IDENTIFYING AND PREVENTING COUNTERFEITING IN THE CONSTRUCTION INDUSTRY

By

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To my mom and dad for their continuous support in my education

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Counterfeiting is the deliberate intention to deceive the construction owner, supplier, or contractor by fraudulent representation of materials or products. The normal quality assurance/control processes may not be adequate to detect counterfeit products due to the high level of sophistication of some counterfeiters.

While counterfeiting has been an ongoing problem for years, it recently has been brought to the public's eye due to high-profile cases such as the Chinese drywall incident. Still, many people are not aware of the issue, and even if they are, they do not have proven methods of preventing the problem. The main reason for this is a lack of concern for the problem due to little available information about the issue. Many companies have never had any counterfeiting problems; for this reason, they suppose that they do not need to be concerned. Others who have experienced counterfeiting are concerned about the problem. By traveling internationally and interviewing different contractors, government agencies, and private organizations, the research team was able to gain knowledge on the issue. Especially of interest were situations in which problems with counterfeiting were identified: how they were identified, what products were counterfeit, and whether accompanying documentation such as mill reports and other paperwork or certification stamps were counterfeit. Everything was done with the goal of preventing the problem from reoccurring in the future.

There are a variety of reasons why counterfeiting needs to be investigated in the construction industry. These reasons range from the loss of income for legitimate business owners to personal safety concerns for the general public. The fact is that counterfeiting can become a deadly endeavor that can cause loss of human life in some cases. There have been cases ranging from crane collapses due to counterfeit cranes to a deadly plane crash caused by the use of counterfeit parts.

The findings of the investigation were astonishing. Even within individual industry sectors, the level of knowledge on the issue varies greatly. The short-term goal of this research is to increase awareness of the problem and inform people of effective ways to prevent the problem from occurring. Preventative measures can range from the use of third-party verification to more diligent sampling performed by manufacturers, suppliers, contractors, and owners. The most important point to be taken from our research is the need for all members of the supply chain to intimately know the entities upstream of their position in the chain. “Know your supply chain” should be the number-one priority of all personnel responsible for the procurement of materials, products, or equipment.

CHAPTER 1
INTRODUCTION

The classic definition of counterfeiting is the production of a product that is intended to imitate or infringe on the market of a legitimate product that is produced and controlled by a state or corporation which is both approved and regulated. Product counterfeiting, commonly defined as the unauthorized copying of trademarked or copyrighted goods, harms legitimate producers through lost sales. International product counterfeiting has become a serious problem in many industries. The problem with this issue is that counterfeiting has not been thoroughly investigated; for this reason, there is not adequate information for companies to examine and apply.

The scope of this research is beyond the classical definition of counterfeiting. Also of interest are materials and products that may lack a company logo, trademark, or copyright. These products often are accompanied by either paperwork or stamps which indicate or document that the product meets certain standards, which they do not. The primary purpose of this research project is to objectively document the scope and impact of the real or potential threat of counterfeiting from low-cost sourcing countries that supply the construction industry and to highlight possible measures to mitigate the problem.

The research found that individuals' definition of what counterfeiting is seems to be consistent. However, knowledge of the issue and perception of the risk varies. The main source of the problem seems to be China and India with other instances scattered. Also, while industry awareness is relatively high, awareness of the industry clients is relatively level. People need to be made aware of the problem of counterfeiting so that preventative measures can be taken to stop the problem from occurring.

CHAPTER 2
BACKGROUND

Although there are many areas of concern related to product integrity, the counterfeit products associated with plant performance, plant life cycle, safety, and structural and product integrity compose the focus of this investigation. While there is much literature on counterfeiting in general, there is very little documentation on counterfeiting related specifically to the construction industry. The counterfeit "industry" does hundreds of billions of dollars of business annually; however, the scope of counterfeiting within construction is unknown. What is known is that counterfeit products have caused significant negative impacts to safety, project schedules, overall costs, and quality of construction. Counterfeit products can be classified into three types. Type "A" counterfeit products are the results of patent infringement or other intellectual property fraud and are of similar quality to the legitimate brand. Type "C" products are obvious fakes that both the selling and purchasing parties know or should know are counterfeit. Type "B" products look legitimate under normal quality management procedures but fail to perform due to low quality. Type "B" products are the primary focus of this research project because they are the most dangerous. Although counterfeit products are manufactured and sold worldwide, many low-cost sourcing countries provide an environment that is conducive to counterfeiting. In this type of environment, products can be manufactured and sold at a high profit margin, and the counterfeiter can operate with little fear of legal penalties. Most of the low-cost sourcing countries have many legitimate and competent suppliers and products but also have a higher number of incompetent or dishonest manufacturers, suppliers, or contractors, leading to more fraudulent products.

CHAPTER 3
LITERATURE REVIEW

Counterfeiting

Product counterfeiting, commonly defined as the unauthorized copying of trademarked or copyright goods, harms legitimate producers through lost sales. International product counterfeiting has become a serious problem in a number of industries (Bloch et al. 1993).

The production and sale of counterfeit products plays a significant role in the international economy (Hung 2003). In the mid-1980s, it was estimated that counterfeit products composed nine percent of total world trade in manufactured goods. Even though many countries have signed agreements to protect intellectual property rights (IPRs), counterfeit products are more available than ever in both world and national markets. According to the World Trade Organization (WTO), world trade increased by 47% from 1990 to 1995; but during this period, the trade of counterfeit products increased by 150%. Including counterfeit products that are produced and marketed domestically within a country, the total value of counterfeit products marketed in the world is now estimated to be more than $1 trillion annually (Hung 2003).

The two most significant characteristics of counterfeiting today are its overwhelming financial significance and its international scope. The counterfeiting problem is not just limited to commercial goods. It is also a problem with industrial goods that sometimes has disastrous consequences. For example, ineffective counterfeit pesticides are estimated to have caused a 15% decrease in Kenya's coffee crop, which is its chief export crop. The problem perpetuated itself when Kenyan farmers, afraid that the ineffective counterfeit pesticides were dangerous, became reluctant to use any pesticides (Abalo 1984).

Counterfeiting and the United States

The United States is the world's largest market for counterfeiters. Counterfeiters choose to counterfeit products of the United States because U.S. multinational corporations (MNCs) expend a great amount of time and money to establish product visibility and brand identity. Therefore, counterfeit products are recognizable because they have been labeled as products of legitimate manufacturers. Also, the distribution of counterfeit U.S. products includes both domestic and international products. Therefore, the counterfeiters can sell their products both inside and outside the United States, expanding their market. The United States is one of the world's leaders in the high-tech industries, and counterfeiters want to make the most technologically advanced products in order to increase profit. Moreover, the international market does not have an adequate supply of legitimate products produced in the United States, a fact that provides counterfeiters an opportunity to produce these kinds of goods in order to meet demand. In the United States, domestic and international legislation have done little to regulate these counterfeiters (Harvey 1987).

Exports to the United States

In 2003, U.S. Customs seized a net value of $94 million in counterfeit and infringing goods in ports of entry into the United States. Of this total, products originating in China accounted for $62.4 million or 66% of the total. The 2003 figures for China represent a significant increase over comparable figures from 2002, when China accounted for 49% of all counterfeit and infringing products and $48 million of the total $98 million in illegal products seized by U.S. Customs (Chow 2004).

Table 3-1. United States Customs Service IPR seizure statistics 2003

Trading Partner	Domestic Value ($)	Percent of Total
China	62,468,018	66%
Hong Kong	8,236,507	9 %
Korea	3,219,268	3 %
Pakistan	2,010,465	2 %
Mexico	1,966,929	2 %
Malaysia	1,331,925	1 %
Philippines	1,224,058	1 %
Canada	1,189,160	1 %
Switzerland	676,197	Less than 1%
Thailand	662,112	Less than 1%
All Other Countries	11,024,588	1 2 %
Total FY 03		
Domestic Value	$ 94,019,227	
Number of Seizures	6,500	

Counterfeits from China and Hong Kong (through which many counterfeits produced in China are transshipped) accounted for $80 million or 75% of the total customs seizures. No other country accounted for more than three percent of counterfeit products. It is well known that many counterfeit products which originate in China are transshipped through other countries, such as those in South America and Canada, before ultimately entering the United States. Thus China accounts for a significantly higher percentage than the 66% reported by the 2003 U.S. Customs statistics. It is possible that China accounts for as much as 80% or more of the counterfeit goods that enter the United States. Note that the $94 million figure represents only the value of the products that were seized by U.S. Customs in 2003. This could be only a tiny fraction of what enters the U.S. market. If the total value of the products seized represents one percent of the counterfeit and infringing products that enter the U.S. market, then the total value of counterfeits that entered the U.S. market in 2003 is approximately $10 billion, with China accounting for between $6–8 billion of that total. It is possible that the actual figures are much higher (Chow 2004).

Counterfeiting in China

There are product counterfeiters all over the world, but the counterfeiting industry in China is acknowledged to pose the most serious counterfeiting problem in world history and appears to still be on the rise. The extent of product counterfeiting operations in China is astounding. According to the Chinese government's own conservative estimates based on a survey it conducted, the total value of counterfeit products domestically produced and marketed in China in 1998 was $16.1 billion (Hung 2003).

A recent study by the People's Republic of China State Council Research and Development Center reported that in 2001 the Chinese economy included $19–24 billion worth of counterfeit goods. Brand owners in China estimate that 15–20% of all well-known brands in China are counterfeit and estimate their losses to be in the tens of billions of dollars per year. Counterfeiting is estimated to now account for approximately eight percent of China's gross domestic product (Chow et al. 2004).

In recent years, there was an increase in the number of both counterfeiting cases handled and criminals punished. All together, 12,260 criminals involved in counterfeiting were prosecuted; only 1,636 received sentences from five-year imprisonment up to the death penalty. The others received less severe penalties. Among all cases, 8,272 were related to counterfeit money, securities, financial documents, and special invoices, an increase of 64% since 1998; 206 were related to patent and trademark counterfeiting and false advertisements, an increase of 26% over the last year with 275 criminals punished (Chow et al. 2004).

Another investigation into 283 enterprises in China conducted by the State Bureau of Quality Technical Supervision revealed a similar situation. Among all the enterprises investigated, 182 have to spend 240 million Yuan ($29 million U.S.) annually and employ more than 1,600 people to combat counterfeiting; 160 of them suffered from counterfeiting activities,

with a total damage of 9.6 billion Yuan, which accounted for 11.1% of their annual gross output value (Chow et al. 2004).

The counterfeiting of trademarks, brands, and other forms of intellectual property in China is now the most serious counterfeiting problem in the world. Fake foreign goods in China are so common that it is not easy for consumers to distinguish between real and fake foreign commodities. Almost every consumer in China knows that counterfeits of well-known international and local brands are offered in every street market. The Shanghai Technical Supervision Bureau recently released the results of a sample survey of computers being sold in the city's market. The survey revealed that nine out of 14 types of imported brand name computers satisfied industry standards. A large number of the low-quality computers that were marketed as world-famous brands were actually shoddy counterfeit products. A survey of the Shanghai footwear market in early 1996 indicated that various brands of shoes, including Nike and Puma, were low-quality counterfeit brands. A disturbing trend is the recent increase in the export of counterfeit products from China to countries and territories abroad, indicating that China has become the source of a global counterfeiting problem (Hung 2003).

Complaints by Chinese consumers about counterfeit and inferior quality products have risen sharply in recent years. As reflected by consumer complaints, almost every product category is subject to counterfeiting including television sets, washing machines, radios, stereos, cameras, motorcycles, pharmaceuticals, baby food and instant noodles. These complaints indicate that many counterfeits are products of inferior quality that may cause harm to unwitting consumers. The most notorious recent incident involved counterfeit liquor, which led to twenty-seven human deaths in 1997 (Chow 2000).

In recent years, China's economy has grown at an amazing rate, with growth rates of 9.8% from 1980–92 and 9.0% more recently. According to some estimates, China will have the world's largest economy in the first decades of the twenty-first century. This rapid economic growth has been greatly aided by foreign direct investment (FDI) from multinational enterprises. In the 1990's, China became the world's second-largest recipient of FDI, after the United States. In 2002, China surpassed the United States to become the world's largest recipient of FDI with $50 billion of foreign capital inflows. FDI is the best method for the transfer of advanced technology, intellectual property and other forms of valuable information. In many cases, the intellectual property component of an FDI in the form of patents, copyrights, and trademarks, is the most important component of the foreign investment. For example, the value of the Coca-Cola trademark in China is many times more valuable than the millions of dollars in capital that the company has invested in China. The same is true for the patents and copyrights owned by pharmaceutical companies and software companies doing business in China today. While multinational enterprises (MNEs) are creating a transfer of technology through FDI that is being absorbed into China's legitimate economy through joint ventures and wholly foreign-owned enterprises, some of this intellectual property is also being diverted into China's illegitimate economy as pirates steal this technology to engage in counterfeiting and other forms of commercial piracy. It is no coincidence that China, the world's largest recipient of FDI, advanced technology, and intellectual property, also has the world's most serious commercial piracy problem (Chow 2000).

Laws and regulations issued by the Chinese government relating to the manufacture of low quality or fake products are not very strict. In general, there is ineffective law enforcement and lack of deterrence in China's legal system. Although China has criminal laws against commercial

counterfeiting within China, the effective enforcement of these laws is impeded by various obstacles. On the other hand, there are essentially no criminal laws that apply to exports. Counterfeiters can export their products without punishment from Chinese authorities. Hence, due to the inadequacies of legal protection, counterfeiters are increasingly exporting all over the world. In the first half of 1994, Liaoning Province punished some manufacturers of low quality or fake products. According to the stipulation of laws and regulations, their fines should have been 18 million Yuan. In fact, these fines were 7 million Yuan. In the end, only 3.15 million Yuan had been paid by these enterprises, 17.5% of the total legal requirement (Chow 2000).

China's local governments take the major responsibility for local economic development. To rapidly develop the local economy, some local governments made concessions to the manufacturers of low-quality products. In fact, local governments often are either directly or indirectly involved in supporting the trade of counterfeit goods. For instance, as many as 100 small fertilizer factories in Haizhou District of Lianyungang City in east Jiangsu Province were involved in counterfeiting fertilizers of poor quality and produced between 80,000 and 100,000 tons annually. In some cases, top managers did not have strong quality awareness and responsibility. Some companies were concerned about quantity and speed alone and ignored product quality, especially when products had good sales. Employees, on the other hand, were also lacking in quality responsibility and quality awareness. In many cases, neither labor nor management was capable of applying quality management methods effectively in their daily practices (Chow 2000).

Another reason for low-quality and fake products is inadequate production capability. According to statistical investigation by some organizations in China, 18% of production equipment is obsolete in terms of domestic standards, 47% of equipment is at the average

domestic level, 22% is at a domestically advanced level and only 13% of the equipment is at an international level (Chow 2000).

Lastly, consumers are also responsible for low quality and fake products. Many prefer such products because of their low price. One of the main reasons for the extensive market for fake products, especially fake foreign goods, is that these products pander to the vanity of consumers, just as they frequently do throughout the world (Chow 2000). The world's largest influx of FDI, widespread access to advanced technology, direct or indirect government involvement and support of the counterfeit trade and a weak legal system combine to give China a counterfeiting and commercial piracy problem that is unprecedented in world history (Chow 2000).

Although there are product quality issues for most counterfeit goods, this is not the case for all goods. Table 3-2 below shows a variety of industrial sectors that had non-conforming products when testing was conducted.

Table 3-2. Conformity in industrial sectors.

Industrial Sectors	Conformity rate	No. of samples	No. of conforming products
Post and telecommunications	86.0%	157	135
Metallurgical industry	83.8%	4469	3743
Pharmaceuticals	80.7%	3131	1528
Petrochemical industry	80.7%	259	209
Metrological products	80.1%	171	137
Chemical products	78.4%	6219	4877
Forestry	75.7%	111	84
Textile products	75.5%	4198	3168
Firefighting and public security products	75.0%	1805	1353
Nonterrous products	73.6%	1108	816
Communications	73.4%	691	507
Energy products	73.1%	2564	1875
Building materials	73.1%	5005	3660
Electronic products	71.5%	1609	1151
Agricultural products	67.5%	3993	2697

Light industry products	67.5%	12368	8353
Machinery building	67.3%	6681	4496
Urban construction	65.2%	411	268
Others	55.6%	54	30
Average	72.9%	55004	40087

Adopted from :(Zhang 1998)

From analysis of the results of more than 10 years of product quality inspection, the main quality problems were identified (Zhang 1998). From the inspection results, it was seen that the quality of approximately 27% of all products was poor—particularly those related to human health and safety, agricultural production materials, important raw materials and components and accessories (Zhang 1998).

Exports from China to the U.S.

As stated earlier, in 2003 China accounted for more than $62 million or 66% of the $94 million value of all counterfeit and infringing goods seized by the U.S. Customs Service at ports of entry into the United States. The value of what is seized can represent only a tiny fraction of what actually enters the U.S. market. An ominous development is that, beginning in 2004, exports of counterfeits from China to the United States and other parts of the world may begin to increase significantly in the foreseeable future (Hung 2003).

Exports from China to Other Locations around the World

While exports of counterfeits from China to the United States have a direct impact on the rights of intellectual property (IP) owners in the U.S., exports by China to other countries also have an economic impact on U.S. IP owners for two reasons. First, exports of counterfeits may reduce exports of legitimate products by U.S. IP owners. For example, if China exports counterfeit batteries to Canada, which are then purchased by consumers, this might decrease demand for legitimate batteries exported from other battery manufacturers. Second, U.S. IP owners need to expend additional resources to combat a global counterfeiting problem that

emanates in large part from China. The cost of these resources includes time, capital, and labor force (Chow 2004).

Significant Rise in Exports from China

Since becoming a member of the WTO, China amended its foreign trade laws in December 2003 to eliminate the monopoly on export rights, which had been limited to state trading companies. The effect of the elimination of the monopoly on export rights is that anyone can now lawfully export products from China. Counterfeiters now are able to export on their own without the need to find a suitable and willing partner within the government or pay fees for their cooperation (Hung 2003).

With today's rapid technology development, counterfeiters have begun to take advantage of the Internet to market their counterfeit products all over the world. This trend, combined with the elimination of restriction on export privileges in China, contributed to a great short term increase in the export of counterfeit products to all parts of the world (Hung 2003).

China is now actively negotiating with its trading partners around the world to reduce customs requirements and other impediments to the importation of its products. China is currently negotiating with several countries on the north coast of South America. Counterfeit products entering these countries would then undergo little scrutiny and might then be transshipped to other countries around the world, including the United State (Hung 2003).

Construction Industry in China

The Chinese economy has been developing at an amazing rate since 1980. The gross value of industrial output grew by an average annual rate of 17% from 1980–1991 and about 27% from 1992–1993, with a share of 57% of the GDP in 1991. The average annual growth rate of agricultural output was six percent from 1980–1990 and four percent from 1991–1993, with a share of 27% of the GDP in 1991. The share of services in the GDP grew from 23% in 1980 to

27% in 1993. Fixed investment grew at an average annual rate of 13% from 1980–1991 and 23.3% from 1992–1994, with a share in the GDP of 32% in 1992. National income grew at an average annual rate of eight percent from 1980–1991 and around 12% from 1992–1994. The total value of exports and imports in 1994 was $121 billion and $115.9 billion, respectively, with a trade surplus of $5.1 billion. FDI inflows reached $42.2 billion by the end of 1994, with an average annual increase of 28.1% from 1986–1994 (Chen 1998).

The gross output value of the construction industry, which was 13.9 billion Yuan in 1978, had reached 382 billion Yuan in 1994. The major construction output for this period could be broken into the following numbers: 110,000 megawatts of new electrical generating capacity; 117 million tons of cement production; 7,484 km of new railway lines; 41,300 km of new highways; 340 million tons of additional harbor cargo handling capacity; more than 10 new major railway stations in big cities; more than 2 billion m^2 of new residential housing; 9.3 billion m^2 of rural housing; and a large number of public facilities. This was complemented by some 25.4 million tons of additional coal production and 183 million barrels of additional petroleum recovery. Currently the annual output of the construction industry is about $93 billion. It employs around 24 million people, more than 5% of the total labor force in the country (Chen 1998).

Construction activities have spread all over the country. The majority of construction activities in China were concentrated in Guangdong province and along the eastern coastal areas in the field of civil engineering and construction installation work from 1978–1994. In recent years, increasing numbers of infrastructure and energy exploration projects are taking place in the inland provinces (Chen 1998).

However, the share of the construction industry in China's GDP is still low compared to developed countries. It shows a strong potential for further growth in China's construction industry. The rapid growth of the construction industry has directly caused an extreme shortage of infrastructure and building space. Moreover, this growth rate is likely to continue to increase in the foreseeable future (Chen 1998).

Construction Material

Materials compose one of the three major factors in the cost of construction. Materials are sometimes ordered weeks or even months ahead of requirement, leading to uneconomical inventory on construction sites or contractors' warehouses. A study by Marsh (1985) shows that the cost of materials and equipment constitutes approximately 60% of a project's cost. Bernold and Treseler commented that material represents a large portion of construction costs and may even represent a larger portion in the future (Bernold et al. 1991).

Every year, China's construction industry consumes 20–30% of the country's total steel production, 70% of cement, 40% of timber, 70% of glass, 50% of paint and 25% of plastic products (Chen 1998). Even though the state plan of building materials production and supply through the quota system has shrunk significantly in the last decade, about 50% of building materials are still produced and supplied through the state plan system for most large projects (Chen 1998).

The cost of material varies among different kinds of construction projects. Various estimates place the identifiable cost of materials on industrial construction projects in the range of 50–60% of the project cost. This does not include economic costs that are not measured but do exist. Materials control 80% of a project's schedule from the initial material acquisition to the delivery of the last item (Kerridge 1987). Materials have a major influence on a project's indirect costs, plans, and operations and are a major factor in a project's process.

The importance of materials is more evident in international construction projects. Managing materials on an overseas project poses another level of complexity, especially in an environment where procurement responsibilities are divided due to factors beyond the control of the owner's project management team or the constructor. Many projects constructed in third-world countries are effected by the unavailability of local sources of supply in the host country, necessitating the import of most materials. Quality can be a very complex issue if materials are procured from a variety of sources (Chen 1998).

Materials Quality Control

Construction quality is recognized as a critical problem in China. Quality of construction work undertaken by the line ministries' construction companies is generally better than that of provincial enterprises, and the quality of construction by state-owned enterprises is considered to be much better than that of urban and rural collectives and rural construction teams (RCTs). The quality of work done by RCTs is the worst; waste of the construction material is a major contributing factor. The reasons for low quality of construction range from poor designs to low-quality materials, weak management, ambitious completion targets, and lack of worker skills. Improving quality of construction is one of the major challenges facing China's construction industry (Chen 1998).

Building materials are consuming a large amount of the raw material resources available. China widely uses raw materials and transport systems. The main problems with the building materials in China are the following:

I. Lower productivity in building materials compared to other industries.

II. Lower profitability of building material.

III. Still using quota system for estimation of construction costs. Cost estimating based on this system is not accurate because it is fixed annually or semiannually while the material prices fluctuate (Chen 1998).

The performance and quality of building materials are very important to the construction industry. They not only affect the safety and functions of construction projects but also influence socioeconomic development. A good example is building construction in Beijing. With the acceleration of the urbanization process in Beijing, there is high demand for building materials used in residential and public buildings. It is difficult to supervise the quality of building materials in Beijing because such a large quantity and great variety of building materials are being used. In addition to bricks and building blocks mainly supplied by Beijing enterprises, an increasing proportion of building materials such as steel, cement, sanitary ceramics, stone materials, and radiators are supplied by enterprises from other provinces, which contribute to complicated supply channels with the participation of numerous companies. This results in a difficult management of product quality (Beijing Municipal Commission of Housing and Urban Rural Development 2007).

Case: The Management of Building Material Situation in Beijing, China

To strengthen the supervision and management of Beijing building material quality, the government of Beijing has passed a set of regulations. The regulations demand that all building materials meet the following requirements: selection of quality materials, limitation of the use of inferior materials and a guarantee that all the building materials be up to standard, beginning with the design phase of a construction project. The construction unit and the building material supply party may sign a sample contract released by the State Administration for Industry and Commerce in which both parties promise to exercise supervision of the building materials to be used—whether they meet the quality standard, the industrial policy, the engineering construction standard, the documents for design and the requirements of the contract. Both parties shall be responsible for the completeness of files on building materials when the project is completed and accepted after examination. They shall also be responsible for the onsite reexamination and

sampling test of the building materials bought (Beijing Municipal Commission of Housing and Urban Rural Development 2007).

Counterfeit Airline Parts

In the aviation industry, aircraft routinely carry 300 or more people. A failure due to a counterfeit aircraft part can be truly catastrophic. Many major airlines currently have fake or used parts among their inventories, and some admit it quietly. In 1998, a report by the Organization for Economic Co-operation and Development said that as much as $1 billion in unapproved airline parts were in the warehouses of U.S. airlines and parts distributors. In 2001, a publication produced by Lawrence Livermore National Laboratory showed that as much as $2 billion in unapproved parts are now sitting on the shelves of parts distributors, airlines and repair stations (Parker 2001). In 2004, the Federal Aviation Administration estimated that two percent of the 26 million airline parts installed in planes are counterfeit (Scottsdale 2006).

Some Other Related Concepts

Gray-market products are legitimate products of the manufacturer but are sold outside the authorized local distribution channel (e.g., pharmaceuticals are generally cheaper in Canada, and these items could be sold in the U.S. as gray-market products). Also called parallel imports, such goods are produced under the protection of a trademark, patent, or copyright, placed into circulation in one market, and then imported into a second market without the authorization of the local owner of the intellectual property right (Maskus 2000). These products are out of the scope of the research because they are legal in certain markets.

Copyright infringement is the use of material that is covered by copyright law without the proper authorization in a manner that violates one of the copyright owner's exclusive rights. These rights may include the right to reproduce or perform the copyrighted work, or to make

similar works (Copyright Law of the United States 2009). This is outside the scope of the research.

Intellectual property theft includes patent infringement and reverse engineering. Companies diligently identify and protect intellectual property because it holds such high value in today's increasingly knowledge-based economy. Extracting value from intellectual property and preventing others from deriving its value are important responsibilities of any company (Loretta 2000). This is also outside the scope of the research.

Low-quality or poorly designed products are legitimately produced but fail due to poor quality control or inadequate design. These types of integrity problems should be caught by a company's normal quality assurance/quality control processes and thus are outside the scope of this research.

CHAPTER 4
RESEARCH METHODOLOGY

To accomplish the research objectives, several interview instruments were developed that are used while interviewing a variety of different people. These people included government agents, insurance agents, owners, contractors, manufacturers, and suppliers. Depending on who was being interviewed, different sets of questions were asked that were specific to a person's area of focus. The questions that were asked included but were not limited to:

1. What is the difference between counterfeits and low-quality products?
2. What do you do to prevent counterfeiting?
3. Have you ever experienced cases of counterfeiting? Where was the problem? Where did it come from? How did you handle the issue? How did you catch it?
4. What do you do to qualify vendors?
5. What are some key indicators of counterfeiting?
6. Who reports to whom in the case of counterfeiting?
7. What trends do you see in counterfeiting?
8. How aware is the industry of counterfeiting?
9. How far back up the supply chain do you test?

The interview included approximately 40 questions in all about various related aspects of this issue. Because this information was mainly qualitative as opposed to quantitative data, it could not be analyzed statistically but more in a process of seeking trends and commonalities. This could supply a wealth of knowledge about good practices and key indicators in identifying and preventing counterfeiting. Members of Congress were initially targeted as interviewees, but this objective was abandoned due to lack of cooperation.

The interview takes approximately one to one and a half hours to conduct, depending on the level of knowledge that the person being interviewed has on the subject. Currently, at the five

locations visited, a total of 43 people were interviewed. These people were contacted with the help of the research team and were chosen due to the fact that their organizations are large and important entities in the global construction industry and their particular position within the organizations. Interviewees from private industry tended to be responsible for either quality or procurement within their organization, those some were in top administration position.

CHAPTER 5
RESEARCH PLAN

Where Is Counterfeiting Occurring?

A variety of source countries have been identified through the research. These countries include China, India, Korea, Taiwan, Mexico, Canada, Indonesia, Africa, France, Saudi Arabia, and even a few cases in the U.S. The main problem areas are southeast China and India. This is because the economies in these areas rely on counterfeiting to stay afloat. The governments in these areas will completely overlook the problem of counterfeiting all or part of the time because they are better off allowing counterfeiting than eliminating the problem.

However, counterfeiting is an ongoing problem throughout the world. Just because a product is from a location that is not prone to counterfeiting does not mean that the product is not counterfeit. Many of the locations that have thriving counterfeiting industries have found that they can send the counterfeit items to locations such as South America, Europe, and Canada. They can then move the items into the supply chain with less scrutiny than they would receive coming straight from China or other areas of Southeast Asia.

Market Trends

This research has shown that the items which are most likely to be counterfeit are smaller items that are often produced in mass. These items can include many things, but the most common are circuit breakers and steel products, which can include piping, valves, vessels, and others. Many of these products tend to come from low-cost source countries such as China that are not as concerned about the consequences of counterfeiting. Also, these activities have increased as demand has increased and a shift has occurred in the location of plants from the U.S. to other countries where labor costs are lower. The main reasons for the popularity of counterfeiting smaller items are the difficulty and expense for companies to test every piece of

these relatively low-cost items that they purchase. Also, the risk for the counterfeiter is lower because the seizure of some of these items would not result in a huge financial loss, and the counterfeiter can afford to make and ship such a great quantity that most of their product makes it into the supply chain.

Regarding the trends in the quality of the counterfeiting (Type A, B, and C counterfeiting), initially it was found that the vast majority of counterfeiting was in Type B. These are products that may appear to be legitimate but actually are made with low-quality components that cause them to be inferior to the real thing. Recently, there has appeared to be a sharp increase in the number of products in Type A. These are products that might actually be of equal quality to legitimate products but have forged documentation or constitute patent infringement. The reason for the sudden increase in Type A counterfeiting in the construction industry is unknown at this time.

Examples of Counterfeiting

Pressure Vessels

Pressure vessels tend to fail due to counterfeit steel as do many other steel products. Often this is a result of low-quality steel or the use of alloys that may not be intended for use with certain chemicals or pressures. Many of these failures tend to occur during the initial hydro testing. This is a very dangerous situation that should never occur. In some cases, these failures have resulted in worker injury and death.

Smaller Items and Circuit Breakers

Smaller items also were found to be counterfeit. These items include rebar, fasteners, and circuit breakers. In one case, a shipment of one million Square D circuit breakers was found coming into the port of New York from China; Square D does not even produce these items in China. In fact, Square D manufactures its products only in the U.S. So all imported Square D

circuit breakers are counterfeit. A good indictation that an item might be counterfeit is if it comes from a location which does not even produce that product.

Piping

Figure 5-1. Ruptured steel pipe

Counterfeit piping is a common problem in the construction industry. The failure in Figure 5-1 occurred during the commissioning of this steel pipe, which contained steam at 1006°F and a pressure of 2538 psi. This failure resulted in the death of two employees as well as serious injuries that left several people in critical condition.

Fly Ash

Public safety is a major concern with counterfeiting. There have been a variety of instances in which people have been injured or even killed due to counterfeit material and equipment. During the research, a multitude of counterfeit materials—not all of them steel—were uncovered. Fly ash is used as an additive in concrete mixes to increase strength. If fake fly ash is used, it can cause the concrete used in both buildings and bridges to come short of the expected

strength for the designed building. This occurred on China's new high-speed railway, which connects Wuhan to Guangzhou. Authorities believe that this problem could lead to the cracking of concrete supports, which could make use of the rail unsafe. This could result in the shutdown of a $12 billion rail system.

Cranes

Counterfeit cranes have become a major problem in recent years. However, the occurrence has been on a much smaller scale than with commodity items that are much easier to counterfeit. Crane collapses have caused multiple deaths. In some cases, these collapses resulted from failure to inspect the crane after it was constructed. However, some have resulted because the complete crane was a fake. Figures 5-2A (real) and 5-2B (fake) illustrate that the differences between the real thing and a counterfeit item can be minuscule. Counterfeiters have been able to duplicate the actual product almost exactly by making the general design and even coloring identical so that only a trained and experienced professional would be able to tell the difference. However, in this case it is obvious that the project personnel were not very familiar with the details of the original.

A.


B.

Figure 5-2. Pair of Tadano cranes. A) This is an actual crane; B) The crane is a fake.

Bolts

Bolts are commonly counterfeit items because they often are already in place when vessels and other items are received. For this reason, it is often a good idea to torque bolts even after they have been installed. Figures 5-3A and 5-3B show how fake bolts were made by welding smaller pieces to the ends of bolts that were the correct sizes to save money or fix broken bolts. In most cases, these bolts are not checked; however, this bolt appeared loose, and when torque was applied, the bolts snapped into the two pieces seen in Figures 5-3A and 5-3B.

Another situation can be seen in Figure 5-3C, where there are visible voids in the manufactured bolts. This defect is not visible to the naked eye, but once the bolt has been split, the voids are clearly visible. These voids can reduce the bolt strength, which leads to failure.

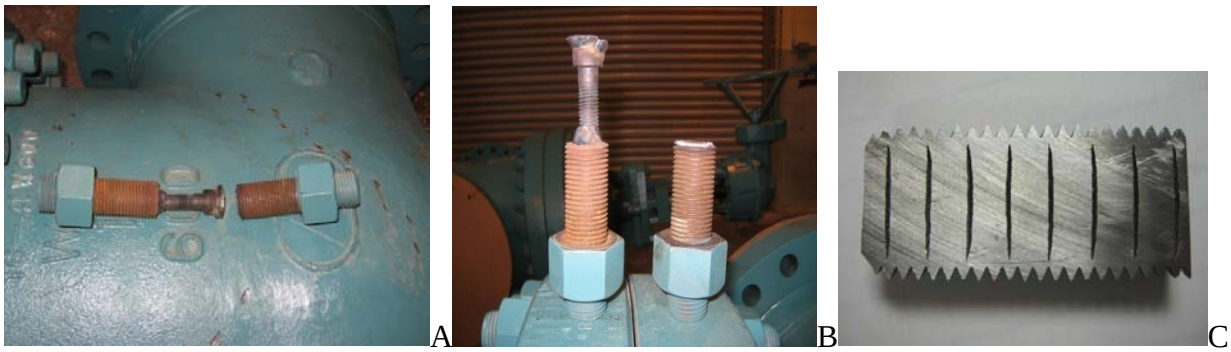

Figure 5-3. Counterfeit bolts. A) Bolts welded together to hide deficent piece. B) Bolts welded together to hide deficent piece. C) Bolt with visable voids

Chinese Drywall

The case of counterfeit Chinese drywall also exemplified health concerns as well as deterioration of building components. In this case, the foul odor of sulfur emanating from the drywall was giving people serious respiratory problems that were compelling them to vacate their houses. Furthermore, the toxin that was given off by this drywall was eating away at any copper components in the building. These included copper piping used in plumbing and also copper wires used in both electrical and HVAC units (Wayne 2009).

Drywall traditionally has been produced in the United States. However, during the construction boom that began in the early 2000s, U.S. producers could not keep the supply at the levels of demand. Therefore, drywall began to be imported from a German company that was actually getting the product from Chinese drywall makers (Wayne 2009). For this reason, extra care should be given during the procurement process so that people know what they actually are getting. Just because a company claims to be producing a product does not mean it is not really outsourcing. This is why checks must always be made on the supply chain.

Valves

Counterfeit pipe valves can be difficult to identify due to the great diversity of design from manufacturer to manufacturer. Analyzing the stamping on the valves tends to be one of the most effective ways to identify counterfeit pipe valves. This can be done by looking at the location of the stamping, number of digits, number of letters, company logo, and general orientation of all the items combined. These items can be hard to identify if the inspector is not experienced with the exact item that is being inspected. In some cases, the counterfeit item may look significantly different from the actual legitimate pipe valve. However, if these items are not compared to each other, both could be considered legitimate. Most counterfeit pipe valves discovered during this research were in the category of Level B counterfeiting because, while the items may have appeared to be correct, they actually were made with low-quality material or parts that could fail at any time.

A great way to prevent counterfeit valves is the use of product manufacturing information (PMI). This provides information specific to the geometrical nature of the product and is done with the use of radiological engineering, 3D modeling and Acrobat software. Basically, this procedure turns a 2D model into a 3D model, which can be used as a visual aid in inspecting and approving products among inspectors who may be unfamiliar with the specific product.

Figure 5-4 below shows two pipe valves. The one on the left is a legitimate Demco valve, while the one on the right is a counterfeit valve. This shows the difficulty in some cases to identify a countefeit item. Minor differences, such as the number on the valve and the impression around these numbers, were indicators used to identify a counterfeit item. If the person looking at these items did not have a great deal of familiarity with the product, an item like this would never be identified.

Figure 5-4. Demco valve on left, counterfeit on right

Who Is Affected by Counterfeiting?

One of the main groups affected by counterfeiting is industrial companies. This is because they deal with a great deal of steel piping, valves, and pressure vessels. Counterfeits of these items have proven to be especially dangerous in a number of cases. The research has found that entire pressure vessels have ruptured before they were even under maximum pressure. In one case, two workers were killed by such a failure.

Not only are these problems dangerous, but they also can be very costly. Many problem items require a large lead time to get replaced. Waiting on these items can cost a company a great deal of lost revenue, because production must be stopped while the problem is resolved.

Government is also affected by counterfeiting but in a different way than private companies. While safety is always a concern for the government, their main concern in many cases with counterfeiting is the country's reputation. If a country's reputation becomes suspect, manufacturers and corporations may blacklist that country from dealing with them in the future. This could be detrimental to that country's economy if they rely on a constant stream of exports.

Insurance companies also feel the effects of counterfeiting. An item that is found to be counterfeit often is insured in some way, shape, or form to protect the purchaser. So while the legal issues are being worked out, the insurer often has to at least temporarily cover the replacement cost whether or not it is at fault. In fact, the payment usually is permanent if there has been loss of property or human casualty. This starts a chain reaction that leads to rate hikes.

Ways to Prevent Counterfeiting

Third-Party Verification

Third-party verification can be effective if the person conducting the inspections is aware of both the problem of counterfeiting and indications that a product may be counterfeit. A person who has not been properly educated on what to look at and look for will do no good. The best thing to do is to make sure that anyone who is hired for such a task has extensive experience in the area or sector he or she is inspecting. Third parties also are a good choice because they have little connection to the manufacturer, supplier, or purchaser.

There are some negatives to hiring a third-party verification group. The main problem, which has already been mentioned, is that they might not have the proper training to identify suspect products. However, another issue in the use of third-party verification is that the owner needs to make sure that the third party has no vested interest in any company they might be inspecting. There have been some cases in India where a third party was overlooking certain issues that were arising because they were afraid that a disruption may have a negative economic

impact on the geographic area and possibly put their job at risk. A good rule to follow is to have all third-party verification done by inspectors from outside the country. This is due to the reasons mentioned above, plus cultural pressures that can cause loss of face for all involved if they find against their countryman.

In-House Inspection

In-house inspection carries many of the same issues as third-party inspection. One of the chief benefits of in-house inspection is that that those doing the inspection know what they should be looking for and where it should be located.

However, there is a downside to in-house inspection. In some cases, reporting an identified problem could have a negative effect on the person doing the inspection. These problems can include loss of job due to plant shutdown, failure of the local economy, and bad future relationships within the company. For this reason, it is often a good idea to avoid having people with an interest in the company oversee the work being performed. Such people may correct problems without ever reporting them in an effort to protect the company.

Getting to the Source

A great way to check for and prevent counterfeiting is to actually go to the source of the product. Visiting the manufacturing plants and checking the processes to see if proper procedure is being followed is an effective way to prevent major problems. This also allows people to see whether the product is actually being produced at the claimed location. It is a good idea to make these checks at random and with little warning to the manufacturer. This is because a manufacturer that is aware of an inspection ahead of time may temporarily correct negligent work, processes, and safety hazards so that the inspectors are not aware of these problems.

Inspecting up the supply chain is also a great way to prevent counterfeiting from occurring. This can be done by having suppliers reveal exact sources of their products and material. Once

this information has been received, the purchaser should then check to ensure that these people actually exist and are not just made up by the supplier. Furthermore, it is a good idea to have the people farther up the supply chain actually approved by the purchasing company as well as the people supplying the products. In most cases, it would even be a good idea to have the vendors sign a contract that says they will use only manufacturers on the approved vendors list. This will ensure that the purchaser will receive a higher quality, legitimate product.

Approving Vendors

All vendors used should be put through some approval procedure. There are a variety of ways to do this, including the use of questionnaires, references, physical inspection, technical inspection, financial analysis, and company audit. The most effective way to approve vendors seems to be to use a variety of these techniques with continual follow-up on all the approved vendors to ensure continued compliance with the company's standards.

In addition to vendors, the sub-suppliers that the vendor is using also should be approved. This allows the purchaser to know exactly where the products are coming from. Many vendors claim to have an approved vendor list (AVL), but it is not uncommon for a vendor who is under pressure to stray from such a list. A clause should be added to the contract which says that if a vendor chooses to use a supplier who is not on the AVL, the purchaser must first approve the change.

CHAPTER 6
DATA ANALYSIS

Looking at the Findings

Counterfeit vs. Low Quality

When describing the differences between low-quality products and counterfeit products, people have somewhat consistent views. The general consensus is that a low-quality product is known by the buyer at the time of purchase to be inferior in quality. A counterfeit product, on the other hand, is a product that is supplied with the intent of misrepresenting or of deceiving the purchaser. Counterfeit products may be high-quality products or very low-quality products. The point is that the purchaser never knows what exactly is being received.

Another common theme with low-quality products is that there are no laws restricting their trade on the market. Often, low-quality products are not attempts to duplicate a legitimate product; they are just given less care and lack detail. Basically, they are not being sold as things they are not. On the other hand, counterfeiting is regarded as stealing or committing fraud by attempting to take the name brand or trademark of a legitimate product. The person supplying the product is attempting to use the trademark or copyright without proper authorization. Another way counterfeiting is committed is through the use of fake documentation or certification. This is done to increase the value of the product being supplied.

Source of Counterfeiting

Although counterfeiting is occurring everywhere, some sources of counterfeiting can be surprising. While China and India are the main sources of counterfeit goods, others should not be overlooked. Of the 43 people interviewed, 23 instances of counterfeiting were found to have come from China compared to only four instances from India. In one case, a company had experienced counterfeiting on four occasions, all of which involved Chinese products. All other

sources of counterfeiting had only single instances reported. These locations included Saudi Arabia, France, Ukraine, Mexico, Korea, Taiwan, Indonesia, Africa, and Canada. Also, two instances were found where the source was inside the U.S. at locations in Texas and Michigan.

Trends in Counterfeiting

The different types of counterfeiting are discussed in Chapter 2. These are Type A, B, and C counterfeiting. One question that was asked in the interviews was: What trends do you see in these different forms of counterfeiting? Answers varied from person to person, with both observed increases and decreases being reported, depending on who was giving the report. The results can be seen in Figures 6-1, 6-2, and 6-3. From these findings, Type B counterfeiting appears to be the greatest threat due to its increasing popularity and the fact that the gap between appearance and quality is widest. The research found no evidence that this threat is decreasing.

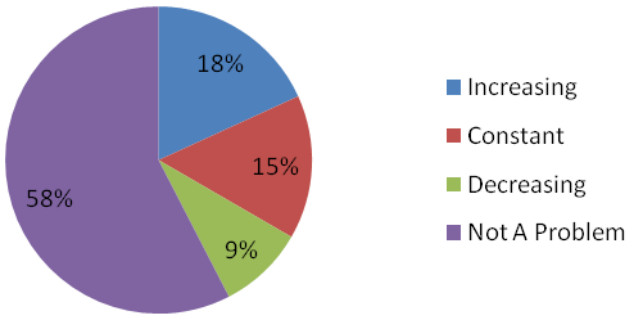

Figure 6-1. Type A counterfeiting

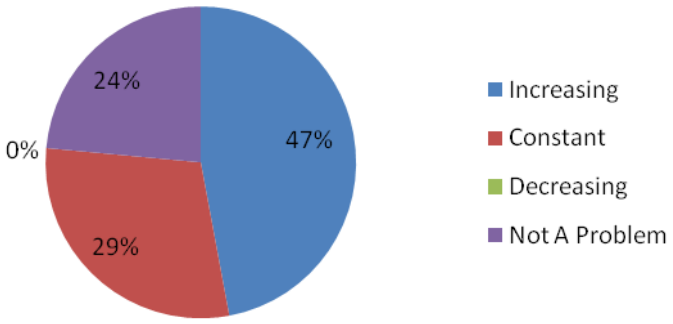

Figure 6-2. Type B counterfeiting

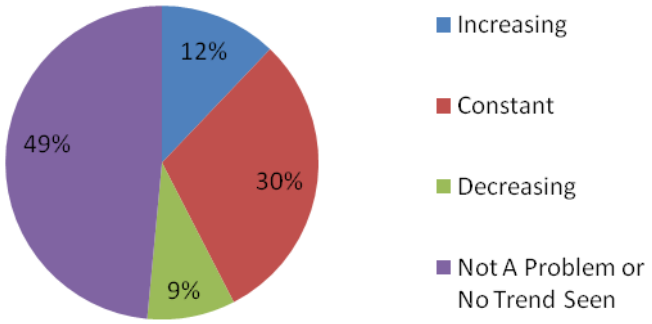

Figure 6-3. Type C counterfeiting

Type A counterfeiting is a newer form of counterfeiting and thus lacks many visible trends. However, the threat is increasing in more cases than it is decreasing. For this reason, the threat cannot be ignored, and attention must be given to the issue.

Finally, Type C counterfeiting, which is one of the older types of counterfeiting, has the smallest effect on construction. This is because most items that fall under the category of Type C are smaller consumer goods and any company with a decent quality program will identify Type C counterfeits. Almost 50% of the interviewees either felt that this was not a problem or could see no trends in this type of counterfeiting.

Qualifying Vendors

An approved vendor list (AVL) is a necessity in the construction industry. Of the people interviewed, 100% of the contractors, manufacturers, and suppliers had some form of AVL. However, there is much variation in the methods used to approve the vendors. In total, there were 19 different ways used to approve vendors. These different methods included the following:

- Questionnaires
- Surveys
- Feedback
- References
- Quality-control maps
- Choosing the biggest supplier when quality cannot be tested

- Use of KPIs (key performance indicators)
- Site review
- Qualification by a third party
- Audit
- Physical inspection
- Post-completion evaluation
- Lab testing of products
- Random inspection of products
- Material inspection
- Review of quality control program
- Complete interview

Of these, the four methods that appeared most frequently were questionnaires, audits, references, and physical inspection. While no method of approving vendors can be considered bad, the more in-depth a process is, the better.

Third-Party Verification

Third-party verification is a practice that many in the construction industry consider to be a necessary part of checking products and vendors. Of the people interviewed, 93% of those who responded to the question of third-party verification were affirmative. Many companies reported great benefits of third-party verification and recommended that it be used by everybody. According to one contractor, the practice has even been written into legislation in the state of Oregon as a requirement in conducting business.

However, there are some concerns about third-party verification. One of these concerns is that while it is effective in the U.S., it is not as effective in other locations such as China due to cultural differences. Another concern is that some third-party verification groups might not be properly trained to deal with certain products and processes. A final concern is that inspectors may not take pride in the products they are inspecting. A person who is part of a company might give an increased level of care compared to a third-party inspector. This is because the inspector's name is not actually on the final product. It is the company he is working for whose reputation is at risk.

Industry Awareness

Correcting a problem can be difficult if no one is aware of the fact that a problem exists. One point of interest in the research was to determine the level of awareness among people in industry of the problem of counterfeiting as well as their current perception of the risk. As Figure 6-4 illustrates, the people interviewed are aware of the risk of counterfeiting, and the majority consider the risk to be high. Some also think the risk is higher at the global level than the local level.

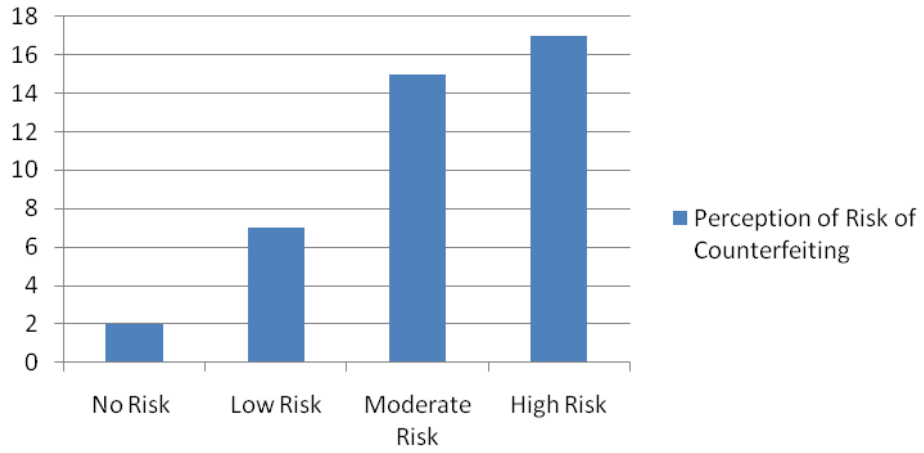

Figure 6-4. Perception of counterfeiting

However, many of these people do not consider their clients to have the same awareness of this risk of counterfeiting. As can be seen in Figure 6-5, the perception of clients' awareness was distributed rather evenly from not aware at all to very aware. In some cases, they indicated a perception that their clients are clueless about the issue. Some mentioned that it really depends on whom and how large the client is. Large clients may have sophisticated measures to discover counterfeiting, while smaller clients may have none.

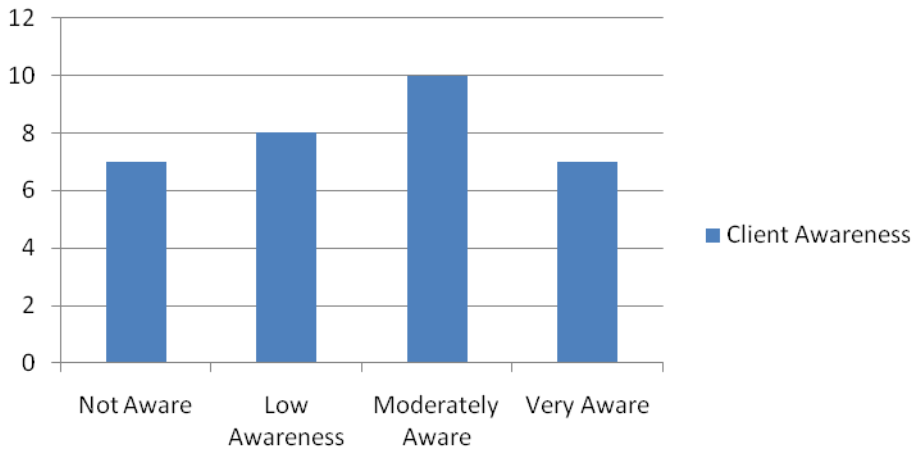

Figure 6-5. Client awareness

Checking up the Supply Chain

Another question that was addressed in the research was: How far up the supply chain do companies check? In most cases, the inspection of the supply chain does not go past the supplier or sub-supplier. However, this is another issue that completely depends on the company involved and its level of concern over the issue of counterfeiting. Figure 6-6 illustrates that the level of checking varies and that there is no uniform segment of the supply chain that is checked. But generally, the supply chain is checked only up to the supplier or sub-supplier.

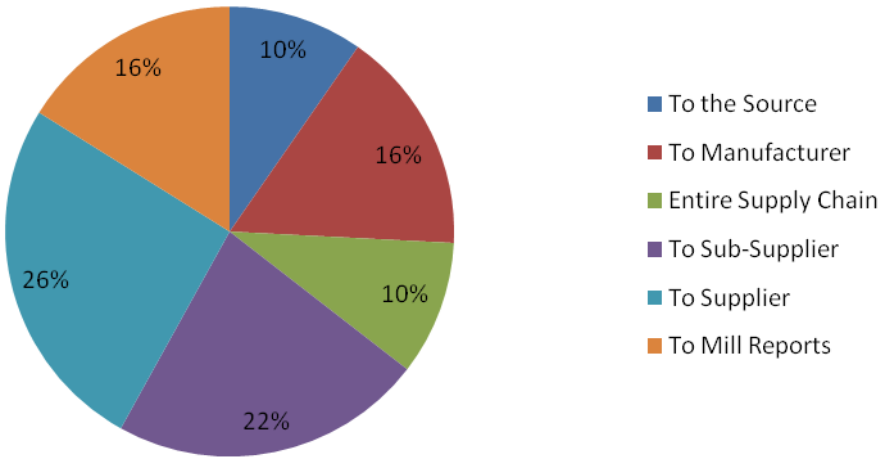

Figure 6-6. Checking the supply chain

Reporting Counterfeiting

A big question concerning counterfeiting is to whom to report the problem. Of the 40 companies interviewed, five of them report issues such as counterfeiting directly to the company president. Three of the 40 companies reported that they direct all problems related to counterfeiting to the V.P. of Procurement. There were six other positions each named by two companies as the person responsible for issues of counterfeiting. These positions are QA/QC, quality engineer, quality supervisor, company V.P., general manager, and chief engineer. Others who were named included site manager, QA team, V.P. of inspection, stakeholders, procurement manager, and the company CEO.

Key Indicators

Throughout the interview process, the people were asked for ideas of key indicators to identify counterfeiting. These key indicators are as follows:

- Prices that are below average market value
- Manufacturers who have painting machines
- Paint colors that are inconsistent with the norm
- Certification labeling from another country
- Products available outside their normal distribution area
- Third-party whistle blowers
- Salespeople who are always saying “yes” or “no problem” or are constantly asking questions about the product
- Documentation that looks incorrect or abnormal
- Suppliers who are overly anxious
- Poor quality appearance
- Surface cracks
- Incorrect appearance

All of these items are indicators that the product or material being purchased may be counterfeit.

CHAPTER 7
CONCLUSION

Counterfeiting is a worldwide problem. While the production of counterfeit items may be concentrated in certain areas of the world, their distribution covers the entire globe. The best way for people to prevent counterfeiting is to be aware of the problem and take the proper steps to prevent it. Of those interviewed almost half feel that their clients have little to no awareness of counterfeiting problem. While the majority of those people feel that counterfeiting is a high risk to the construction industry. Another way to prevent counterfeiting is to use a combination of efforts such as the use of third parties, full knowledge of the supply chain, and inspection. However, these efforts alone will be ineffective if the people performing these tasks do not know what they are looking for. Inspection by experienced personnel who have no connection to the manufacturer, supplier, or purchaser is one of the most effective ways to combat counterfeiting. Proper training is important for employees to adequately perform the required tasks.

Knowing who is involved is also an effective way to prevent the problem from occurring. While trust is an important factor in conducting successful business, no one should ever be completely trusted. A good motto to use is “Trust but verify.” Verification is important in all levels of business. In this world, people are generally looking out for themselves and often are not concerned with whom they hurt. Therefore, the more people know about who is involved, the safer their business will be.

All vendors should be continually approved and qualified to ensure that the buyer is receiving at the end of year one what was being supplied from day one. Approving vendors only at the beginning is therefore not enough. Vendors and suppliers should be continually monitored and checked to ensure that proper procedure is being implemented and followed throughout the

entire process. Random checks of the manufacturing plants and the supply chain should be conducted anytime something suspicious occurs.

If problems are discovered, the purchaser should immediately cut off business with the supplier to let it know that this is not an acceptable business practice. Also, the purchaser should make all parties associated with the company aware of the issue to discourage others from making the same mistake.

The research found that the majority of those interviewed check back to the supplier in their supply chain. However, this still only makes up 26 percent of the people interviewed. In total, the research found six different places to where the supply chain was checked. While most do not check all the way back to the source, many say this would be the best way to prevent counterfeiting.

The research also found that there are different levels of concern depending on the type of counterfeiting. Type "B" counterfeiting is assumed to be increasing by 47 percent of the companies interviewed. While 49 percent do not feel that type "C" is even a problem and 58 percent feel this way about type "A". On the other hand, only 24 percent feel that type "B" is not a problem. So, more care needs to be given to products with known cases of type "B" counterfeiting.

The bottom line is that counterfeiting is a problem which is never going to completely disappear as long as there is someone willing to deal in counterfeit products. Companies need to be educated about counterfeiting and have steps in place to prevent the problem. This way companies will be prepared to identify counterfeiting and this will allow them to catch and report all issues which arise. However, until every item or piece of equipment is checked, the problem of counterfeiting will never be completely eliminated.

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BIOGRAPHICAL SKETCH

Russel Thomas Dingman II was born in Amarillo, TX. He is the son of Russel and Mary Dingman and is the elder of two sons. When he was at the age of two, his family moved to Ocala, FL, where both of his parents had grown up. He attended Forest High School of Ocala, FL, from which he graduated in 2003. He began his college career in the summer of 2003, at the University of Florida. In 2007, he completed his Bachelor of Science with a degree of agricultural operations management: construction and process management.

While attending UF, he worked as a Graduate Assistant to Dr. Edward Minchin. He was also a member of the Heavy/Civil Competition Team as well as Treasurer for SLX, the BCN Honors Fraternity. Upon graduating with a Master of Science in Building Construction, he pursued a job in the construction industry.