under this framework, within privately owned companies and public institutes and companies that are not yet knowledgeable while contributing to the pursue of the non-proliferation objectives. Although many multinational companies are performing regular checks, many other companies either public or privately held are transferring technology and knowledge lacking any assessment regarding these controls. Most of these are not aware of the regulation existence or the forms of application while others are aware but have decided to be not compliant. The aim of this paper is to focus on the technology transfers that are subject to the export regulation.

Therefore the aim of this dissertation is to raise questions about the knowledge of existing export regimes that apply to certain technology transfers and to inquire, at this point, if technology transferees and receivers are aware of the need to comply with the rules identified by the several non-proliferation multilateral regimes.
In the attached document you may find, together with the research objectives and the methodology used for the interview phase, a set of questions that we would like you to reflect on while providing us your insight. Would you be willing to schedule an interview to allow us to collect this information?
Thank you.
Best regards,

Interview Methodology

For this dissertation it will be used the case-study strategy. The goal is to understand how each of the companies that are part of this study deal with the export regulations either in the scope of dual-use IP and/or technology transfers.
The interview is structured in the following groups of questions:

- Questions about the interviewee and general company information
- Questions about the knowledge on the export compliance regulations
- Questions about the next steps on the export compliance internal program

Interview Questions & Transcription

Some of the following questions were taken and adapted from the export compliance program available under the EAR. Following there is the transcript of the semi-structured interviewed done for the single case study.

Questions about the interviewee and general company information

(1) Please give us your name and the name of the company you work for?

Floriberto Lima, SILICONGATE LDA

(2) Please indicate the company operation area? Or in other words what is the market where the company is positioned?

Europe, USA, South Korea, Taiwan, China, Israel

(3) What type of product or services are developed and delivered to customers? (Please describe with some detail)

Microelectronics Power Management IP. Licensing on a per use base. IP supplied as hard macro.

(4) Where is the company located? (Region and country, if applicable)

Europe, Portugal

(5) What type of market (national/international) is the company working for?

International

(6) How long ago was the company formed? (in years)

4

(7) Please describe your profile, years of experience and your role or position within your company?

3 years CEO, responsible for general management and worldwide sales

(8) How does your company deliver its products and/or services? Please described if these are tangible and/or intangible methods?

Intangible (digital database delivery through FTP)

Questions about the knowledge on the export compliance regulations

(9) Are you and your company familiar with the export controls?

No

If your answer was 'yes' to the previously question, please proceed to the next question. If it was 'no' please proceed to question (21)

(10) Please name the export regulation you are familiar with and that your company is subject to?

(11) Does management issue a formal Management Commitment Statement or an export compliance policy that communicates clear commitment to export controls?

(12) Is the formal statement from current senior management communicated in a manner consistent with management priority correspondence?

(13) Does the formal statement or the export compliance policy states that no sales will be made contrary to the applicable export regulations?

(14) Does the formal statement or the export compliance policy emphasize End-Use/End-User prohibitions?

(15) Does the formal Statement include the name, position, and contact information, such as: e- mail address & telephone number of the person(s) to contact with questions concerning the legitimacy of a transaction or possible violations?

(16) Is the management commitment communicated on an ongoing basis by: Company publications? Or regular operating procedures?

(17) What management records will be maintained to verify compliance with procedures and processes (including the formal statement or the export compliance policy)?

(18) What management records will be maintained to verify compliance with procedures and processes (including the formal statement or export compliance policy)?

(19) How long and in what format the records must be retained?

(20) Do the formal statement or export compliance policy related procedures include re-export guidelines or any special instructions?

Information related to company products

(21) Have your company ever matched its product line against the list of controlled products?

No

(22) In that case what is the outcome of that assessment?

(23) Is there a written procedure that describes how items are classified under the applicable export regulation?

No

(24) Does a technical expert within the company classified or helped in the items classification?

No

(25) Is there a written procedure that describes the process for seeking commodity jurisdiction determinations[7]?

NO

(26) Is an individual designated to ensure that product/country license determination guidance is current and updated?

No

[7] When doing business, ie exporting from several countries it is require to understand the local jurisdiction and applicable legislation. For instances special attention has to be made regarding reexports issues, *de minimis rules* (§734.4 and Supplement No. 2 to part 734 of the EAR) and the origin of goods.

(27) When shipping products are there any records about the appropriate shipping authorizations, license required or no license required (NLR)?

NO

(28) Are reporting procedures required by local authorities and/or by applicable legislation or export regulation?

Not known

Information related to screening checks on end-users, end-use and destination country

(29) Are screening checks regarding persons or entities performed, including sanctioned countries?

No

(30) Does the company have an on-going procedure for monitoring compliance of consignees, end-users and other parties involved in export transactions?

No

(31) Is there a written procedure to ensure screening of orders/shipments to customers covering servicing, training, and sales of items against the applicable list of entities, persons or countries sanctioned or restricted?

No

(32) Is there a procedure to stop orders or shipping activities if a customer and/or designed consignee (and/or other parties) are found on any restricted or sanctioned lists?

No

(33) Are all orders documented and maintained on file?

Yes

(34) Is a checklist with the regular export checks such as end-use, end-user, destination country and product, documented and maintained on file for each and every order?

No

(35) Is there a database of customers with most relevant business information?

No

(36) Is a checklist regarding end-use and other relevant export control information documented and maintained on file in the customer profile?

No

(37) Is the customer base checked at least annually against the red flag indicators or when a customer's activities change?

No

Information related to export compliance training

(38) Have export/distribution/sales personnel been instructed on how to recognize situations that may involve prohibited end-use activities, such as nuclear, missile systems & unmanned air vehicles, prohibited chemical & biological weapons?

No

(39) Is a list of employees/positions defined who should receive export control/compliance training?

No

(40) Are there written procedures that describe an ongoing program of export transaction/compliance training and education on a cyclic basis?

No

(41) Is there a schedule to conduct export compliance training (including date, time, and place)?

No

(42) Are attendance logs used for documentation which includes agenda, date, trainer, trainees, and subjects?

No

(43) Do training methods include:

- Orientation for new employees?
- Formal (structured setting, agenda, modules used)?
- Informal (less structured basis, verbal, daily, on- the-job exchanges)?
- Circulation of written memoranda and e-mails to a small number of personnel, (usually group specific instruction)?
- Refresher courses and update sessions scheduled?
- Employee desk procedure manuals?
- Back-up personnel training?
- Deemed exports?

None, no training

(44) Do the written procedures clearly describe detailed step-by-step processes that employees are expected to follow, regarding regulatory record keeping?

No

Information related to export compliance audit

(45) Are written procedures established to verify ongoing compliance (audit)?

No

(46) Are internal reviews performed on a cycle basis?

NO

Information related to reporting and escalation procedures

(47) Are there internal procedures in place to notify management within the company if a party is determined to be in non- compliance? Is contact information provided for each official in the chain?

No

(48) Are there internal procedures in place to notify the appropriate Government officials (e.g., export administration's office within each of the applicable jurisdiction) when non-compliance is determined?

No

- ***Questions about the next steps on the export compliance internal program***

(49) Regarding the set of questions above, are you and your company planning to develop a new or improve the existence export compliance policy or program?

Yes

(50) What are the next steps or goals planned towards the export compliance policy or program?

General assessment and implementation of the required process.

C. Appendix - Transcript of SiliconGate Interview - available on Vimeo

Interview to Pedro Faria de Oliveira of SiliconGate, done by Alberto Mendonça of UPTEC in 2010. The full interview is available under the following link: http://vimeo.com/6501300. The objective of the interview is to assess one of the company members regarding the usage of the UPTEC facilities, but the initial part of the interview, which describes the company in an informal way how it was formed, is very interesting. This transcript will only focus on how the company was formed and partnerships it has.

(1) Como surgiu a ideia de formarem a SiliconGates?

A SiliconGate nasceu mais ou menos de uma oportunidade. A Chipidea Microelectrónica tinha sido vendida, portanto estamos a falar de 2007/2008, e houve uma altura em que foi restruturada pelos novos donos – a (empresa) americana MIPS. E alguns dos colaboradores da Chipidea viram a oportunidade (de criarem a empresa), porque durante essa reestruturação a MIPS decidiu descontinuar algumas áreas de negócio. Algumas (áreas) que tinham bastante sucesso e uma boa quota de mercado mundial. E portanto por aí surgiu a ideia. Então algumas pessoas juntaram-se e tomaram a decisão de arrancar com a SiliconGate para tentar agarrar essa quota de mercado, que tinha sido deixada livre pela Chipidea.

(2) Qual é o core business da SiliconGates?

Pode mos dizer que o core business é IP na área da micro-electrónica. Portanto propriedade intelectual na área a micro-electrónica. Fazemos circuitos e, dentro desta área que acaba por ser um bocadinho grande, porque há muito tipo de circuitos, nós especializamo-nos em mobile power management. Portanto são circuitos de gestão de energia para aplicações móveis – telemóveis, PDAs (smartphones), leitores de mp3, essas coisas todas.

(3) Quais são a principais dificuldades com que se estão a deparar nesta fase de arranque?

Ora bem, essa pergunta já é mais complicada. Todos os sócios são engenheiros (da área da electrónica), nunca tinham aberto uma empresa, apesar de já termos alguma experiência profissional, uma coisa é estar a ver as coisas a serem feitas outra coisa é fazê-las. É sempre um bocadinho diferente. Portanto essa será uma barreirazinha que irá ultrapassar com o tempo, mas que nunca estará completamente ultrapassada. Além disso temos a actual conjunctura que não nos favorecerá muito no arranque, mas também não será necessariamente má, tem efeitos positivos, porque a concorrência estará a sofrê-la mais do que nós provavelmente. Porque já tem uma estrutura montada que tem de sustentar e com o encolher do mercado tem mais dificuldades.

Mas de qualquer maneira para nós (a conjuntura) também dificulta um bocadinho. Esse será se calhar o entrave maior. E depois a outra questão que nos segura agora um bocado é, se calhar tem também a ver com a nossa experiência nesta área que é portanto a ansiedade de começar. Há muita incerteza, o que é normal e as coisas até estão a correr bem.

(4) Que trabalho já estão a executar ou pretendem implementar brevemente?

Ora neste momento para entrar no mercado temos de provar as nossas competências. Fomos ajudados por causa da nossa experiência na Chipidea, isto é os clientes conhecem-nos em muitos casos, mas isso só por si não chega. É preciso provar que para além das próprias capacidades das pessoas a empresa tem capacidade de garantir que o trabalho é feito.

Portanto numa primeira fase estamos a desenvolver os circuitos novos. Tudo de novo e a testá-los. Estamos a produzir o que nesta area se chama os test-chips que são produzidos em colaboração com o INESC-ID, com a entidade com a qual temos uma parceria. Já produzimos o primeiro, que tem alguns circuitos dentro. Alguns circuitos que são fundamentais para começar, que está neste momento a ser testado e cujos os resultados preliminares são bons.

Já fizemos um segundo test-chip, mas ainda não chegou da fábrica (foundry) e estamos a preparar um terceiro para vir a 21 de Setembro se não me falha a memória.

(5) Com que apoios e parceiros podem contar neste momento para assegurar a sustentabilidade da empresa?

Parceiros em termos financeiros não temos nenhums. São os próprios sócios que estão a garantir a sustentabilidade da empresa. Em termos de parcerias, mas aí não entra tanto no campo financeiro, temos como eu já disse o INESC-ID.

É uma parceria muito importante porque nos abre as portas a uma imensidão de recursos, que caso contrário seria muito difícil de garantir, porque é muito dispendiosa e uma empresa começcar assim é muito difícil. Mas em termos de parcerias é só isso. .

(6) O que é que ambicionam a médio-longo prazo conquistar?

Mais uma pergunta difícil. Em primeiro lugar temos a clara ambição de sermos líderes mundiais a fornecer este tipo de propriedade intelectual. Portanto os circuitos de power management, direccionados para a área de mobile power management. Essa será a nossa primeira ambiçao. Correndo bem esta temos muitas outras hipóteses... porque nós no fundo somos engenheiros e projectamos circuitos... circuitos... há imensidão de circuitos que o mercado pede todos os dias.

Neste momento com toda a sinceridade estamos a pensar nisso, estamos totalmente focados nisto. E isso será tudo a médio-long prazo. A curto prazo nós claramente queremos investir na área de mobile power management e ser líderes mundiais de mercado nessa área.

D. Appendix - Acronyms

Acronym	Description
(US) GAO	United States Government Accountability Office
AG	Australia Group
ASIC	Application-Specific Integrated Circuit
B2B	Business to Business
BAFA	Federal Office of Economics and Export Control [Germany]
BIS	Bureau of Industry & Security [USA]
CCL	Commerce Control List.
CEO	Chief Executive Officer (corporate title)
CGEA	Community General Export Authorization
CIA	Central Intelligence Agency (US government)
COCOM	Coordinating Community for Multilateral Exports Control
COTS	Commercially Off-the-Shelf Products
CW	chemical warfare
CWC	Chemical Weapons Convention
DoC	United States Department of Commerce
DoD	United States Department of State
DSL	Direcção de Serviços de Licenciamento
EAR	Export Administration Regulations [USA]
EC	European Community
ECCN	Export Control Classification Number
EDA	Electronic Design Automation
EU	European Union (or Community)
FW	Firmware
GAO	United States Government Accountability Office
GTN	General Technology Note (REGULATION (EU) No 388, 2012)
HDL	Hardware Design Language
HDMI	High-Definition Multimedia Interface
HW	Hardware
IC	Integrated Circuit
INESC	Instituto de Engenharia de Sistemas e Computadores
INESC-ID	Instituto de Engenharia de Sistemas e Computadores - Investigação e

Acronym	Description
	Desenvolvimento
IP	Intellectual Property
ITAR	International Traffic in Arms Regulations
M&A	Merger and Acquisition
MTCR	Missile Technology Control Regime
NIST	National Institute of Standards and Technology, U. S. Department of Commerce
NLR	No License Required
nm	Nanometer
NPT	Treaty of Non-Proliferation of Nuclear Weapons
NSG	Nuclear Suppliers Group
NTN	Nuclear Technology Note (REGULATION (EU) No 388, 2012)
OPCW	Organization for the Prohibition of Chemical Weapons
R&D	Research and Development
SIP	Silicon Intellectual Property
SW	Software
TT	Technology Transfer
UPTEC	Parque de Ciência e Tecnologia da Universidade do Porto
US	United States of America
USB	Universal Serial Bus
VLSI	Very-Large-Scale Integration
WA	Wassenaar Arrangement
WIPO	World Intellectual Property Organization
WMD	Weapons of Mass Destruction

E. Appendix - Glossary

Term	Definition
Appendix lists or control lists	Lists of controlled items under the EU Dual-use Regulation. These are composed of Appendixes I and IV of the EU Dual-use Regulation. The Appendix I list includes all dual-use items that should not be exported from the European Community without authorization. The Appendix IV list contains the items from the Appendix I list that will require an authorization – export license – even between EU member states (Wetter, 2009). The items under these Appendix are based on control lists adopted by international export control regimes – the Australia Group (AG), the Nuclear Suppliers Group (NSG), the Wassenaar Arrangement and the Missile Technology Control Regime (MTCR) Source (Wetter, 2009) See also CCL
ASIC	An application-specific integrated circuit, or ASIC, is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use. For example, a chip designed to run in a digital voice recorder is an ASIC. As feature sizes have shrunk and design tools improved over the years, the maximum complexity (and hence functionality) possible in an ASIC has grown from 5,000 gates to over 100 million. Modern ASICs often include entire microprocessors, memory blocks including ROM, RAM, EEPROM, Flash and other large building blocks. Such an ASIC is often termed a SoC (system-on-chip). Designers of digital ASICs use a hardware description language (HDL), such as Verilog or VHDL, to describe the functionality of ASICs. (source: http://en.wikipedia.org/wiki/Application-specific_integrated_circuit)
Basic Scientific or Fundamental Research	Experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective (EAR - Definitions of Terms, 1996). University based research is not considered "fundamental research" if the university or its researchers accept (at the request, for example, of an industrial sponsor) other restrictions on publication of scientific and technical information resulting from the project or activity. Scientific and technical information resulting from the research will nonetheless qualify as fundamental research once all such restrictions have expired or have been removed.
BIS	The U.S. Bureau of Industry and Security (BIS) is an agency of the United States Department of Commerce which deals with issues involving national security and high technology. A principal goal for the bureau is helping stop proliferation of weapons of mass destruction, while furthering the growth of United States exports. The Bureau is led by the Under Secretary of Commerce for Industry and Security. The mission of the BIS is to advance U.S. national security, foreign policy, and economic interests. BIS's activities include regulating the export of sensitive goods and dual-use technologies in an effective and efficient manner; enforcing export control, anti-boycott, and public safety laws; cooperating with and assisting other countries on export control and strategic trade issues; assisting U.S. industry to comply with international arms control agreements; monitoring the viability of the U.S. defense-industrial base; and promoting federal initiatives and public-private partnerships to protect the nation's critical infrastructures. (source Wikipedia: http://en.wikipedia.org/wiki/Bureau_of_Industry_and_Security)

Catch-all clause	An instrument whereby state authorities may impose a license requirement for an export of an item or items not currently on a control list. For such a requirement to be valid, an appropriate catch-all warning (or catch-all notification) must have been received by the exporter before the export has taken place. Some catchall clauses also impose a license requirement if the potential exporter knows (in some legislation, suspects or has reason to believe) that the intended end-use is related to WMD proliferation. Article 4 & 8 of theEU Dual-use Regulation constitutes a catch-all clause for the EU regulations. In the EAR the catch-all provision is defined as any EAR item that will have a military end-use when exported to China.
CCL	A list of items under the export control jurisdiction of the Bureau of Industry and Security, U.S. Department of Commerce. Note that certain additional items described in part 732 of the EAR are also subject to the EAR. The CCL is found in Supplement No. 1 to part 774 of the EAR. The Commerce Control List (CCL) is divided into 10 categories. Each category is subdivided into five groups, designated by the letters A through E: (A) Equipment, assemblies and components; (B) Test, inspection and production equipment; (C) Materials; (D) Software; and (E) Technology. See §738.2(b) of the EAR. Source (EAR - Definitions of Terms, 1996). See Appendix Lists.
Cloud Computing	Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a metered service over a network (typically the Internet). Cloud computing is a marketing term for technologies that provide computation, software, data access, and storage services that do not require end-user knowledge of the physical location and configuration of the system that delivers the services. A parallel to this concept can be drawn with the electricity grid, wherein end-users consume power without needing to understand the component devices or infrastructure required to provide the service. (source Wikipedia: http://en.wikipedia.org/wiki/Cloud_computing) Nevertheless NIST defines, cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models (Mell, et al., 2011). Essential Characteristics: **On-demand self-service**: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider. **Broad network access:** Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations). **Resource pooling:** The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth. **Rapid elasticity:** Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be

	unlimited and can be appropriated in any quantity at any time. **Measured service:** Cloud systems automatically control and optimize resource use by leveraging a metering capability1 at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. Service Models: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). **Deployment Models**: **Private cloud**. The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises. **Community cloud**. The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises. **Public cloud.** The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider. **Hybrid cloud**. The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds). (Mell, et al., 2011)
COCOM	A multilateral organization that cooperated in restricting strategic exports to controlled countries. COCOM was officially disbanded on March 31, 1994. COCOM members included: Australia, Belgium, Canada, Denmark, France, Germany, Greece, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, United Kingdom, and United States (EAR - Definitions of Terms, 1996).
Commodity	As in the EAR, it means any article, material, or supply except technology and software (EAR - Definitions of Terms, 1996).
Deemed Exports	It's a term usually used by the EAR, although the same concept exists in WA and EU regulations. Deemed exports are considered a release or transfer of controlled information, items and/or technology to foreign nationals, which means non-US citizens (or under the protection of a US Green Card or Residency authorization) or non-European citizens, if other jurisdictions are considered. The release of information to foreign nationals or other residents from other countries outside the EU are subject to the same rules any other export, either that foreign national is on his home country or visiting another country. This concept does not apply for EU citizen within the EU community space.
Diversion	The transfer of controlled items to unauthorized end-users, directly, through in-country transfers or through unauthorized re-exports (Wetter, 2009).
DoD	United States Department of Defense (often referred to as the DoD), is the Executive Department of the Government of the United States of America charged with coordinating and supervising all agencies and functions of the government

	concerned directly with national security and the United States Armed Forces.. (source Wikipedia: http://en.wikipedia.org/wiki/Department_Of_Defense)
Dual use	In the context of the EAR, dual-use applies to items that have both commercial and military or proliferation applications. While this term is used informally to describe items that are subject to the EAR, purely commercial items are also subject to the EAR (see §734.2(a) of the EAR) (EAR - Definitions of Terms, 1996). According to (Wetter, 2009) dual use is defined as items having both potential civil and potential military applications. Dual-use items are goods and technologies of a dual-use nature.
Dum-dum bullet	The 'dum-dum' was a British military bullet developed for use in India - at the Dum-Dum Arsenal - on the North West Frontier in the late 1890s. The dum-dum comprised a jacketed .303 bullet with the jacket nose open to expose its lead core. The aim was to improve the bullet's effectiveness by increasing its expansion upon impact. The phrase 'dum-dum' was later taken to include any soft-nosed or hollow pointed bullet. The Hague Convention of 1899 outlawed the use of dum-dum bullets during warfare. (source: http://www.firstworldwar.com/atoz/dumdum.htm)
EDA	Electronic design automation (EDA or ECAD) is a category of software tools for designing electronic systems such as printed circuit boards and integrated circuits. The tools work together in a design flow that chip designers use to design and analyze entire semiconductor chips. Before EDA, integrated circuits were designed by hand, and manually laid out. Some advanced shops used geometric software to generate the tapes for the Gerber photoplotter, but even those copied digital recordings of mechanically drawn components. The process was fundamentally graphic, with the translation from electronics to graphics done manually. The best known company from this era was Calma, whose GDSII format survives. (source: http://en.wikipedia.org/wiki/Electronic_design_automation)
End-user	AS defined in the context of the EAR, it means the person abroad that receives and ultimately uses the exported or re-exported items. The end-user is not a forwarding agent or intermediary, but may be the purchaser or ultimate consignee.
Etching and dry etching	Etching is used in micro-fabrication (integrated circuits) to chemically remove layers from the surface of a wafer during manufacturing. Etching is a critically important process module, and every wafer undergoes many etching steps before it is complete. The two fundamental types of etchants are liquid-phase ("wet") and plasma-phase ("dry"). Each of these exists in several varieties. Modern VLSI processes avoid wet etching, and use plasma etching instead. Plasma etchers can operate in several modes by adjusting the parameters of the plasma. Source Wikipedia: http://en.wikipedia.org/wiki/Etching_(microfabrication)
Export	As defined by (Wetter, 2009) in the context of the EU, the transfer of items from an EU member state to a third country. A re-export is an export of an item that has previously been imported into the European Community. According to the EU Regs export means: i) an **export procedure** within the meaning of Article 161 of Regulation (EEC) No 2913/92 (the Community Customs Code); ii) **a re-export** within the meaning of Article 182 of that Code but not including items in transit; and iii) **transmission of software or technology by electronic media, including by fax, telephone, electronic mail or any other electronic means to a**

	destination outside the European Community; it includes making available in an electronic form such software and technology to legal and natural persons and partnerships outside the Community. Export also applies to oral transmission of technology when the technology is described over the telephone (REGULATION (EU) No 388, 2012)
Foundry or fab	In the context of the semiconductor industry or microelectronics industry a semiconductor fabrication plant (commonly called a fab) is a factory where devices such as integrated circuits are manufactured (source: http://en.wikipedia.org/wiki/Semiconductor_fabrication_plant).
HDMI	HDMI (High-Definition Multimedia Interface) is a compact audio/video interface for transferring uncompressed video data and compressed/uncompressed digital audio data from an HDMI-compliant device ("the source device") to a compatible digital audio device, computer monitor, video projector, or digital television.[1] HDMI is a digital replacement for existing analog video standards.
Hard macro	In the context of the development of SIP or IP cores a hard macro is the design of a logic function on a chip that specifies how the required logic elements are interconnected and specifies the physical pathways and wiring patterns between the components. Also called a "macro cell." Contrast with soft macro. (source: http://www.pcmag.com/encyclopedia_term/0,1237,t=hard+macro&i=44094,00.asp) Hard cores, by the nature of their low-level representation, offer better predictability of chip performance in terms of timing performance and area. Analog and mixed-signal logic are generally defined as a lower-level, physical description. Hence, analog IP (SerDes, PLLs, DAC, ADC, PHYs, etc.) are provided to chip makers in transistor-layout format (such as GDSII.) Digital IP cores are sometimes offered in layout format, as well. Such cores, whether analog or digital, are called "hard cores" (or hard macros), because the core's application function cannot be meaningfully modified by chip designers. Transistor layouts must obey the target foundry's process design rules, and hence, hard cores delivered for one foundry's process cannot be easily ported to a different process or foundry. Merchant foundry operators (such as IBM, Fujitsu, Samsung, TI, etc.) offer a variety of hard-macro IP functions built for their own foundry process, helping to ensure customer lock-in. (source: http://en.wikipedia.org/wiki/Semiconductor_intellectual_property_core)
In the public domain	According to the WA, this expression means "technology" or "software" which has been made available without restrictions upon its further dissemination. Note: Copyright restrictions do not remove "technology" or "software" from being "in the public domain" (WA - Definitions of Terms, 2011)
SIP or IP Core	In electronic design a Semiconductor Intellectual Property Core, IP core, or IP block is a reusable unit of logic, cell, or chip layout design that is the intellectual property of one party. IP cores may be licensed to another party or can be owned and used by a single party alone. The term is derived from the licensing of the patent and source code copyright intellectual property rights that subsist in the design. IP cores can be used as building blocks within ASIC chip designs or FPGA logic designs.
Item	In the context of the EAR "item" means "commodities, software, and technology." When the EAR intends to refer specifically to commodities, software, or technology, the text will use the specific reference (EAR - Definitions of Terms, 1996).
nm	A nanometre (American spelling: nanometer; symbol nm) is a unit of length in the metric system, equal to one billionth of a meter. The name combines the SI prefix nano- (from the Ancient Greek νάνος, nanos, "dwarf") with the parent unit name

	meter (from Greek μέτρον, metron, "unit of measurement"). 1 nm = 1×10^{-9} m = 1×10^{-3} μm. (source Wikipedia: http://en.wikipedia.org/wiki/Nanometer)
Off-The-Shelf Products Or Commercial Off-The-Shelf (COTS)	A product ready to be used. The term defines a non-developmental item (NDI) of supply that is both commercial and sold in substantial quantities in the commercial marketplace, and that can be procured or utilized under government contract in the same precise form as available to the general public. For example, technology related items, such as computer software, hardware systems or free software with commercial support, and construction materials qualify as COTS. COTS purchases are alternatives to in-house developments or one-off government-funded developments. COTS typically requires configuration that is tailored for specific uses. (Source Wikipedia: http://en.wikipedia.org/wiki/Commercial_off-the-shelf)
Publicly available information	Information that is generally accessible to the interested public in any form and, therefore, not subject to the EAR (See part 732 of the EAR) (EAR - Definitions of Terms, 1996)
Publicly available technology and software	Technology and software that are already published or will be published; arise during, or result from fundamental research; are educational; or are included in certain patent applications (see §734.3(b)(3) of the EAR). (EAR - Definitions of Terms, 1996)
Red flags (or red flag indicators)	Things to Look for in Export Transactions. You may use this check list to discover possible violations of the Export Administration Regulations: • The customer or its address is similar to one of the parties found on the Commerce Department's [BIS's] list of denied persons. • The customer or purchasing agent is reluctant to offer information about the end-use of the item. • The product's capabilities do not fit the buyer's line of business, such as an order for sophisticated computers for a small bakery. • The item ordered is incompatible with the technical level of the country to which it is being shipped, such as semiconductor manufacturing equipment being shipped to a country that has no electronics industry. • The customer is willing to pay cash for a very expensive item when the terms of sale would normally call for financing. • The customer has little or no business background. • The customer is unfamiliar with the product's performance characteristics but still wants the product. • Routine installation, training, or maintenance services are declined by the customer. • Delivery dates are vague, or deliveries are planned for out of the way destinations. • A freight forwarding firm is listed as the product's final destination. • The shipping route is abnormal for the product and destination. • Packaging is inconsistent with the stated method of shipment or destination. • When questioned, the buyer is evasive and especially unclear about whether the purchased product is for domestic use, for export, or for reexport. (Source: EAR – Red Flag indicators - http://www.bis.doc.gov/complianceandenforcement/redflagindicators.htm)
Re-export or reexport	As defined by the EAR, *Reexport* means an actual shipment or transmission of items subject to the EAR from one foreign country to another foreign country. For purposes of the EAR, the export or reexport of items subject to the EAR that will transit through

	a country or countries, or be transshipped in a country or countries to a new country, or are intended for reexport to the new country, are deemed to be exports to the new country. (See §734.2(b) of the EAR.) In addition, for purposes of satellites controlled by the Department of Commerce, the term "reexport" also includes the transfer of registration of a satellite or operational control over a satellite from a party resident in one country to a party resident in another country (EAR - Definitions of Terms, 1996).
Soft cores	IP cores are typically offered as synthesizable RTL. Synthesizable cores are delivered in a hardware description language such as Verilog or VHDL. These are analogous to high level languages such as C in the field of computer programming. IP cores delivered to chip makers as RTL permit chip designers to modify designs (at the functional level), though many IP vendors offer no warranty or support for modified designs. IP cores are also sometimes offered as generic gate-level netlists. The netlist is a boolean-algebra representation of the IP's logical function implemented as generic gates or process specific standard cells. An IP core implemented as generic gates is portable to any process technology. A gate-level netlist is analogous to an assembly-code listing in the field of computer programming. A netlist gives the IP core vendor reasonable protection against reverse engineering. Both netlist and synthesizable cores are called "soft cores", as both allow a synthesis, placement and route (SPR) design flow. (source: http://en.wikipedia.org/wiki/Semiconductor_intellectual_property_core)
Subject to the EAR	A term used in the EAR to describe those commodities, software, technology, and activities over which the Bureau of Industry and Security (BIS) exercises regulatory jurisdiction under the EAR (See §734.2(a) of the EAR) (EAR - Definitions of Terms, 1996).
Technology	In the context of the **WA,** technology is defined as specific information necessary for the "development", "production" or "use" of a product. The information takes the form of technical data or technical assistance. Controlled "technology" for the Dual-Use List is defined in the General Technology Note and in the Dual-Use List. Technical Notes: 1) 'Technical data' may take forms such as blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories. 2) 'Technical assistance' may take forms such as instruction, skills, training, working knowledge, consulting services. 'Technical assistance' may involve transfer of 'technical data' (WA - Definitions of Terms, 2011). In the context of the EU **regulations** and the **EAR**, it refers to export of "technology" which is "required" for the "development", "production" or "use" of goods controlled in Categories 1 to 9, is controlled according to the provisions of Categories 1 to 9. "Technology" "required" for the "development", "production" or "use" of goods under control remains under control even when applicable to non-controlled goods. Controls do not apply to that "technology" which is the minimum necessary for the installation, operation, maintenance (checking) and repair of those goods which are not controlled or whose export has been authorized. Note: This does not release such "technology" specified in 1E002., 1E002.f., 8E002.a. and 8E002.b. Controls on "technology" transfer do not apply to information "in the public domain", to "basic scientific research" or to the minimum necessary information for patent applications. (REGULATION (EU) No 388, 2012). According to the **EAR**, controlled "technology" is defined in the General Technology Note and in the Commerce Control List (Supplement No. 1 to part 774 of the EAR). Note: 1) Technical assistance may take forms such as instruction, skills training, working knowledge, consulting services. 2) "Technical assistance" may involve transfer

	of "technical data" (EAR - Definitions of Terms, 1996)
Technology Transfer	Can assume several means of transfers According to (Auer, 2005) **Transfers to Foreign Nationals transfers** of any technology or source code to a foreign national (either in the United States or abroad) to be an export (or reexport) to the home country or countries of the foreign national. Under this "deemed export rule", if a license would be required for the export of certain technology or source code to the home country of the foreign national, the release of such technology or source code within the United States to a foreign national would require a license. Transfers to permanent residents, or persons protected under the U.S. Immigration and Naturalization Act are not subject to the restrictions on transfers to foreign nationals. **Electronic Transfers** (e.g., via the Internet, e-mail and facsimile). The United States controls electronic transmissions of dual-use controlled technology or software that are or will be received abroad, unless the data has been made publicly available. (Auer, 2005) (See below for broader controls that apply to encryption software and technology.) Under the EAR, transfers of items on the Internet are treated like transfers made through Other methods of distribution and publication on the Internet are treated like other methods of publication. Publication of documents or e-mails of controlled technology and software on the Internet to a foreign destination, when the expectation is that the only the intended party can open the document or e-mail, is an export to that destination (Auer, 2005).
Trade Secret	A trade secret is a formula, practice, process, design or blueprint, instrument, pattern, or compilation of information which is not generally known or reasonably ascertainable, by which a business can obtain an economic advantage over competitors or customers. (source Wikipedia: http://en.wikipedia.org/wiki/Trade_Secrets)
USB	Universal Serial Bus (USB) is an industry standard developed in the mid-1990s that defines the cables, connectors and communications protocols used in a bus for connection, communication and power supply between computers and electronic devices. Source: http://en.wikipedia.org/wiki/Universal_Serial_Bus