

TRUST WITHIN THE US-EU FRESH GRAPEFRUIT SUPPLY CHAIN

By

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To my family and beloved husband. Through God's grace, they have been the greatest support system on earth.

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doubted my ability to complete the thesis requirement of the Master of Science degree.

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LIST OF ABBREVIATIONS

AHP	Analytical hierarchy process
B2B	Business to business
B2C	Business to consumer
CI	Consistency index
CR	Consistency ratio
E-commerce	Electronic commerce
EU	European Union
HVP	High value product
λ	Lambda
RCI	Random consistency index
US	United States

Abstract of Thesis Presented to the Graduate School
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Business transactions around the world have transitioned from personal business relationships, to electronic-business (e-business) structures, also referred to as e-commerce. As new technologies are adopted, so are new un-researched problematic situations that directly affect the safety and reliability of the world food supply. Our primary objective of this research was to identify key factors of trust that are currently found within business-to-business (B2B) relationships along the US-EU fresh grapefruit supply chain. Because of the complexity of identifying the numerous and subjective elements of trust, the Analytical Hierarchy Process (AHP) will provide the foundation for analysis. This method involves interviewing fresh grapefruit exporters to the EU and collecting pairwise rankings of which elements of trust are more important. This should ultimately aid in sustaining an international flow of safe, high-quality food as agricultural B2B relationships transition into the realm of e-commerce.

CHAPTER 1 INTRODUCTION

Problem

As new technologies drive innovation to generate greater business-to-business (B2B) efficiencies, business transactions around the globe will continue their transition from the traditional 'relationship' based interactions towards more electronically dependent business communications. This form of electronic business is referred to in the literature as e-business or electronic commerce (e-commerce).

The infiltration of e-commerce within international supply chains has sparked many unanswered questions. In order to maintain an affordable and cost effective world food supply, it is essential to understand the elements that are currently affecting modern, international agricultural supply-chains. While e-commerce is currently not the dominate form of B2B transactions within the worlds food supply, it is important to notice the direction in which agricultural trade is moving in the hopes of laying the ground work for a successful e-business transition in the future.

Little research has been conducted regarding cross-cultural, B2B trust development. As the world is increasingly becoming an international marketplace, it is important to recognize the cross-cultural partnerships that are forming as a result. Heffernan stated that trust has been identified as an essential element to maintaining successful international business alliances. This is due to heightened levels of uncertainty and risk as a partner's culture, values, and goals may be very different within global markets (Lane 1998). The literature indicates more research is needed to understand the critical element of trust within the world of B2B transactions. As world economies become more integrated, the global market becomes larger and stronger as trade and policy links grown between countries (Edmondson 2008). Along this thread, the

European Commission recognizes the European Union (EU) as one of the major trading regions for United States (US) agricultural products. Maintaining a safe, affordable, and reliable food supply is a top priority for both the EU and the US. As the US is a key supplier of many food products to the EU, the success of the international supply chains connecting the two political regions is critical. Furthermore, as trust has been identified as the key element in maintaining cross cultural, B2B relationships, research is needed to identify the key elements of trust within this trading arena (European Union 2006). Once these elements are identified, it is predicted that economic efficiencies will be captured as participants become better equipped to meet their business alliance needs while being prepared to transition towards the avenue of e-commerce (European Union 2006).

Market Background

General US Exports

Population growth and general economic performance drives global demand for food and agricultural products, which lays the foundation for trade and US exports (USDA 2008c). Edmondson (2008) found that agricultural exports play a significant role in both the farm and nonfarm economy through the effects on employment, purchasing power, and income. He states that in 2006 each export farm dollar generated an additional \$1.65 in domestic business activity. As a result, the \$71.0 billion earned in agricultural exports stimulated an additional \$117.2 billion in general economic activity in 2006 (Edmondson 2008). Farm purchases such as fuel, fertilizer and other necessary production inputs for export commodities caused economic stimulation within manufacturing, trade and transportation sectors (Edmondson 2008). Agricultural export production also provides the need for 841,000 full-time jobs with 482,000 of those jobs existing in the nonfarm sector (Edmondson 2008). The connection is clear. US agricultural exports are a vital contributor to the overall health of the general economy.

Brook (2006) reports that over the past five years, the values of agricultural exports from the US have been on the rise hitting record levels. Increased demand in Canada and Mexico are primarily responsible for the renewed growth within agricultural exports (Brooks 2006). Figure 1-1 shows all major agricultural products being exported from the US over the past five years.

The largest area of exports has consistently been cereal products. These types of products include major cereals such as barley, millet, oat and triticale, as well as pseudo cereals that include buckwheat, amaranth and quinoa (Seibel 2006). These products currently compose 23% of total US agricultural exports and have traditionally been the largest export product (USDA 2008c).

Since the 1990s, high value products (HVP) - meats, poultry, live animals, oilseed meals, vegetable oils, fruits, vegetables and beverages - have been on the rise due to an increase in world population and income . These products have become key players for US exports. As all US exports have been on the rise, HVPs have increased at a faster rate than bulk products - wheat, rice, coarse grains, oilseeds, cotton and tobacco - and as a result represent the majority of US agricultural exports (USDA 2008c).

Oil seed products represented 14% of total US agricultural exports in 2007. Most of the US oil seed production is being exported to Canada and Mexico (USDA 2008c). Within the meat category, a large portion of poultry products are being exported to the Russian Federation and Mexico. Japan, Mexico and Canada are the largest importers of US red meat products (USDA 2008c). However, Brooks (2006) states that meats, as a general category, are a relatively small percentage of total US exports due to disease outbreaks and related trade restrictions. The cattle and beef sectors have been affected the most by these restrictions (Brooks 2006).

Brooks (2006) indicates that fruits, nuts, fish and vegetables, combined, contribute 14% of total US agricultural exports. The US has been recognized as providing high quality nuts for snacks and confectionaries on the world market (Brooks 2006). The top nut export would be almonds - representing 70% of total production - followed by walnuts (Brooks 2006). Fresh grapefruit is the number one fruit product being exported accounting for nearly 40% of sales (Brooks 2006). Fish and vegetables contribute a total of 7% to the total US agricultural exports and top products include fish roes, pacific salmon and potatoes (Brooks 2006, USDA 2008c).

General US Exports to the EU

The US and EU account for the largest bilateral trade alliances in the world when both goods and services are considered together (European Union 2008). Due to the significant volume of trade between the two political regions, there is a high level of interdependence between the two economies (European Union 2008). Together, they account for about 40% of the world's trade (External). The largest percentage of trade between the US and EU comes from the trade of machinery and vehicles (European Union 2008). Among the member states, the United Kingdom and Germany are the two largest importers of US goods and services (European Union 2008).

However, when evaluating US agricultural exports, the EU is no longer the number one trading partner, but does remain a primary market for several products produced in the US (USDA 2008c). Figure 1-2 shows the total amount of US agricultural exports as well as the share going to the EU. In 2007 the US exported a value of \$89.9 billion, while the EU imported \$8.7 billion equaling 9.7% of total US agricultural exports (USDA 2008c). In the same year, the EU ranked fourth in total agricultural US imports by US dollar values (USDA 2008d).

Figure 1-3 shows the major agricultural commodities being exported to the EU over the past five years. As in the world market, HVPs are increasing at a rapid rate for exports going to

the EU. Fruits and nuts are again the largest trade area within the specialty HVP crops. The top two fresh fruit products being exported into the EU are grapefruit and apples (USDA 2008d). Within the processed fruit sector the top products are prunes and raisins (USDA 2008d). Walnuts in various forms and processed states are the top nut products being exported to the EU (USDA 2008d). Cereal exports to the EU represent 13% of total US exports to the EU. Note that cereals to the EU are not as dominate as that found within the world market, but is still a significant export market for US cereals. Figure 1-5 and Figure 1-6 show the top two importing countries for each fruit product - grapefruit, apples, prunes, raisins - sent to the EU. One fact worth mentioning is the nearly non-existent export of meat products to the EU. This is a direct result of the trade restrictions mentioned earlier due to disease outbreaks and production practices.

Grapefruit Exports

Florida is the largest producer of grapefruit within the US. During the 2007-2008 season, 1,127 tons of grapefruit were produced in Florida, with total US grapefruit production equaling 1,556 tons (USDA 2008a). The second largest US producer of grapefruit is Texas, whose crop in 2007-2008 totaled 256 tons (USDA 2008a). When looking at Florida grapefruit production, St. Lucie and Indian River counties account for 69% of the state's total production during the 2006-2007 season (USDA 2007). These counties are located on the eastern coast of Florida and are found within the Indian River region of citrus production (USDA 2007). During the 2006-2007 growing season, the Indian River growing region was responsible for 71.7% of total grapefruit production in Florida (USDA 2007). The 2006-2007 season statistics are being used as the updated citrus summary for the 2007-2008 production year has yet to be released by the USDA.

In 2008, \$124,842,000 of fresh grapefruit was exported from the US throughout the world (USDA 2008d). Top 2008 export destinations in descending order are: Japan; France; Canada; and the Netherlands (USDA 2008d). In 2008, \$34,792,000 of fresh grapefruit was exported from this US to the EU (USDA 2008d.) This value places fresh grapefruit as the number one fresh fruit product going from the US to the EU.

Research Objective

The primary objective of this study is to identify the elements of trust that exist along the US-EU fresh grapefruit supply chain. Fresh grapefruit is the number one fresh fruit product being exported from the US to the EU and for this reason is the focus of this research. In order to collect the needed research data, fresh grapefruit exporters will be interviewed to identify which objects of trust are most important. In order to establish a vector of relative importance, weighted pairwise comparisons of the trust elements will be collected through one-on-one interviews. As more business alliances are trending towards the use of e-commerce to conduct daily activities, this analysis will be used in further research that will ultimately aid in this transition.

Secondary objectives for this research include:

- Identify the structure and size of the fresh grapefruit supply chain from the US to the EU.
- Identify key players for one-on-one interviews.
- Identify various market challenges within the fresh grapefruit US-EU supply chain.

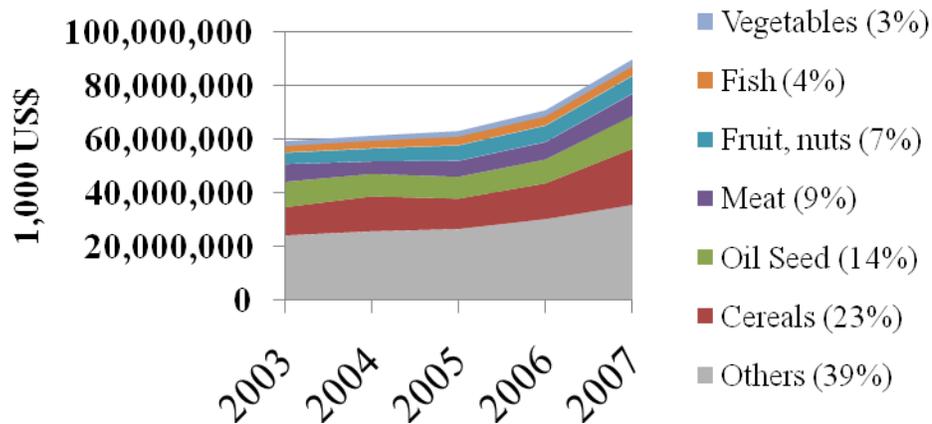


Figure 1-1. Categories of total US agriculture exports (Source: USDA 2008b)

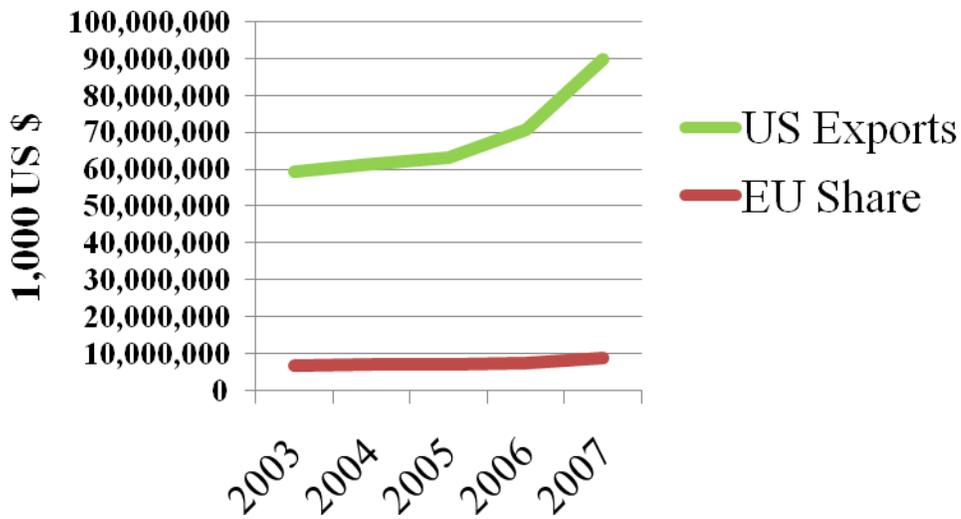


Figure 1-2. Total US agricultural exports (Source: USDA 2008b)

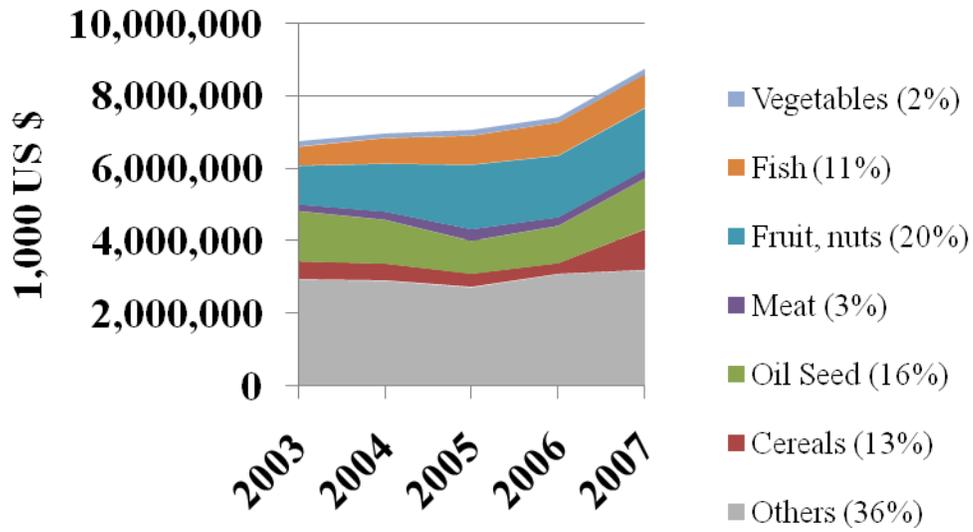


Figure 1-3. Categories of US agricultural exports to the EU (Source: USDA 2008b)

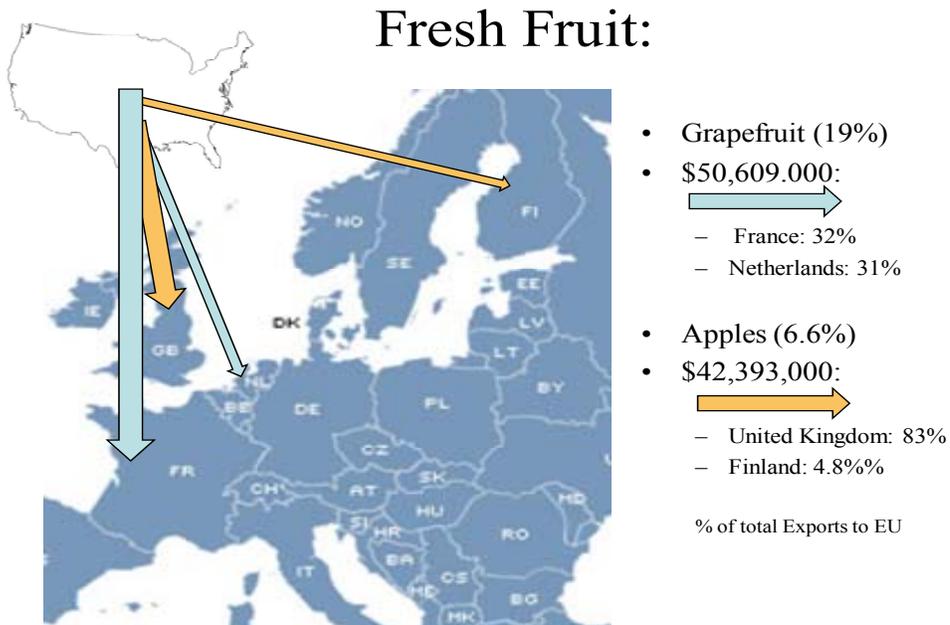


Figure 1-4. Top two exporting destinations for fresh fruit going to the EU (Source: USDA 2008b)

Processed Fruit:

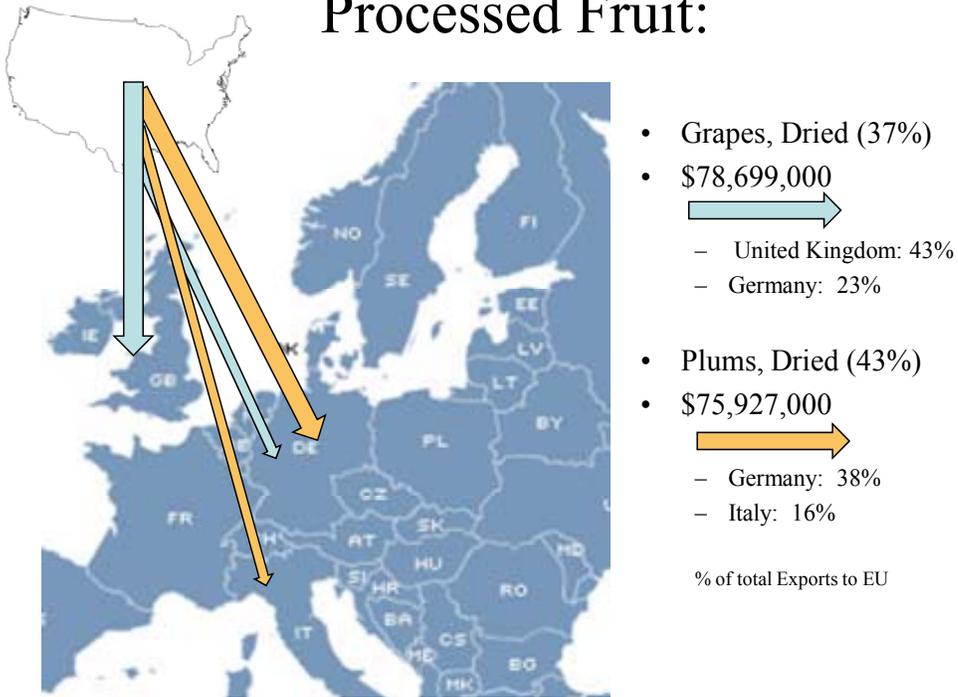


Figure 1-5. Top two exporting destinations for processed fruit going to the EU (Source: USDA 2008b)

CHAPTER 2 LITERATURE REVIEW

The topic of trust within organizational studies has generated increased interest among researchers (Mayer, Davis, and Schoorman 1995). When looking at strategic B2B management, the development of trusting relationships has been identified as a key element within the increasingly competitive global market (Huff and Kelley 2003). For this relationship development to happen, both the organization and its team members must be both trustworthy and trusting (Huff and Kelley 2003). This section of the research will review the elements that have been identified within the literature for organizational, interorganizational and international trust development.

Factors of Organizational Trust

Due to the ambiguous nature the term *trust* embodies, it is important to have a clear understanding of how this research defines trust prior to outlining the elements of B2B trust. Mayer's (1995) definition is the most commonly accepted within the B2B and e-commerce literature (Grabnew-Krauter and Kaluscha 2003). He defines trust as, "*the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party*" (Mayer, Davis, and Schoorman 1995).

A 'party', or organization, is composed of individuals, which leads to the first form of trust relevant to B2B transactions. This form is called propensity to trust, which is defined as "*a trait that leads to a generalized expectation about the trustworthiness of others*" (Mayer, Davis, and Schoorman 1995). Mayer (1995) indicates that this form of trust is an individual personality trait that can be influenced by society's trust levels. Research indicates that people naturally have inborn trust dispositions which aid in their acceptance of trust and perceived reduction of risk.

Individuals with greater propensity to trust are naturally more trusting regardless of any other variable found within the development of trust. As a result, an individual's propensity to trust plays a critical role in the overall level of trust found within an organization (Mayer, Davis, and Schoorman 1995).

This factor will play an interesting role when conducting participant interviews within the grapefruit supply chain. Often times there is one decision maker for an agricultural firm whose innate propensity to trust determines the overall trusting nature of the firm. This is only relevant when looking at a firm to be the trusting party (trustor), not the party to be trusted (trustee) (Mayer, Davis, and Schoorman 1995).

When firm A expects firm B to provide a promised level of quality and quantity of product or service, each member of firm B plays a role in establishing trustworthy credibility within the industry. This form of trust is called internal trust, which is defined as "*the climate of trust within an organization, defined as positive expectations that individuals have about the intent and behaviors of multiple organizational members based on organizational roles, relationships, experiences, and interdependencies*" (Shockley-Zalabak et al 2000). Behavioral consistency among members of a firm is important for trust to be established within the organization (Brenkert 1998) and aids in the development of a credible reputation among other firms. If an individual or firm acts inconsistently there would be a lack of general trustworthiness to the firm (Brenkert 1998). As a result, when internal trust is established teamwork, leadership, goal setting and performance appraisals improve (Jones and George 1998; Mayer, Davis, and Schoorman 1995; McAllister 1995).

Once the firm's overall propensity to trust and internal trust elements have been defined, the final factor of B2B trust becomes relevant; external trust. This form of trust is defined as

“the extent to which organizational members have a collectively held trust orientation toward a partner firm” (Zaheer, McEvily, and Perrone 1998.). For example, how does firm A know if Firm B has a high level trustworthiness or if Firm B is simply misleading firm A to believe it is trustworthy? From the literature, we know that “trust” is the willingness to take risk (Mayer, Davis, and Schoorman 1995), and “trustworthiness” is when an exchange partner is worthy of the trust of others (Barney and Hansen), but how does this solve the dilemma between Firm A and Firm B?

Mayer, Davis, and Schoorman (1995), and Saunders et al. (2004) have identified three primary factors of trustworthiness that can serve as indicators to Firm A regarding Firm B’s trust credibility. Ability, benevolence and integrity are the most commonly used terms to define trustworthiness due to the unique perspective from which the trustor (Firm A) can evaluate the trustee (Firm B) (Mayer, Davis, and Schoorman 1995).

Mayer, Davis, and Schoorman (1995) use the term *ability* to evaluate a specific skill set in which a party claims to be proficient. The scope of the specific skill set is important as a trustee may be very knowledgeable in one range of ability, which is an indicator of trust within that domain (Mayer, Davis, and Schoorman 1995). However, the party does not inherit universal trust as it may have very little experience or education regarding a different skill set (Mayer, Davis, and Schoorman 1995.). This indicates that trust is discipline specific (Zand 1972).

The second identified basis for trust development is benevolence, which is defined as *“the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive”* (Mayer, Davis, and Schoorman 1995.). This factor of trustworthiness acknowledges the possibility of opportunistic behavior from the trustee, but reduces the threat due to the perception of positive B2B intentions from the trustee toward the trustor (Mayer,

Davis, and Schoorman 1995). In other words, benevolence is the inverse of a trustee's likeliness to lie and serves as a key factor to the establishment of trust (Mayer, Davis, and Schoorman 1995)

Finally, *integrity* factors into trust by incorporating the trustor's perception regarding the trustee's ability to maintain acceptable principles (Mayer, Davis, and Schoorman 1995). By adhering to some set of principles, one defines their personal integrity, but if a trustee's personal integrity does not align with the trustor's personal principles, the trustee lacks moral integrity in the eyes of the trustor (McFall 1987). These three factors combined serve as a strong indication to the trustee regarding the trustworthiness of the trustor. The three forms of trust found within B2B organizational studies have been identified alongside indicators or trustee trustworthiness and it is now important to outline how these variables are applied within B2B supply chains.

Interorganizational Trust and Relationships

Swaminathan , Jayashankar, and Tayur (2003) define a supply chain to be “*a set of entities involved in the design of new products and services, procuring raw materials, transforming them into semi finished and finished products, and delivering them to the end customer.*” A set of entities or firms must work together throughout the supply chain in order to meet their core functions as identified by Salin (2000). She first states that supply chains are to be responsive to consumer needs and secondly, they are to efficiently transform and transport goods and services to consumers (Salin 2000). In order for firms to meet consumer demand with supply, they must be able to work together efficiently. Trust is not only a critical element within organizational management, but has also been identified within supplier literature and channel literature as an important factor (Heffernan 2004).

Throughout B2B supply chains some relationships are well established and long term while others are new and underdeveloped. Heffernan (2004) identifies a five-stage B2B

relationship lifecycle that examines exactly how relationships are developed and terminated.

The five stage process: pre-relationship stage, early interaction stage; relationship growth stage; partnership stage; relationship end stage has been mentioned by several other researchers as well (Ford 1982; Frazier 1983; Dwyer, Schurr, and Oh 1987; Borys and Jermison 1989; Larson 1992; Millman and Wilson 1994; Palmer and Bejour 1994; Wilson, 1995; Ford, Gadde, Hakansson, and Snehota 2003).

Pre-relationship stage. The pre-relationship stage refers to the activities that occur prior to the development of any form of a relationship (Heffernan 2004). As reported by Mayer, Davis, and Schoorman (1995), it is this stage of the relationship where some form of basic trust must be established before a relationship is pursued. Heffernan (2004) outlines a four step process. First, a business change occurs that requires the development of a new relationship. Newly established interorganizational need prompts the search for potential B2B partners. This is the point within the lifecycle where reputation (Saunders et al. 2004) and the firm's ability to perform become critical within the supply chain (Mayer, Davis, and Schoorman 1995). Next, is the formation of a list of potential business partners and the final set is the selection of the best potential firm (Heffernan 2004). "*Finding the appropriate partner is a critical step in the relationship development process*" (Wilson 1995), and once a firm has been selected, the relationship transitions into the early interaction stage (Heffernan 2004).

Early interaction stage. The next stage of the lifecycle, the early interaction stage, is where the style and structure of the B2B relationship is negotiated (Ford, 1982). High levels of uncertainty exist due to the lack of experience the firms have regarding each other's business culture (Heffernan 2004). At this point Mayer, Davis, and Schoorman (1995), state that "*as a relationship begins to develop, the trustor may be able to obtain data on the trustee's integrity*

through third-party sources and observation, with little direct interaction.” This is where integrity is suggested by Mayer, Davis, and Schoorman (1995), to play the largest role in the development of trust due to the lack of benevolence the trustor has towards the trustee. As the relationship develops, the trustor will be able to gain insight regarding the intention of the trustee (Mayer, Davis, and Schoorman 1995). If a strong sense of benevolence is perceived by the trustor, the role of benevolence will positively impact the development of trust (Mayer, Davis, and Schoorman 1995). However, it is during this stage of the lifecycle that the relationship is the most fragile due to the inexperience each organization has with one another and can be easily terminated prior to further development (Heffernan 2004).

Relationship growth stage. In this stage, the relationship is undergoing construction. There is a high level of interaction and engagement between the partners as mutual learning towards the specifics of the relationship are being established (Heffernan 2004). The exposure each firm gains from one another aids in the reduction of uncertainty between the two organizations (Ford, 1982). Each firm is focused on learning the other’s business culture, standards, and identifying any adaption’s needed for the partnership to be a success (Heffernan 2004). This stage, coupled with the first two, is where the creation of trust is most crucial (Wilson 1995; Jap 2001).

Partnership stage. The partnership stage is the fourth stage along the lifecycle and is the point where the relationship is at its most mature point (Fort, et al 2003). The B2B alliances have developed a stable partnership where the learning that occurred in the relationship growth stage has proven beneficial as each organization is now equally important to each other (Heffernan). The establishment of equal importance is the foundation for an implicit or explicit expression of maintaining a committed B2B relationship (Heffernan 2004).

Relationship end stage. When the purpose of the relationship no longer exists, the relationship end stage identifies how the partners uncouple the relationship (Heffernan 2004). A relationship can be terminated at any time during the lifecycle, but the relationship end stage only occurs when the reason for the relationship no longer exists (Heffernan 2004).

The B2B lifecycle outlines the natural progression of relationship and trust development within new B2B alliances. Time is an important factor as trading partners may initially be familiar with a firm's reputation, however time is the only way for a trading partner to demonstrate its integrity and predictability (Saunders et al. 2004). It is necessary to identify and understand the trust creation process as the research indicates that trading partners throughout any supply chain are only willing to adopt new business alliances and transaction commitments when trust is present (Saunders et al. 2004).

Cross Cultural Interorganizational Trust

A topic worth mentioning is the variation found in trust and trust development when discussing international business alliances. Social norms directly affect how and if trust will develop among potential partners (Doney, et al. 1998.). Lane (1998) identifies trust as extremely important for competing firms in foreign markets due to the enhanced uncertainty and possible differences found within each partner's culture, values and business goals (Lane 1998). Doney et al. (1998) state that *"Since each culture's "collective programming" results in different norms and values, the processes trustors use to decide whether and whom to trust may be heavily dependent upon a society's culture."* As a result, it is important to understand how trust is developed in cross-cultural B2B relationships.

Huff and Kelley (2003) indicated that few authors have formally linked the characteristics found within collectivist and individualist societies with trust, while many scholars have associated high levels of trust among collectivists, and low among individualist societies.

Dunning (1997) states that “*firms which are best able to identify and reconcile (cultural) differences, or even exploit them to their gain, are likely to acquire a noticeable competitive advantage in the marketplace*”. The purpose of this review is to identify some of the key social differences among cultures that can be associated with the development of trust.

Individualism and collectivism describes how an individual and the prevailing society as a whole relate (Hofstede 1980a). Hofstede defines individualism and collectivism as:

Individualism implies a loosely knit social framework in which people are supposed to take care of themselves and their immediate families only, while collectivism is characterized by a tight social framework in which people distinguish between in-groups and out-groups; they expect their in-group to look after them, and in exchange for that they feel they owe absolute loyalty to in (Hofstede 1980b).

Within the literature the implied perceptions that trust is high in collectivist societies and low in individualist societies (Huff and Kelley 2003) has been substantiated by key cultural differences. Many argue the reason for high levels of trust among collectivists is due to their interdependent world view, and emphasis on nurturing relationships, while individualist do not hold the same perspective of the world and relationships (Triandis 1989,1995; Chen, Xiao-Ping Chen, and Meindl 1998; Hofstede 1980a, 1980b).

The primary example of a collectivist society is that of Japan’s (Huff and Kelley 2003). Within Japan’s culture there is an emphasis on achieving a form of harmony (Sullivan and Peterson 1982) where warmth, cooperation, sharing and fellowship are focused upon. Theoretically, once harmony has been achieved, the development of trust within both personal and professional relationships will occur (Huff and Kelley 2003), which is a major goal of the Japanese social structure (Hazama 1978

The literature does indicate that certain characteristics of the collectivist’s culture do prevent the development of trust (Huff and Kelley 2003). One reason why the development of trust may be impaired is the distinct difference between those members of in-groups and out-

groups (Triandis 1995). Collectivists prefer to be involved with in-group members and tend to be relatively ineffective with strangers. In general, when compared to individualists, collectivists use avoidance behavior, manipulate and compete with out-group members more extensively than individualists do (Huff and Kelley 2003). This in-group preference reduces the possibility of trust development outside of group boundaries (Yamagishi 1998a, 1998b). The desire for collectivists to belong to a group is learned through society and aligns with their intrinsic desire to place group interests above personal interests (Huff and Kelley 2003).

However, in general, once an individual has been accepted as an 'in-group' member, the level of trust found within this culture is much higher than that found within individualists' societies (Huff and Kelley 2003). Yamagishi found that within several studies that in the Japanese culture, their dedication to joint monitoring and social sanctioning reduces the opportunity for free riding which results in community commitment to an organization or network. This is the basis for their preference to working with in-group members only but also explains why the Japanese culture in particular has been identified as a 'trusting' society. In general, the Japanese firms have been praised for their lower transaction costs than US firms and are able to capture greater relational rents due to their cultural environment that cultivates trust, goodwill and cooperation (Dore 1983; Dyer 1996; Hill 1995; Sako 1991).

When researching individualist societies, typical countries include that of the United States, Canada, Germany and Australia (Huff and Kelley 2003). Within this form of society, individual ties are very loose where people are primarily responsible to look after themselves and perhaps the interest of their immediate families (Hofstede 1983). A great deal of freedom is given to individuals within the society (Hofstede 1983). Due to the loose relationships found among individuals, firms rarely trust each other (Huff and Kelley 2003). This refers back to how

an individual's propensity to trust is directly influenced by society's trust levels (Mayer, Davis, and Schoorman 1995). Within individualist societies, Doney et al (1998) asserts that relationships are weak, trust is low and motives tend to be calculative. As a result, individualistic firms require greater levels of contractual guarantees to reduce the risk of B2B transactions. This ultimately causes higher transaction cost for individualist firms when compared to collectivist firms (Dyer and Singh, 1998)

The key differences found within collectivists and individualist social structures is important within the scope of this research due to the number of countries that are key players within the US fresh grapefruit supply chain. With Japan and the EU being the top two offshore destinations for fresh, Florida grapefruit, the existence of cultural differences should be acknowledged. Lenartowicz (1999) states that "*Understanding the nature and influences of culture is central to international business.*" This becomes even more crucial as the EU is made up of twenty-seven unique countries with each possessing some degree of either a collectivist or individualist's social structure.

CHAPTER 3 THEORETICAL FRAMEWORK

Analytical Hierarchy Process

The Analytical Hierarchy Process (AHP) is widely documented and accepted as a decision making method when analyzing multi-criteria situations (Forman and Gass 2001). Founded at the Wharton School of Business by Thomas Saaty (Saaty, 1996), the process serves three basic functions: structuring complexity, measuring on a ratio scale, and synthesizing information (Forman and Gass 2001). The process allows decisions makers to “*model a complex problem in a hierarchical structure showing the relationships of the goal, objectives (criteria), sub-objectives, and alternatives*” (Forman and Selly2001). Due to the complexity of identifying the numerous elements of trust, the AHP method provides the foundation for this research.

The ability of the AHP to enhance decision making during the ‘choice’ acknowledged within the literature; however, its ability to be applied to all areas of problem solving that include evaluation and measurement is not as recognized (Forman and Selly 2001). Forman and Gass (2001) wrote that, “*any situation that requires structuring, measurement, and/or synthesis is a good candidate for application of the AHP*”. For this reason, AHP is identified as the preferred method to evaluate the broadly defined concept of trust. As the most important elements of trust within international food chains are researched, “*AHP will allow for the application of data, experience, insight, and intuition in a logical and thorough way*” (Forman and Selly 2001).

The basis for the AHP has been described as a pie chart. Each wedge represents an objective that contributes to the overall goal of the process; a successful decision. The objective wedges are further broken down into smaller portions to represent sub-objectives. Once the lowest levels of sub-objectives have been identified, they are divided into alternative wedges. Each alternative wedge represents the proportion it contributes to the sub-objective. By

prioritizing wedges, it can be determined how much each alternative contributes to the overall decision (Forman and Selly 2001).

To understand the structure of analysis, the three basic functions of AHP must first be introduced. They are as follows:

Structuring Complexity

When evaluating multi-criteria decision, Forman and Selly (2001) state the importance of structuring complex decisions into a hierarchy of importance. In order to achieve an accurate and unbiased decision, Forman and Selly (2001) accept the results of numerous experiments (Martin 1973; Miller 1956) that have shown the human brain to be limited in both its discrimination ability and short term memory. They conclude that if a human attempts to accurately evaluate anything above 7-9 variables at once, they would be unable to maintain an accurate comparison. By structuring multi-criteria situations into groups of alternatives, with less than 7-9 variables in each level, the human brain is able to overcome its limitations to gain accurate and consistent decisions.

The following example demonstrates the importance of structuring multi-criteria decisions. A professor would like to evaluate each student's participation throughout a semester on a grading scale of 0 to 100. There are 50 students in the classroom. Accuracy and consistency are often lost in the subjective nature of 'classroom participation.' Martin (1973) and Miller (1956) have proven that without accurately structuring the many criteria that contribute to the overall goal of the evaluation (a student's participations grade), large inconsistencies are inevitable throughout the evaluations. They state that after about 7 to 9 students, the internal 'grading scale' is impossible to remain consistent due to the proven limitations of the brain (Martin 1973; Miller 1956). Once the 50th student is evaluated, confusion among ranking will have occurred. As a result, the grades are impossible to defend objectively. For example, if student A receives a

participation grade of 98, student B receives a grade of 94 and student C receives a grade of 49, did student A really participate twice as much as student C? What does a score of 98 really mean? Did they really not give 2% of the total participation required? What did student A do differently from student B to have receive a 4.3% higher grade?

When evaluating students, professors want to remain objective, but due to brain limitations, many times evaluations such as the example given above become very subjective and difficult to substantiate. However, when evaluating such complex problems that include both qualitative and quantitative elements, Saaty (1996) has shown that structuring the criteria into groups of 9 factors or less can aid in obtaining reasonable consistency.

Saaty states in his 1982 book that when looking at multi-criteria situations, AHP allows the decision maker to structure the problem as a hierarchy. The first level of the hierarchy is to identify the overall goal of the decision process. From this point, he explains the development of sub-clusters based on identified objectives and criteria important to the overall decision goal. Decision makers continue to derive subclusters of related topics and criteria by decomposing preferences until the most general of factors is reached (Saaty 1996). Once the structural complexity of the situation has been broken down into subclusters, subsubclusters, etc., the result is a decision tree (Saaty 1996). An example of a structured decision hierarchy can be found in Figure 3-1. Forman and Selly have stated that *“This ‘hierarchical’ arrangement has been found to be the best way for human beings to cope with complexity.”*

Trust Hierarchy

The structure of the AHP within this research is a hierarchy of trust shown in Figure 3-2. The hierarchy was developed by a group of European researchers whose focus is to determine B2B trust elements for food quality and food safety. Their research was the catalyst for determining the elements of trust within the fresh grapefruit export market to the EU.

In order to structure the complexity of B2B trust elements for food quality and food safety, the trust hierarchy has been structured to include five levels. Figure 3-2 outlines the bottom three levels as they are the most extensive in detail. The first level states the objective of the decision tree which is to identify elements of trust from the perspective of a *buyer* who is in the early stages of finding an international supplier. The second level of the hierarchy identifies three objectives of trust, which includes the *product*, *seller* and *market environment*. The following level identifies numerous dimensions of trust with regard to the specified objective in the higher level. Each dimension numbered 1.x is in relation to the seller's *product*, those dimensions numbered 2.x are in relation to the *seller* and those numbered 3.x are in relation to the *market environment*. This level is the first level to be shown in Figure 3-2. Immediately below the listed dimensions of trust are sub-dimensions. The bottom level of the trust hierarchy outlines a wide variety of sources of trust found within each dimensions and sub dimensions of trust (Oosterkamp 2007).

An example of how to follow the design of the trust hierarchy can be explained by following the path from top to bottom when evaluating the *product* being sold. From the explanation above it is known that from Figure 3-2 each criteria on the far left of the table numbered 1.x is in relation to the trust objective, *product*. From 3-2 there are 5 criteria outlined to contribute to the overall *product* objective. The criteria are: *reputation*, *specification*, *inspection*, *certification*, and *price/performance ratio*. To the right of the outlined criteria in Figure 3-2 is a list of many alternatives that contribute to the identified criteria. For instance, if one was to follow the trust hierarchy from *product* to *reputation*, there are 3 alternatives that contribute to the reputation of a product. Those alternatives, as identified in Figure 3-2 are: *intrinsic qualities*, *trade brand of the product*, and *region of origin*. By following the trust

hierarchy one level at a time, it is easily seen how the dimensions of trust have been structured from the top of the hierarchy throughout the bottom.

Measuring on a Ratio Scale

The second of the three major functions of the AHP is the importance of ratio-scale measures, as stated by Forman and Selly (2001). In order to understand the value ratio-scale measures play within the AHP process, we must first define the four accepted scales of measurement. Stevens (1946) identifies the scales of measurement to include nominal, ordinal, interval, and ratio-scales of measure. In the order given, Forman and Selly (2001) recognize each scale as having the same properties as the one behind it, plus a few. For example, ratio measures have the same properties as interval, ordinal and nominal measures, but interval measures do not have the same properties as ratio measures (Forman, Selly 2001). Further explanation will outline the properties of each measure and demonstrate the importance of utilizing the ratio scale within AHP.

Nominal

Nominal numbers are placed on the lowest level of scale in terms of meaning conveyed. They are very simply numerical representations for names. They give no information regarding the ordering of the numbers and are for informational purposes only. An example of a nominal measure is a zip code. The numbers found in the zip code imply nothing more than the area in which you live (Forman and Selly 2001).

Ordinal

Forman and Selly (2001) define ordinal numbers to imply an order or ranking among variables that could be increasing or decreasing in order. For example, a ranking of universities based on student enrollment could place the university with the highest or lowest enrollment as #1. Regardless if the list is ascending or descending, there is no indication of how much larger

or smaller one university is compared to another. When looking at ordinal measures the only information known is that one ranking is above another (Forman, Selly 2001).

Interval

Interval numbers contain the measure of both ordinal and nominal measure as well as providing information regarding the intervals between elements (Forman, Selly 2001). An example given by Forman and Selly (2001) is that of race horses. If the winning horse finished 15 links ahead of the second place horse we know the interval by which the first placed horse won, but we do not know if this was an impressive win. The example goes on to explain that if the horse had won by 15 links in a $\frac{1}{4}$ mile race, the win would have been really strong when compared to if the horse won by the same distance in a $2\frac{1}{2}$ mile race. In this situation it would be important to know the ratio of time between the first and second place horse in order to determine the strength of the win.

Ratio

Ratio measures incorporate all of the elements described above, while also having the properties of ratios. Measures on a ratio scale indicate that equivalent ratios are considered equal (Forman, Selly 2001). A good example of such measures is observing the difference in temperature between the Fahrenheit and Kelvin scale. Because the Fahrenheit measure does not have a ratio property it is incorrect to conclude that a temperature of 80 degrees is twice as warm as 40 degrees. However, when using the Kelvin scale to evaluate such a difference in temperature, the inference would be correct due to the ratio property within the Kelvin scale (Forman, Selly 2001).

Because the ratio-scale provides more information than interval or ordinal measures, it is the foundation of the AHP process (Forman, Gass 2001). As previously outlined, the AHP allows for both objective and subjective decisions. Forman and Gass (2001) state that this is

done “*by eliciting pairwise relative comparisons that produce dimensionless ratio-scale priorities.*” Ratio-scale measurements are important because as interviewees are asked to estimate the relative importance, preference, or likelihood - depending on what is being evaluated - the relative judgments produced fall along a dimensionless ratio-scale of priorities for which no scale exists (Forman, Gass 2001). The properties found within ratio-scale measures allow for individual judgments to be made throughout the decision tree without being based upon a set of agreed decision standards (Forman, Gass 2001).

Once the decision tree is formed, pairwise comparisons are used to derive priorities within each cluster with respect to their parent cluster (Forman, Selly 2001). These relative comparisons are used to develop a ratio scale of importance through the hierarchy system (Forman, Selly 2001). To achieve a global priority throughout the hierarchy, local priorities of each element within a cluster are multiplied by the global priority of the parent element (Forman, Gass 2001). The details of this process are outlined further in this chapter.

Consistency

A measurement of decision inconsistencies is an important by-product of conducting pairwise comparisons to derive priorities (Forman, Selly 2001). As pairwise decisions are made, a measure of consistency is important in order to determine that the judgments were not made randomly. However, just as things in life are not consistent, AHP allows for those inconsistencies (Forman, Selly 2001). A consistency ratio of 10% or less is preferred; however there are certain parameters that would constitute the acceptance of a higher inconsistency rating (Forman, Selly 2001). High ratios of inconsistency found within AHP can occur due to a number of factors. Forman and Selly (2001) state reasons such as clerical error, lack of information, lack of concentration, real world application and inadequate model structure as all potential causes for evaluation inconsistencies. Decision inconsistencies may be a result of any one of these factors,

however, it is important to remember that obtaining a perfect inconsistency measure of 0 not be the goal of the decision making process. Forman and Selly (2001) state that *“a low inconsistency is necessary but not sufficient for a good decision. It is possible to be perfectly consistent but consistently wrong. It is more important to be accurate than consistent.”*

Synthesis

The final objective of the AHP is to synthesize information to aid the decision maker in his/her selection or future forecast (Forman, Gass 2001). Once all pairwise comparisons have been made for each portion of the decision tree, the information is synthesized in order to obtain an overall preference (Forman, Selly 2001). From this point a ranking of the alternatives in relation to the overall goal of the decision can be generated (Forman, Selly 2001), which ultimately serves as a guideline for the decision maker.

Research shows that decisions based on intuition can be adequate, but intuition alone is not sufficient for making complex critical decisions (Forman, Selly 2001). AHP allows for the decomposition of multi-criteria situations to in order to best identify key objectives that aid in complex decision making (Forman, Selly 2001). *“The Analytic Hierarchy Process (AHP) is not a magic formula, or model that finds the ‘right’ answer. Rather it is a process that helps decision-makers to find the ‘best’ answer”* (Forman, Selly 2001).

Calculation of AHP

Pairwise Comparisons

Once the complexity of the problem has been structured into a decision tree, the relative weights (importance) of each criterion can be calculated. The first step in determining the importance of each criterion is to conduct a pairwise comparison of each variable found within a group of criteria. Saaty (1982) explains the use of a matrix as the preferred form when making pairwise comparisons due to its ability to offer a *“framework for testing consistency, obtaining*

additional information through making all possible comparisons, and analyzing the sensitivity of overall priorities to changes in judgment.” Saaty (1982) also includes the ability of a matrix to handle the dominating and dominated aspects of priorities.

Saaty (1982) explains the first step in the pairwise comparison process by beginning at the top of the decision tree hierarchy to choose the criterion, C , which will be used in the first comparisons. Then, from the level immediately below C , the alternatives to be compared: A_1 , A_2 , A_3 and so on are placed into a matrix. For the purpose of this example, let us say there are four alternatives being compared under the first selected criteria. Figure 3.2 shows the elements as they are to be arranged in matrix form.

To conduct the pairwise comparisons, compare A_1 in the first column to A_1 , A_2 and so on in the top row with respect to criteria C in the upper left hand corner of the matrix. Continue the comparison process with element A_2 in column one and so on throughout the matrix (Saaty, 1982).

When a decision maker is performing the pairwise comparisons it is important that the alternatives in the first column of the matrix be compared to the elements in the first row. It is also important that the comparisons be phrased consistently throughout the evaluation. For example, one way to compare the elements in Figure 3-1 could be phrased: “Compared to criteria C , how strongly is alternative A_1 preferred over alternative A_2 ?” There are many ways this could be phrased depending on the relationship the elements have when compared to the criteria in the next higher level (Saaty 1982), however, the key concept is to maintain consistency throughout the comparison matrix.

To fill in the matrix with pairwise comparisons Saaty (1982) utilizes numbers to represent the relative importance of one element over another with respect to the identified criteria. Table

3.1 outlines the numerical scale used for the comparisons that was derived from Saaty's (1982) pairwise comparison scale. The values of 1 through 9 and their reciprocal values are identified with their given definitions to be used during the pairwise comparison process. When comparing one element of the matrix with itself, the comparison must be given a value of 1. As a result in Figure 3-3 the diagonal of the matrices has been completed with the value of 1 (Saaty 1982). From this point, the pairwise comparisons are completed by assigning each comparison a numerical values the scale in table 3-1. Once a pair of alternatives have been compared once, the reciprocal value is then used for the comparison of the second alternative to the first. For example, in Figure 3-3 in the comparison between (A_4, A_3) the reciprocal values of the assigned judgment to comparison (A_3, A_4) should be used (Saaty 1982).

Deriving Weighted Ratios

The following example will be used to clarify the AHP process and its ability to evaluate subjective data. Suppose a student must make the decision of which university to attend based on three alternatives - each university athletic program, academic strengths and cost of tuition. To build the decision matrix the criteria, "University Satisfaction," is placed in the upper left-hand corner with the three factors that will contribute the decision of which university to is listed in the top row and far left column (Figure 3-4). By completing the matrix, the factor most important to the student - in regards to "University Satisfaction" - will be identified.

To complete the matrix the student was asked: "How much more important is the university's athletic program when compared to its academic strength and cost of living?" This was consistent throughout the matrix, while keeping in mind that the diagonal values of 1 were already assigned and the second set of evaluates are assigned the reciprocal value of the first evaluation. As a result, in this sample matrix, there were only three pairwise comparisons to be made. The pairwise comparisons made indicate that the student believes the athletic program to

be moderately less important – important than academic strength with a rating of 1/4 (Table 3-1), while the athletic program compared to the cost of living is equally important-moderately less important. The third comparison shows the student to believe that academic strengths when compared to the cost of living is more important. By completing the pairwise comparison matrix, the decision maker is able to derive independent ratio scale priorities as opposed to randomly assigning weighted values to each (Forman, Selly 2001).

Saaty (1982) explains the next step in the AHP to be synthesizing the judgments in order to get an overall estimate of priorities regarding which factors are more important to the student in terms of overall university satisfaction. To begin, add the values in each column (Figure 3-5). Then divide each value in each column by the sum of that column to normalize the matrix (Figure 3-6). The normalization of the matrix is an important factor as it allows for true comparisons among elements. Saaty (1982) concludes the final step in the process of obtaining a percentage of relative preference is to calculate an overall average over the rows by summing the values in each row of the normalized matrix and dividing by the number of entries (Figure 3-7).

Figure 3-6 yields the percentage of overall relative preference when comparing the athletic program (13%), academic strength (67.6%) and cost of living (19.2%) within a particular university. It can be concluded that academic strength is three times as important to overall university satisfaction when compared to the cost of living and athletic program. The athletic program is only slightly less important when compared to the cost of living element

When looking at a simple example of a decision hierarchy - such as determining university satisfaction with only three alternatives - the relative priorities of the matrix are also considered the overall priorities for the entire decision tree as there are only two levels in the hierarchy. However, for more complex decision hierarchies, additional calculations are needed in order to

compute the overall priorities for each sub cluster in respect to the entire hierarchy. The calculation is simple, yet provides an overall picture to which criteria are most important within the hierarchy. To compute the overall priority rating, the relative rating of each alternative is multiplied by the priority percentage of the corresponding criteria. The highest level of the decision hierarchy is the only situation where the relative priorities are also the overall priorities. This is because of the fact that there are no priority percentages of criteria above that level. By calculating the overall priorities, the relative priorities will be normalized throughout the hierarchy to develop a global priority rating for the entire decision tree (Saaty 1982).

Through this synthesis of information a ratio of relative and overall priorities were identified, but the issue of consistency must be addressed in order to confirm that the comparisons were not made randomly.

Deriving the Consistency Ratio

The CR is an important factor of the AHP. Since each set of criteria are placed into a matrix of alternatives to be evaluated against, it is important to have some measure of consistency throughout the decision process. The CR serves only as an indicator of regularity throughout the decision process while a consistency ratio of 0 should not be the goal of the pairwise evaluations (Saaty, 1982). The purpose of the consistency ratio is to warn of random judgments, not to guarantee perfectly consistent evaluations.

When looking at the university example, the percentage of relative preference has been calculated, but the decision process has not been tested for consistency. In order to calculate the consistency ratio, the percentages of relative preferences (13, 67.6, and 19.2) serve as the priority vector of the three alternatives with respect to overall university satisfaction (Saaty 1982).

To begin the consistency index calculation, multiply each column of the original decision matrix by the corresponding priority value (Figure 3-8). Once the priority vector has been

multiplied throughout the decision matrix, sum the values in each row (Figure 3-9). From this point one begins to solve for lambda (λ) max. This is done by dividing the values in the column of row totals (Figure 3-9) by the corresponding value in the priority vector. An average is then found of the three entries (Equation 3-1) in order to complete the calculation of λ max. Lambda max is then inserted into the consistency index (CI) formula (Donegan et al) found in Equation 3-2 (Saaty 1982).

The final step in solving for the consistency ratio is to insert the CI into the consistency ratio (CR) formula (Donegan et al) in order to determine the overall consistency of the decision matrix. In that formula the CI is divided by the random consistency index (RCI) which is provided in Table 3-2. Saaty provides this index as a given in his 1982 book publication. If the overall CR is less than 10%, the pairwise comparison judgments are considered to be consistent (Equation 3-3) (Saaty 1982).

Role of AHP in Supply Chain Management

The primary reason for selecting the AHP as the theoretical foundation for this research is its ability to structure the complexity of possible decision alternatives, give quantitative measurements of pairwise comparisons which result in the synthesis of new information to aid in the decision making process (Forman and Gass 2001).

B2B supply chain participants are often faced with many choices that are followed by some form of a decision. As a result, the AHP process can be applied within the world of organizational supply chain management. Akarte, Surendra, and Ravi (2001) conducted a study evaluating the supplier selection process by using the AHP method within the automotive casting sector. They believed that suppliers within the sector were no longer being selected due to price, but rather the overall capability of the supplier to meet the buyers' needs. In order to meet supplier selection criteria of both qualitative and quantitative function, AHP is the decision

method of choice as it allows for both forms of criteria to integrate to aid in the synthesis of a decision (Akarte, Surendra, and Ravi 2001).

Within their work, Akarte, Surendra, and Ravi (2001) begin their AHP analysis of selecting an automobile casting supplier by structuring the complexity of the problem. Through research and industrial investigation, they identified four groups of criteria: Product Development Capability, Manufacturing Capability, Quality Capability, and Cost and Delivery. They further structured these four identified criteria into the third level of the hierarchy which provides detailed subclusters of criteria derived from the variables in level 2.

After the completion of the decision tree, Akarte, Surendra, and Ravi (2001) utilize the 1-9 scale of AHP to assign relative weights to each of the criteria using pairwise comparisons. They follow the levels of the decision hierarchy to assign the relative weights. They first evaluate the four criteria derived from the main objective, and then evaluate the sub-criteria in level three. Within their research, both objective and subjective data are being evaluated, which require two performance measurement calculations (Akarte, Surendra, and Ravi 2001)

Objective criteria such as total cost and production accuracy are evaluated depending on if a maximum or minimum value of the criterion is most preferred (Akarte, Surendra, and Ravi 2001). If a maximum value is desirable (such as maximum part size capability), the performance measure is calculated by normalizing the values. If the minimum value of the criterion is preferred (such as the lowest cost supplier must have the highest preference), the reciprocal of the values is first taken and then normalized to calculate the performance measure.

When conducting a subjective criteria evaluation, the relative performance measure of each sub-cluster criteria is calculated by quantifying qualitative ratings through pairwise comparisons. Akarte, Surendra, and Ravi (2001) give the example of rating the casting complexity of a

supplier with qualitative values of low, medium, high and very high. By conducting a pairwise comparison of all of the sub-criteria found under a certain criteria, quantifiable weights are given to qualitative measures. Once the quantifiable performance values are determined, they too are normalized to ensure consistency among objective and subjective criteria (Akarte, Surendra, and Ravi 2001)

After all of the identified criteria have been evaluated, the overall score of the supplier is obtained by the sum of the product of the performance measure of the supplier for each criterion. Akarte, Surendra, and Ravi (2001) then identify the supplier with the highest overall score to be considered the most suitable business partner. The ultimate result of utilizing the AHP process is the synthesis of a quantifiable data to aid in the decision of selecting casting supplier.

Akarte, Surendra, and Ravi (2001) then go on to create a web-based decision support system for casting supplier evaluation and buyer-supplier interaction. This transition into the field of e-commerce is important to the greater goal of this research by establishing the foundation of supplier selection based solely on e-commerce communications. However, the key ideas pulled from the work of Akarte, Surendra, and Ravi (2001) is the use of AHP directly within the discipline of supply chain management and supplier selection. From their work, the application of AHP within the grapefruit export supply chain with the purpose of identifying trust elements is substantiated.

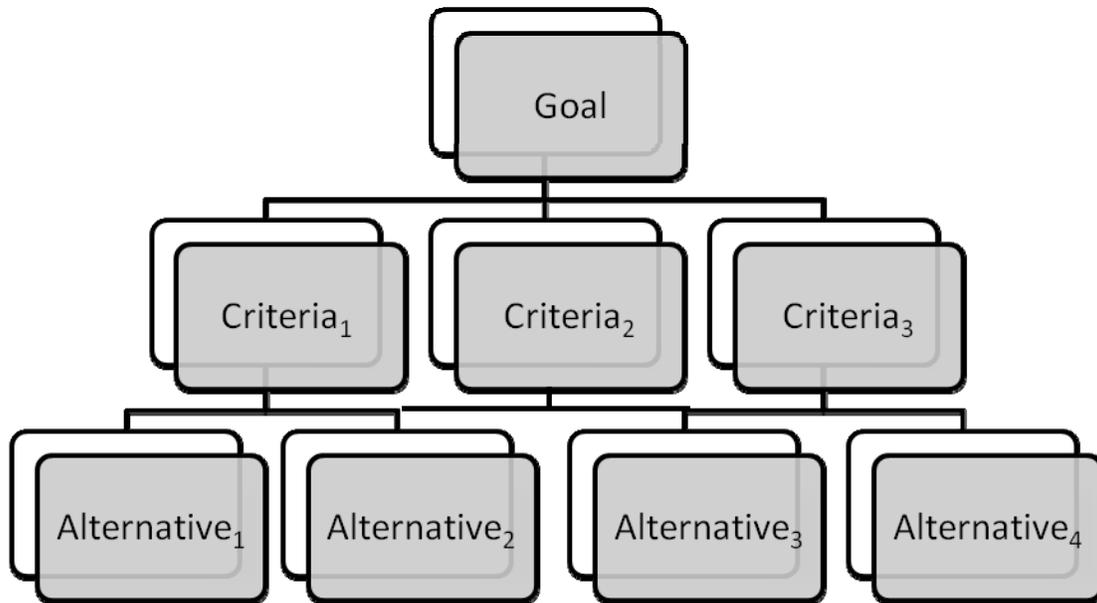


Figure 3-1. Structured decision hierarchy

<u>Dimensions of the objects of trust</u>	<u>Sources of trust (intrinsic and enforced, new partners)</u>
1.1 Reputation	1.1.1 Intrinsic qualities (e.g. taste) 1.1.2 Trade brand of the product 1.1.3 Region of origin
1.2 Specification	1.2.1 Product specification as agreed 1.2.2 Statement that product complies with legal requirements 1.2.3 Product safety warranty 1.2.4 Production process specification 1.2.5 Specification of origin of raw material
1.3 Inspection	1.3.1 Physical examination of product 1.3.2 Laboratory analysis of product sample 1.3.3 Visit to production site
1.4 Certification	1.4.1 Sector specific quality or hygiene code 1.4.2 HACCP or ISO 9000 of original producer 1.4.3 Eurepgap, brc, ifs, gmp+ 1.4.4 Regional origin (AOC) label 1.4.5 Corporate Social Responsibility label
1.5 Price / performance ratio	
2.1 Capability	2.1.1 Company's information on tracking and tracing 2.1.2 Company's information on production capacity 2.1.3 Company's information on communication and services 2.1.4 A visit to the production site/ his company 2.1.5 An audit to see if the supplier meets all our standards 2.1.6 Company is ISO 9000 certified 2.1.7 Company complies with sector standard
2.2 Relationship	2.2.A between individuals
	2.2.B between companies
2.3 Reliability	2.3.A Adequate communication
	2.3.B Deliveries
	2.3.C Problem solving
	2.3.D Financial situation
2.4 Reputation	2.2.A.1 Partner and I share the same philosophy of life 2.2.A.2 Partner is kind 2.2.A.3 Impression that partner will be flexible 2.2.A.4 We share the same language 2.2.A.5 Know the partner already through my professional network 2.2.A.6 Know the partner already through mutual friends / family 2.2.A.7 The partner is family 2.2.A.8 The partner is a friend 2.2.B.1 Partner and I share a common work philosophy 2.2.B.2 Partner and I share a common interest in a long term relationship 2.2.B.3 Partner and I develop common rules for coordination 2.2.B.4 Partner accepts that transaction rules are set out by me 2.2.B.5 Assessment of partner's growth potential 2.2.B.6 Partner is willing to invest in the relationship 2.2.B.7 Partner is prepared to bargain 2.3.A.1 Partner responds on time 2.3.A.2 Important matters are actively communicated 2.3.A.3 Partner responds adequately 2.3.B.1 Impression that the partner is honest 2.3.B.2 Oral agreement 2.3.B.3 Partner is willing to draw up a contract 2.3.B.4 Logistics warranty 2.3.B.5 Partner is willing to be closely monitored 2.3.C.1 Partner thinks ahead with us to avoid problems 2.3.C.2 Partner is competent in solving problems 2.3.D.1 The financial report of the seller 2.3.D.2 A financial audit on the seller
2.4 Reputation	2.4.1 Official recommendation by a public institution 2.4.2 Official recommendation by an industry association 2.4.3 Official recommendation by purchasing organisations 2.4.4 Informal recommendation by someone I know 2.4.5 Informal recommendation by a superior 2.4.6 Partner is member of branch- or professional association 2.4.7 Reputation of partner in my network
3.1 Control institutions	3.1.1 Knowledge of checking personell 3.1.2 Strictness of checking process 3.1.3 Test criteria 3.1.4 Acknowledgement by business partner 3.1.5 Dissemination of the quality sign 3.1.6 Accreditation
3.2 Informal institutions	3.2.1 Political stability 3.2.2 Social control among operators
3.3 Legal institutions	3.3.1 Contract enforcement options 3.3.2 Food quality and safety level
3.4 Reputation	3.4.1 Enforceability of contracts 3.4.2. Reliability of operators

Figure 3-2. Trust hierarchy (Source: Oosterkamp 2007)

C	A ₁	A ₂	A ₃	A ₄
A ₁	1	0	0	0
A ₂	0	1	0	0
A ₃	0	0	1	0
A ₄	0	0	0	1

Figure 3-3. Sample matrix for pairwise comparison

Table 3-1. Scale of relative importance

Data Entry Value	Definition
9	Absolutely dominating
8	Much more important – absolutely dominating
7	Much more important
6	More important – more important
5	More important
4	Moderately more important – more important
3	Moderately more important
2	Equally important – moderately more important
1	Equally important
1/2	Equally important – moderately less important
1/3	Moderately less important
1/4	Moderately less important – less important
1/5	Less important
1/6	Less important – much less important
1/7	Much less important
1/8	Much less important – absolutely inferior
1/9	Absolutely inferior

University Satisfaction	AP	AS	CL
Athletic Program (AP)	1	1/4	1/2
Academic Strength (AS)	4	1	5
Cost of Living (CL)	2	1/5	1

Figure 3-4. Completed sample matrix

Sum the values in each column ↓	University Satisfaction	AP	AS	CL
	Athletic Program (AP)	1	1/4	1/2
	Academic Strength (AS)	4	1	5
	Cost of Living (CL)	2	1/5	1
	Column Total	7	1.45	6.5

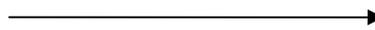
Figure 3-5. Synthesizing judgment ratios

University Satisfaction	AP	AS	CL
Athletic Program (AP)	1/7	.25/1.45	.5/6.5
Academic Strength (AS)	4/7	1/1.45	5/6.5
Cost of Living (CL)	2/7	.2/1.45	1/6.5

Divide each entry in a column by the column total.

Figure 3-6. Normalized matrix

University Satisfaction	AP	AS	CL	Relative Preference
Athletic Program (AP)	.143	.172	.077	.130
Academic Strength (AS)	.571	.689	.769	.676
Cost of Living (CL)	.286	.138	.153	.192



Sum the values across each row and divide by the number of entries in each row

Figure 3-7. Relative preferences

University Satisfaction	AP (0.13)	AS (.676)	CL (.192)
Athletic Program (AP)	1	.25	.5
Academic Strength (AS)	4	1	5
Cost of Living (CL)	2	.2	1

Figure 3-8. Multiplication of priority vector

University Satisfaction	AP (0.13)	AS (.676)	CL (.192)	Row Total
Athletic Program (AP)	.13	.169	.096	.395
Academic Strength (AS)	.52	.676	.96	2.16
Cost of Living (CL)	.26	.135	.192	.59

Figure 3-9. Totaling of priority vector multiplication

$$\begin{bmatrix} .395 \\ 2.16 \\ .59 \end{bmatrix} \div \begin{bmatrix} .13 \\ .68 \\ .19 \end{bmatrix} = \begin{bmatrix} 3.04 \\ 3.17 \\ 3.11 \end{bmatrix} \longrightarrow \frac{3.04 + 3.17 + 3.11}{3} = \frac{9.32}{3} = 3.11 = \lambda_{\max}$$

Equation 3-1

$$CI = \frac{\lambda_{\max} - n}{n - 1} = \frac{3.11 - 3}{2} = .055$$

Equation 3-2

$$CR = \frac{CI}{RCI} = \frac{.055}{.58} = 9.48\% < 10\% \rightarrow \text{Consistent}$$

Equation 3-3

Table 3-2. Random consistency index

Matrix Size	1	2	3	4	5	6	7	8	9	10
RCI	0.0	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

CHAPTER 4 DATA COLLECTION

In order to identify the elements of trust that exist along the US-EU fresh grapefruit supply chain, one-on-one interviews were conducted with every fresh grapefruit exporter shipping to the EU from the state of Florida. During the interviews, exporters were asked to conduct a series of pairwise comparisons that were derived from a developed trust hierarchy. The criteria and alternatives of the trust hierarchy were formulated into a macro-enabled spreadsheet that allowed the interviewees to adjust a computer generated bar diagram to indicate the appropriate ratio of importance one alternative possessed over another. An in depth discussion of each of the mentioned data collection elements can be found below.

Firm Selection

In order to obtain the most accurate information from the one-on-one interviews, an in-depth investigation was conducted to identify all Florida exporters of fresh grapefruit to the EU. From a list of 45 licensed citrus exporters provided by the Florida Department of Citrus (2008), 10 are currently exporting fresh grapefruit directly to the EU. From the remaining 45 licensed exporters, 7 are currently exporting fresh grapefruit to the EU by brokering their fruit to one of the 10 direct exporters. Of the remaining licensed exporters, they are either not exporting fresh grapefruit or not participating in the European market.

All 10 direct exporters of fresh grapefruit to the EU are located in the Indian River citrus region of the state and were primarily centered in the Vero Beach area of Florida. Due to the reasonable size of the population, a census survey of all 10 exporters was conducted.

Data Collection Process

Interviews were conducted with a person within each firm that would be knowledgeable about European buyers. The interviews averaged 30-45 minutes in length. The participants

answered general questions regarding the size and type of company they worked for before conducting the pairwise comparisons. This was to get a general idea of how large a player the company was in the European market for fresh grapefruit.

Each interviewee was then asked to evaluate the pairwise comparisons by taking the perspective of what they felt their European buyers of fresh grapefruit would prefer. In order to uphold Saaty's emphasis on maintaining consistency within the phrasing of the question, as mentioned earlier, each participant was asked the same question. Depending on which trust objective was being evaluated, interviewees were asked: "In regards to *your product*, which alternative do you feel your European buyers prefer?" *Your product* was interchanged with *your company*, and *market environment*. Also to maintain consistency, in the event that a participant questioned the definition of an alternative during the comparison the trust hierarchy was used for clarification (Figure 3-2). By definition, the hierarchy is decomposed into clusters and subclusters that contribute to the level above it. As a result, if a participant asked for the applied definition of *inspection* with regards to the *product*, the definition given was found in the level immediately below *inspection*, which includes: 1.3.1 Physical examination of product, 1.3.2 Laboratory analysis of product sample, and 1.3.3 visit to Production site.

From this point, interviewees were asked to conduct the pairwise comparisons by utilizing a bar graph as shown in Figure 4-1. The priority judgments were assigned by moving the middle bar in the direction of the preferred objective. The degree to which the participant moved the bar served as an indication to how much more an objective was preferred over another by automatically assigning a numeric value that coincides to Saaty's (1982) scale of relative importance (Table 3-1). By utilizing this method, interviewees were allowed to assign visual weights to subjective material. The data collected during the interviews is comparable due to the

use of ratio-scale measures. As a result, each participant develops a unique ratio-scale of measure as they assign judgments to each comparison. For example, participant A may be more extreme in their judgments while participant B may be much more conservative in their assessment, however their results could be the same as each interviewee has inadvertently developed a unique ratio-scale of measure that can be normalized and compared.

Each level of the trust hierarchy was input into a pairwise comparison matrix and participant's judgments were entered into each matrices by using the bar tool. Figure 4-2 shows this concept. Participants only saw the graphical judgment tool during the interview. The comparison matrices and calculations were all behind the scenes in the programming of the macro-enabled spreadsheet.

Figure 4-2 shows a situation where only three pairwise comparisons need to be made in order to complete the trust objective matrices. This coincides with Saaty's (1982) use of reciprocal values in the second comparison of alternatives. As a result, the programming of the spreadsheet electronically filled in the lower portion of the matrix with the reciprocal values of the first judgments.

The final element of the data collection process was acknowledging the consistency ratio. As each participant evaluated a pairwise comparison group, the consistency ratio was simultaneously being calculated with each judgment. The consistency ratio was only complete once all judgments had been made for the identified criteria. As AHP does allow for a CR of 10% or less, the spreadsheet indicated if the judgments fell within this accepted range. The consistency measure was on the screen for participants to see, however the measure was not pointed out to participants, as it is not the goal of the comparison process to obtain perfect consistency.

After all comparisons had been made for each section of the decision, participants were asked to review their judgments in order to make sure their answers were as they intended. In several interviews, once the participant was asked to review their answers, the slight changes they made did alter the CR to decrease from a rejected level to an accepted level. However, in several situations, even after the participant was asked to review their judgments, the CR would still indicate an unacceptable level of consistency. These inconsistencies do not render the answers invalid, as referred to in Chapter 3, but reasons for these will be discussed later.

As a final measure to ensure the interviewees agreed with their indicated preferences, the calculated relative priorities were reviewed. If at any point the participants did not agree with what the final calculations of the pairwise comparisons, the sub-cluster in question was revisited. The interviewees were able to re-evaluate their decisions in an attempt to reduce the chance of human error when using the macro-enabled spreadsheet. Only during two interviews did the interviewee ask to revisit a portion of the evaluation. In both instances the participant accidentally slid the decision bar in the opposite direction they intended. This was the last step in insuring the data collected was as accurate as possible.

Data

Tables 4-1 through 4-6 outline the information gathered during the interviews. The tables are arranged according to the trust hierarchy (Figure 3-2). The pairwise comparison numbers coincide with the numerical values assigned in Figure 3-2, keeping in mind that the dimensions numbered 1.x are in relation to the *seller's product*, those dimensions numbered 2.x are in relation to the *seller* and those numbered 3.x are in relation to the *market environment*. The priority values coincide with Saaty's (1982) scale of relative importance (Table 3-1) in decimal form. The last row of each table indicates the CR for each firm in relation to that hierarchy level.

Note that in Table 4-4 the CR is inapplicable because only one pairwise comparison is being made.

For example, in table 4-1 each firm is identified on the top row with their assigned determined judgments for each pairwise comparison below. In the far left column the pairwise comparison being made is identified in accordance to the identified trust hierarchy (Figure 3-2). From table 4-1, Firm D placed a value of 8.4 when evaluating the *product* compared to the *company*. Firm D placed a value of 8.3 when evaluating the *product* compared to the *market environment* and a value of 0.13 was given when comparing the *company* to the *market environment*. The definitions of the given values can be found in Table 3-1.



Figure 4-1. Pairwise graphical judgment tool

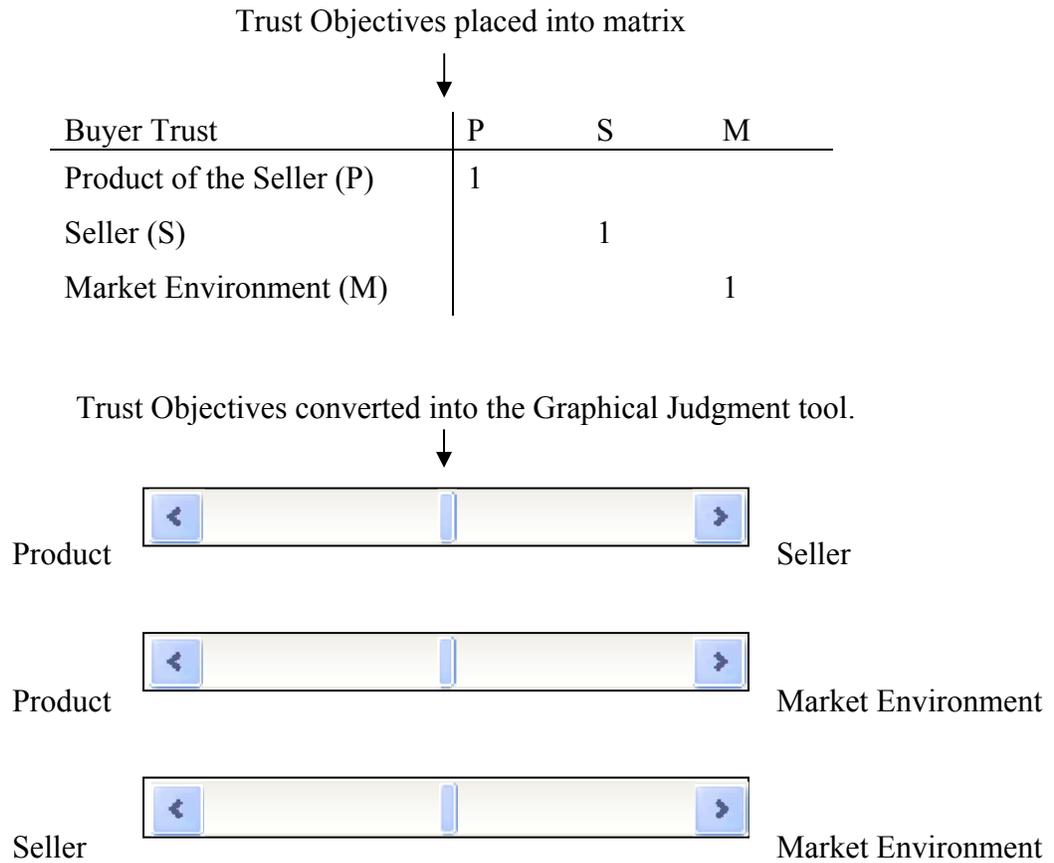


Figure 4-2. Visualization of applied graphical judgment tool

Table 4-1. Evaluation of the 1st hierarchy level

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
1 – 2	1	0.71	9	8.4	7	0.12	1.1	1	3	2.6
1 – 3	0.42	0.59	9	8.3	3.3	1	6	5.6	1	2.4
2 – 3	0.5	0.59	9	0.13	6.9	1	1	5.6	0.24	4.2
CR	≤ .10	≤ .10	> .10	> .10	> .10	> .10	> .10	≤ .10	≤ .10	> .10

Table 4-2. Evaluation 1 with respect to “product”

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
1.1 – 1.2	.28	1.4	0.11	6.1	0.42	5	5.3	1	0.5	7.2
1.1 – 1.3	0.19	0.37	0.11	0.26	0.36	3	0.18	1	0.5	7.2
1.1 – 1.4	0.2	0.36	0.11	0.26	0.36	3	0.18	1	0.5	7.2
1.1 – 1.5	0.2	1	0.11	0.13	0.29	5.3	0.19	5.6	0.23	4.2
1.2 – 1.3	3.6	0.48	1.1	1	3.2	1	0.19	5.7	2.2	0.16
1.2 – 1.4	3.4	0.4	0.11	0.26	3.2	1	0.11	5.7	0.56	0.16
1.2 – 1.5	0.31	0.3	0.11	0.13	3.4	3	0.19	1	0.29	0.11
1.3 – 1.4	2.9	0.5	1	0.23	0.4	0.3	0.19	0.18	0.5	2
1.3 – 1.5	0.38	1	0.11	0.12	1	1	0.19	0.19	0.27	0.36
1.4 – 1.5	0.48	2.5	1	0.16	0.21	0.3	6.1	5	0.28	0.31
CR	> .10	≤ .10	> .10	> .10	> .10	> .10	> .10	> .10	≤ .10	> .10

Table 4-3. Evaluation 2 with respect to “seller”

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
2.1 – 2.2	0.59	0.25	9	0.21	7	0.31	1	5.4	1	4.2
2.1 – 2.3	0.56	1.5	1	0.14	7	0.42	0.19	0.25	1	0.17
2.1 – 2.4	0.53	1.5	9	1	7	1	1	1	1	4.5
2.1 – 2.5	0.36	0.5	1	0.19	7.1	0.48	0.11	3	2.6	0.14
2.2 – 2.3	2.2	1	0.11	6.2	4.6	4	1	0.21	1	0.23
2.2 – 2.4	1	2	9	6.4	5.5	4	5.5	0.91	1	5.5
2.2 – 2.5	0.56	2	0.11	1	5.1	1	1	2.4	3.3	0.21
2.3 – 2.4	1	1.6	9	6	7.9	4	1	1	1	6.1
2.3 – 2.5	0.45	1	0.11	1	7	3.1	1	2.6	2.6	1
2.4 – 2.5	0.53	0.59	0.11	0.18	0.18	0.31	0.11	2.6	2.8	0.16
CR	≤ .10	≤ .10	> .10	> .10	> .10	> .10	> .10	> .10	≤ .10	> .10

Table 4-4. Evaluation 2.2 with respect to “relationship with seller”

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
2.2.A – 2.2.B	4.7	1.9	0.19	8.6	7.8	5.2	5.3	5.8	5.1	7.5
CR	-not applicable-									

Table 4-5. Evaluation 2.3 with respect to “reliability of the seller”

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
2.3.A – 2.3.B	2.6	3.3	1	0.14	0.13	5.7	0.19	1.1	0.25	0.3
2.3.A – 2.3.C	2.7	0.56	4.8	8	8	2.1	5.9	3.7	0.45	5.6
2.3.B – 2.3.C	2.8	1	4.7	7.9	7.9	2	5.9	3.8	3	4.3
CR	> .10	> .10	≤ .10	> .10	> .10	> .10	> .10	≤ .10	≤ .10	≤ .10

Table 4-6. Evaluation 3 with respect to “market”

Pairwise Comparisons	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Firm H	Firm I	Firm J
3.1 – 3.2	7.2	6	6.4	8.4	9	5.3	9	3.8	1.8	0.37
3.1 – 3.3	7.2	4.3	6.5	8.3	9	4.8	9	3.5	1	0.34
3.2 – 3.3	5.5	1.2	1	0.13	1	4.9	0.19	0.26	1	0.31
CR	> .10	≤ .10	≤ .10	> .10	≤ .10	> .10	> .10	> .10	≤ .10	> .10

CHAPTER 5 EMPERICAL MODEL RESULTS

Results

By using the macro-enabled spreadsheet as the data collection tool, the calculations needed to derive the weighted priorities were running behind the scenes as participants entered their comparison judgments. Much like a SAS programming model, once a data set has been obtained and the necessary series of mathematical equations have been programmed, the econometric model is run in order to obtain the results. The macro-enabled spreadsheet method of data collection coupled with the mathematical analysis of the AHP allowed the mathematical results of the model to be instantaneous.

To demonstrate this point an in-depth exploration of how the data collected from firm A during the pairwise comparisons in the first level of the decision hierarchy were transformed into the solutions of the AHP. Figure 4-3 shows how the trust objectives were converted into a matrix and then presented to interviewees in the macro-enabled spreadsheet. Figure 5-1 provides the data collected from firm A - top hierarchy level - as a completed decision matrix. Figures 5-2 through 5-6 and Equations 5-1 through 5-3 then follow the outlined mathematical procedure for calculating the relative preference vector, consistency index and the consistency ratio as outlined in Chapter 3. The relative preference values in Figure 5-4 match the figures found in Table 5-2. The acceptable CR in Equation 5-3 aligns with the CR indicator in Table 4-1. This mathematical process was repeated for each node of the decision tree within the macro-enabled spread sheet.

The results of each interview have been summarized and organized into data tables below. Each table (Tables 5-2 through 5-11) indicates the relative priority percentage of each alternative

when compared to the corresponding criteria as well as the overall priorities for each trust objective its sub-cluster within the decision hierarchy.

Cumulative Results

When looking at the overall results of the 10 firms, the cumulative findings give a strong indication to which elements of trust are the most important to buyers of fresh grapefruit in the EU when looking to make the buy decision from US producers. Table 5-1 provides the results of all 10 firms averaged together and the range of each comparison to gain a cumulative perspective of the collected results.

When evaluating the first level of the decision hierarchy, when asked to compare between the *product*, the *selling company*, and the *market environment* 5 of the 10 firms ranked the *product* as the most important object of trust to European buyers. Another firm evaluated the *product* criteria to have equal priority preferences as the *selling company*. Overall, when the results were averaged together the *product* was given an overall weighted priority of 47.79% (Table 5-1).

In the second level of the hierarchy, the results of the sub-cluster beneath the *product* criterion were diverse. Four of the firms placed price/performance as the top contributor to the success of the overall *product* criteria. When averaged together, *price/performance* was given an overall priority of 14.78% (Table 5-1) within the *product* cluster. The remainder of the firms were split in their priority rankings between *certification*, *reputation* and *specification*.

Referring back to the first level of the hierarchy, it is worth noting that three of the 10 firms interviews placed the *market environment* as the number one trust indicator to European buyers. This is mainly due to the sub-alternative of *private control institutions*. For the purposes of the interview, *private control institutions* were defined to be things such as ISO certification and EurepGap. They are institutions that contribute to the market environment of the product,

but are not required by the domestic government to be exported. Nine of the 10 firms ranked this sub-alternative as the number one contributor to the importance of the *market environment* to buyers in the EU. This is primarily due to consumer preferences regarding chemical residues on fresh fruit within the European market. Various private control institutions serve as indicators to buyers in the EU that the product meets a higher standard than is placed on it by the USDA, which is considered a *public legal institution*.

The *selling company* criterion was ranked second in overall importance with an overall averaged priority of 28.07% (Table 5-1). Within the level immediately below it, the alternatives of *competence to solve problems* and *relationship with the buyer* and *reliability* were all relatively close in overall averaged rankings. An interested fact worth mentioning is when evaluating the third level of the hierarchy below the criterion *relationship with the buyer*, 9 of the 10 firms indicated that the *relationships with individuals* were the most important factor in regards to the overall *relationship with the buyer*. Table 5-1 indicates the averaged relative priority percentage to be 76.68%. This is a strong indication that European buyers will follow an export sales manager from company A to company B if a sounds relationship was developed between the individuals making the B2B transactions.

Overall, the 10 firms interviewed place a high relative priority rating on their product as the number 1 indicator of trust in the eyes of European buyers who are seeking new exporters of fresh grapefruit from the US. Of the alternatives that contribute to the success of the overall product, *price/performance* was ranked as the most important.

Acknowledging the Consistency Ratios

The issue of consistency must be addressed. When evaluating the data collected, Firm I was the only firm to obtain and consistency ratio of 10% or less in each of the 6 comparison matrices. However, this does not indicate that the data gathered from the remaining 9 firms is to

be deemed unacceptable. Forman and Selly state that under certain circumstances higher levels of inconsistency can be accepted. Satty (1982) also concludes that when looking at a CR over 10%, “*the judgments may be somewhat random and should perhaps be revised.*”

None of the literature reviewed provides a clear-cut indication of when to accept and when to reject data based on the CR. However, Forman and Gass (2001) do provide an example where if the inconsistency is 40 or 50%, it can be concluded that something is wrong. Because each set of results were reviewed and approved by participants, it is not concluded that any of the comparisons observed were made randomly. Many of the CR’s reported in Chapter 4 (42%) were only slightly over the acceptable level of consistency (<20%), and will be accepted. Due to the fact that each participant agreed with the results their comparisons generated, it is not applicable to reject the judgments. However, the remainder of the unacceptable CR’s were above 20% and serve as an indication that something was wrong. Based on the listed causes of high CRs outlined by Forman and Selly (2001), some rationalization can be provided.

Forman and Selly (2001) first list *clerical error* as being a potential cause for inconsistency. This is not thought to be the primary cause of gathered levels of inconsistency as each participant was asked to review his/her answers prior to moving on to the next portion of the evaluation. However, there is no way of determining if the individual didn’t catch their clerical mistake while reviewing the provided judgments. Forman and Selly (2001) state that this form of error can be very difficult to detect in many computer analyses.

Lack of Information is the second recognized cause of inconsistency by Forman and Selly (2001). They state that if one has “little or no information about the factors being compared, then judgments will appear to be random and a high inconsistency ratio will result.” Because each individual interviewed is a key player within the export market of fresh grapefruit to Europe

and has extensive hands-on experience, it is not thought that this reason of inconsistency can be applied to the gathered data set. However, due to the fact that each interviewee was taking the perspective of they felt their European buyers prefer, there is a possibility that this factor could play a role in skewing CR's to an unacceptable level.

The third possible explanation provided by Forman and Selly (2001) regarding high CR's is the *lack of concentration* of the interviewee. Because each interview was done in person and participants were observed while completing the comparisons, it is concluded that each person was focused on producing accurate data. However, a lack of concentration could be applicable when considering the level on concentration given towards applying the given definitions of each criteria and alternative within the trust hierarchy. This is point is made due to the confusion many participants had with altering their perceived definition of a term to the one used for the purposes of the interview.

One prime example of this is the confusion generated with the *market environment* objective. For the purposes of the study, the alternatives found within the *market environment* cluster were identified as *private control institutions*, *informal institutions* and *public legal institutions*. *Private control institutions* are defined as institutions such as EurepGap. *Informal institutions* are defined as things found within the environment of the exporting country that no one could control-such as social norms, government stability, and exchange rates. *Public legal institutions* are defined as government agencies that provide the legal regulations for products being grown and exported from the US such as the USDA.

When these definitions were given, each participant asked for them to be repeated several times and several struggled with ignoring their personal definition of a "market environment" in order to apply the one utilized by the trust hierarchy. For this reason, it is thought that several of

the high inconsistency ratios could be due to participants utilizing their personal definition of a market environment as opposed to actively using the one provided.

The fourth possible explanation given by Forman and Selly (2001) to explain high CR's is that *the real world is not always consistent*. This could definitely be applied within the realm of this research as several of the participants explained their frustration with the pairwise comparisons by stating, "*it depends*." The world fresh grapefruit supply, exchange rates, production quality, and demand all play continuously changing roles in the exporting of fresh grapefruit to Europe. The constantly changing conditions of the market can potentially alter the perceived preferences of European buyers. For this reason, each participant was asked to apply judgments in accordance to what the market most commonly reflects, however, many of the participants struggled with establishing one perceived preference over the other.

Inadequate model structure is the final reason of high CRs given by Forman and Selly (2001). They state that a decision hierarchy should be developed where each alternative can be comparable within the magnitude of the given AHP scale (1-9). If the hierarchy is not constructed properly the decisions maker will be forced to make extreme judgments throughout the pairwise comparison, which will result in a high CR. This model structure used is believed to be correctly structured, however the explanation of extreme judgments can be applied to the data gathered from firm C. Three of the six comparison matrices completed by firm C utilized the extreme judgment of 9 or 1/9 in every comparison. It is not concluded that this is due to an inadequate model, but an extreme sense of judgments as each individual is allowed to develop a unique ratio-scale of measure is applicable. The answers given by firm C did reflect transitivity where *A* is greater than *B* and *B* is greater than *C*, however in such situations the calculations of AHP result in high CR's.

In summary, the data collected during the 10 interviews will be accepted regardless of the inconsistency ratio. The primary reason for acceptance is that each firm agreed and approved the results of their interview coupled with the fact that no clear line is given in the literature regarding when to accept or reject data based on a high CR. The secondary reason to accept the data is based on the in-depth analysis of the reasons given by Forman and Selly and their application within this data set.

Buyer Trust	P	S	M
Product of the Seller (P)	1	1	.42
Seller (S)	1	1	.50
Market Environment (M)	2.4	2	1

Figure 5-1. Completed decision matrix from firm A: top hierarchy level

	Buyer Trust	P	S	M
Product of the Seller (P)		1	1	.42
Seller(S)		1	1	.50
Market Environment (M)		2.4	2	1
Sum the values in each column		4.4	4	1.92

Figure 5-2. Synthesizing judgment ratios from firm A: top hierarchy level

Buyer Trust	P	S	M
Product of the Seller (P)	1/4.4	1/4	.42/1.92
Seller (S)	1/4.4	1/4	.50/1.92
Market Environment (M)	2.4/4.4	2/4	1/1.92

Divide each entry in a column by the column total.

Figure 5-3. Normalized matrix from firm A: top hierarchy level

Buyer Trust	P	S	M	Relative Preference
Product of the Seller (P)	.227	.25	.219	.232
Seller (S)	.227	.25	.260	.246
Market Environment (M)	.545	.5	.521	.522

→
Sum the values across each row and divide by the number of entries in each row

Figure 5-4. Relative preferences of firm A: top hierarchy level

Buyer Trust	P	S	M
	(0.232)	(.246)	(.522)
Product of the Seller (P)	1	1	.42
Seller(AS)	1	1	.50
Market Environment (M)	2.4	2	1

Figure 5-5. Multiplication of priority vector for firm A: top hierarchy level

Buyer Trust	P	S	M	Row Total
	(0.232)	(.246)	(.522)	
Product of the Seller (P)	.232	.246	.219	.697
Seller(AS)	.232	.246	.261	.739
Market Environment (M)	.557	.492	.522	1.571

Figure 5-6. Totaling of priority vector for firm A: top hierarchy level

$$\begin{bmatrix} .697 \\ .739 \\ 1.571 \end{bmatrix} \div \begin{bmatrix} .232 \\ .246 \\ .522 \end{bmatrix} = \begin{bmatrix} 3.00 \\ 3.01 \\ 3.01 \end{bmatrix} \rightarrow \frac{3.00 + 3.01 + 3.01}{9} = \frac{9.02}{3} = 3.01 = \lambda_{\max}$$

Equation 5-1

$$CI = \frac{\lambda_{\max} - n}{n - 1} = \frac{3.01 - 3}{2} = .003$$

Equation 5-2

$$CR = \frac{CI}{RCI} = \frac{.003}{.58} = .52\% < 10\% \rightarrow \textit{Consistent}$$

Equation 5-3

Table 5-1. Cumulative averaged results for all 10 firms

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	47.79%			47.79%
Range	(14% to 77.8%)			
1.1 Reputation		18.2%		8.69%
		(2.2% to 55.7%)		
1.2 Specification		16.21%		7.74%
		(2.8% to 40%)		
1.3 Inspection		11.79%		5.63%
		(3.3% to 22%)		
1.4 Certification		22.94%		10.96%
		(8.4% to 54.1%)		
1.5 Price Performance		30.93%		14.78%
		(12.1% to 59.8%)		
2. Selling Company	28.07%			28.07%
Range	(6% to 57.7%)			
2.1 Capability		18.8%		5.27%
		(4.8% to 56.7%)		
2.2 Relationship with the buyer		23.16%		6.5%
		(5.4% to 44.9%)		
2.2.A Relationship with individuals			76.68%	4.98%
			(15.6% to 89.6%)	
2.2.B Relationship with Companies			23.31%	1.51%
			(10.4% to 84.4%)	
2.3 Reliability		23.3%		6.54%
		(13.7% to 39%)		

Table 5-1. Continued

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
2.3.A Adequate communication			34.92%	2.28%
			(13.2 to 63.3%)	
2.3.B Deliveries			50.56%	3.3%
			(19.5% to 75.7%)	
2.3.C Financial situation			14.52%	.95%
			(4.8% to 39.1%)	
2.4 Reputation of selling company		10.04%		2.81%
		(2.1% to 22.9)		
2.5 Competence to solve problems		24.71%		6.94%
		(5.6% to 48.7%)		
3. Market Environment Range	24.15%			24.15%
	(4.2% to 52.3%)			
3.1 Private Control Institutions		64.71%		15.63%
		(14.2% to 81.8%)		
3.2 Informal Institutions		15.06%		3.64%
		(4.6% to 27.1%)		
3.3 Public legal institutions		20.22%		4.88%
		(5.9% to 59.2%)		

Table 5-2. Firm A results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	23.1%			23.1%
1.1 Reputation		4.5%		1.0%
1.2 Specification		27.9%		6.4%
1.3 Inspection		17.3%		4.0%
1.4 Certification		11.7%		2.7%
1.5 Price Performance		38.6%		8.9%
2. Selling Company	24.6%			24.6%
2.1 Capability		10.6%		2.6%
2.2 Relationship with the buyer		21.8%		5.4%
2.2.A Relationship with individuals			82.5%	4.4%
2.2.B Relationship with companies			17.5%	0.9%
2.3 Reliability		15.4%		3.8%
2.3.A Adequate communication			55.5%	2.1%
2.3.B Deliveries			29.7%	1.1%
2.3.C Financial situation			14.8%	0.6%
2.4 Reputation of selling company		18.4%		4.5%
2.5 Competence to solve problems		33.8%		8.3%
3. Market Environment	52.3%			52.3%
3.1 Private Control Institutions		75.5%		39.5%
3.2 Informal Institutions		18.5%		9.7%
3.3 Public legal institutions		5.9%		3.1%

Table 5-3. Firm B results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	24.1%			24.1%
1.1 Reputation		12.8%		3.1%
1.2 Specification		9.6%		2.3%
1.3 Inspection		22.0%		5.3%
1.4 Certification		36.3%		8.7%
1.5 Price Performance		19.3%		4.6%
2. Selling Company	30.1%			30.1%
2.1 Capability		15.2%		4.6%
2.2 Relationship with the buyer		33.5%		10.1%
2.2.A Relationship with individuals			65.5%	6.6%
2.2.B Relationship with companies			34.5%	3.5%
2.3 Reliability		19.3%		5.8%
2.3.A Adequate communication			39.3%	2.3%
2.3.B Deliveries			21.6%	1.3%
2.3.C Financial situation			39.1%	2.3%
2.4 Reputation of selling company		11.8%		3.6%
2.5 Competence to solve problems		20.2%		6.1%
3. Market Environment	45.8%			45.8%
3.1 Private Control Institutions		71.7%		32.9%
3.2 Informal Institutions		14.2%		6.5%
3.3 Public legal institutions		14.1%		6.4%

Table 5-4. Firm C results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	77.8%			77.8%
1.1 Reputation		2.2%		1.7%
1.2 Specification		8.3%		6.4%
1.3 Inspection		12.4%		9.7%
1.4 Certification		30.4%		23.6%
1.5 Price Performance		46.8%		36.4
2. Selling Company	18.0%			18.0%
2.1 Capability		25.3%		4.6%
2.2 Relationship with the buyer		5.4%		1.0%
2.2.A Relationship with individuals			15.6%	0.2%
2.2.B Relationship with companies			84.4%	.08%
2.3 Reliability		18.5%		3.3%
2.3.A Adequate communication			45.4%	1.5%
2.3.B Deliveries			45.1%	1.5%
2.3.C Financial situation			9.5%	0.3%
2.4 Reputation of selling company		2.1%		0.4%
2.5 Competence to solve problems		48.7%		8.8%
3. Market Environment	4.2%			4.2%
3.1 Private Control Institutions		76.3%		3.2%
3.2 Informal Institutions		11.9%		0.5%
3.3 Public legal institutions		11.8%		0.5%

Table 5-5. Firm D results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	75.4%			75.4%
1.1 Reputation		9.1%		6.8%
1.2 Specification		4.5%		3.4%
1.3 Inspection		7.4%		5.6%
1.4 Certification		19.3%		14.5%
1.5 Price Performance		59.8%		45.1%
2. Selling Company	6.0%			6.0%
2.1 Capability		4.8%		0.3%
2.2 Relationship with the buyer		44.9%		2.7%
2.2.A Relationship with individuals			89.6%	2.4%
2.2.B Relationship with companies			10.4%	0.3%
2.3 Reliability		20.5%		1.2%
2.3.A Adequate communication			20.0%	0.2%
2.3.B Deliveries			75.1%	0.9%
2.3.C Financial situation			4.9%	0.1%
2.4 Reputation of selling company		4.4%		0.3%
2.5 Competence to solve problems		25.6%		1.5%
3. Market Environment	18.7%			18.7%
3.1 Private Control Institutions		76.9%		14.4%
3.2 Informal Institutions		4.6%		0.9%
3.3 Public legal institutions		18.5%		3.5%

Table 5-6. Firm E results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	67.9%			67.9%
1.1 Reputation		7.0%		4.8%
1.2 Specification		40.0%		27.1%
1.3 Inspection		13.4%		9.1%
1.4 Certification		14.8%		10.1%
1.5 Price Performance		24.8%		16.8%
2. Selling Company	23.7%			23.7%
2.1 Capability		56.7%		13.4%
2.2 Relationship with the buyer		21.3%		5.1%
2.2.A Relationship with individuals			88.5%	4.5%
2.2.B Relationship with companies			11.4%	0.6%
2.3 Reliability		13.7%		3.2%
2.3.A Adequate communication			19.5%	0.6%
2.3.B Deliveries			75.7%	2.5%
2.3.C Financial situation			4.8%	0.2%
2.4 Reputation of selling company		2.7%		0.7%
2.5 Competence to solve problems		5.6%		1.3%
3. Market Environment	8.4%			8.4%
3.1 Private Control Institutions		81.8%		6.9%
3.2 Informal Institutions		9.1%		0.8%
3.3 Public legal institutions		9.1%		0.8%

Table 5-7. Firm F results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	14.0%			14.0%
1.1 Reputation		46.2%		6.5%
1.2 Specification		15.5%		2.2%
1.3 Inspection		10.0%		1.4%
1.4 Certification		13.9%		1.9%
1.5 Price Performance		14.9%		2.0%
2. Selling Company	57.7%			57.7%
2.1 Capability		8.6%		5.0%
2.2 Relationship with the buyer		39.3%		22.6%
2.2.A Relationship with individuals			83.9%	19.0%
2.2.B Relationship with companies			16.1%	3.7%
2.3 Reliability		26.0%		15.0%
2.3.A Adequate communication			63.3%	9.5%
2.3.B Deliveries			19.5%	2.9%
2.3.C Financial situation			17.2%	2.6%
2.4 Reputation of selling company		6.8%		3.9%
2.5 Competence to solve problems		19.3%		11.1%
3. Market Environment	28.4%			28.4%
3.1 Private Control Institutions		69.0%		19.6%
3.2 Informal Institutions		22.8%		6.5%
3.3 Public legal institutions		8.2%		2.3%

Table 5-8. Firm G results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	55.3%			55.3%
1.1 Reputation		6.2%		3.4%
1.2 Specification		2.8%		1.5%
1.3 Inspection		12.6%		7.0%
1.4 Certification		54.1%		29.9%
1.5 Price Performance		24.3%		13.4%
2. Selling Company	28.5%			28.5%
2.1 Capability		8.0%		2.3%
2.2 Relationship with the buyer		22.9%		6.5%
2.2.A Relationship with individuals			84.1%	5.5%
2.2.B Relationship with companies			15.9%	1.0%
2.3 Reliability		22.6%		6.4%
2.3.A Adequate communication			23.3%	1.5%
2.3.B Deliveries			69.9%	4.5%
2.3.C Financial situation			6.8%	0.4%
2.4 Reputation of selling company		7.9%		2.3%
2.5 Competence to solve problems		38.5%		11.0%
3. Market Environment	16.2%			16.2%
3.1 Private Control Institutions		79.5%		12.9%
3.2 Informal Institutions		5.0%		0.8%
3.3 Public legal institutions		15.5%		2.5%

Table 5-9. Firm H results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	45.9%			45.9%
1.1 Reputation		27.6%		12.7%
1.2 Specification		35.2%		16.2%
1.3 Inspection		3.3%		1.5%
1.4 Certification		21.7%		10.0%
1.5 Price Performance		12.1%		5.5%
2. Selling Company	45.9%			45.9%
2.1 Capability		23.2%		10.6%
2.2 Relationship with the buyer		10.4%		4.8%
2.2.A Relationship with individuals			85.3%	4.1%
2.2.B Relationship with companies			14.7%	0.7%
2.3 Reliability		39.0%		17.9%
2.3.A Adequate communication			45.3%	8.1%
2.3.B Deliveries			42.9%	7.7%
2.3.C Financial situation			11.8%	2.1%
2.4 Reputation of selling company		19.9%		9.2%
2.5 Competence to solve problems		7.5%		3.4%
3. Market Environment	8.2%			8.2%
3.1 Private Control Institutions		62.2%		5.1%
3.2 Informal Institutions		10.8%		0.9%
3.3 Public legal institutions		27.0%		2.2%

Table 5-10. Firm I results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	41.5%			41.5%
1.1 Reputation		10.7%		4.4%
1.2 Specification		15.3%		6.3%
1.3 Inspection		8.2%		3.4%
1.4 Certification		18.8%		7.8%
1.5 Price Performance		47.0%		19.5%
2. Selling Company	12.5%			12.5%
2.1 Capability		22.6%		2.8%
2.2 Relationship with the buyer		23.7%		3.0%
2.2.A Relationship with individuals			83.6%	2.5%
2.2.B Relationship with companies			16.4%	0.5%
2.3 Reliability		22.6%		2.8%
2.3.A Adequate communication			13.2%	0.4%
2.3.B Deliveries			62.3%	1.8%
2.3.C Financial situation			24.5%	0.7%
2.4 Reputation of selling company		22.9%		2.9%
2.5 Competence to solve problems		8.2%		1.0%
3. Market Environment	46.0%			46.0%
3.1 Private Control Institutions		40.0%		18.4%
3.2 Informal Institutions		27.1%		12.5%
3.3 Public legal institutions		32.9%		15.2%

Table 5-11. Firm J results

Criteria	Relative Priorities			Overall Priorities
	Level 1	Level 2	Level 3	
1. Product	52.9%			52.9%
1.1 Reputation		55.7%		29.5%
1.2 Specification		3.0%		1.6%
1.3 Inspection		11.3%		6.0%
1.4 Certification		8.4%		4.5%
1.5 Price Performance		21.7%		11.5%
2. Selling Company	33.7%			33.7%
2.1 Capability		13.0%		4.4%
2.2 Relationship with the buyer		8.4%		2.8%
2.2.A Relationship with individuals			88.2%	2.5%
2.2.B Relationship with companies			11.8%	0.3%
2.3 Reliability		35.4%		12.0%
2.3.A Adequate communication			24.4%	2.9%
2.3.B Deliveries			63.8%	7.6%
2.3.C Financial situation			11.8%	1.4%
2.4 Reputation of selling company		3.5%		1.2%
2.5 Competence to solve problems		39.7%		13.4%
3. Market Environment	13.3%			13.3%
3.1 Private Control Institutions		14.2%		1.9%
3.2 Informal Institutions		26.6%		3.5%
3.3 Public legal institutions		59.2%		7.9%

CHAPTER 6 SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

As B2B transactions are shifting from traditional, one-on-one business relationships, to electronically based transactions, agricultural exporters face many challenges that must be overcome in order to make a smooth transition. Trust has been identified as a key element within B2B transactions and plays an even more important role within the realm of e-commerce. Just as business to consumer (B2C) transactions have transitioned into the world of e-commerce, the focus of this research is to discover the key elements of trust that play an important role within the world of international agricultural B2B relationships.

Due to the strength of the US to EU agricultural trade region, fresh grapefruit exports from the US to the EU are the focus of this thesis. The EU is the trade destination of interest as the US is one of their key agricultural suppliers. Fresh grapefruit has been the crop of choice for this research as it is the number one fresh fruit product being exported from the US to the EU. As this research focuses on fresh grapefruit going to the EU, the larger goal of this research topic is to begin the identification process of key trust elements playing a role within all major US to EU supply chains. It is the aim that if the key elements of trust can be successfully identified between the US – EU trade stream, a safe, affordable and maintainable food supply can be sustained throughout the EU and US as B2B transactions trend towards the world of e-commerce.

In order to collect such data, the AHP was the research tool of choice due to its well documented ability aid in the decision making of complex, multi-criteria situations (Forman, Gass 2001). Due to the complexity and qualitative nature of trust, the AHP provides the

necessary theoretical framework to best identify the key elements of trust within the US-EU fresh grapefruit supply chain.

The AHP pairwise comparisons - obtained through one-on-one interviews – provide quantifiable data points of perceived trust priorities to be cumulatively analyzed among the census population of fresh grapefruit exporters. Through this process the key elements of trust within the US-EU export supply chain of fresh grapefruit have been identified.

Conclusions

From the overall priority rankings gathered from the completion of the AHP, it is concluded that the *product* trust objective is perceived as the top trust indicator to European buyers looking to purchase fresh grapefruit from a new supplier in the US. Of the characteristics that contribute to what defines the *product* being sold, the *price performance ratio* was the most important factor to EU buyers that is perceived from US exporters. This indicates that when US exporters are looking for European buyers, they are most likely to focus on the price-performance ratio of their product. This information can be taken one step further in the implementation of international e-business websites. It would be expected exporters would want to provide information that they have a strong price-performance ratio.

The collected data also provides strong indicators towards the importance of developing strong personal relationships with individuals – not necessarily companies. This provides a direct correlation to an individual's propensity to trust, which has been identified as the first form of trust found within B2B transactions. This form of trust deals directly with an individual's general trustworthiness towards others. This serves as another indication that firms are composed of individuals who make important B2B transaction decisions based directly on their propensity to trust.

Within the realm of e-commerce, this conclusion also serves as a spring board for the possible implementation of one-on-one video communication technology within an exporting company's website. This is a simple example of how personal relationships, or the sense of a personal relationship, can be conveyed via the internet. Through innovation, both the needs of European buyers and the efficiencies gained through the uses of B2B e-commerce can be successfully merged.

The final conclusion which deserves further explanation is the important role private control institutions play within the US to EU fresh grapefruit supply chain. Table 5-1 shows the averaged relative priority to be 64.71% and the overall priority equaling 15.63%. These percentages serve as a clear indicator that although the market environment as a whole might not be the most important contributor of trust to EU buyers, private control institutions are very important. This data coincides with what fresh grapefruit exporters casually verbalized during the one-on-one interviews. The importance of the private control institutions is primarily due to consumer preferences of European buyers as they are very specific regarding acceptable levels of hazardous substances on fresh fruit. This is also something that could very easily be transferred to the forum of e-commerce. Just as in the B2C, e-business websites provide seals of privacy control and identity theft prevention, the agricultural export sector could provide electronic indicators to buyers that their products meet certain private control institutions requirements.

Implications

The implications of this research should serve as a starting point for further research within the realm of e-commerce and the world food supply. From an economic perspective it is the goal of agricultural economist to aid in overall effective allocation of resources in order to maintain the world's food supply. This research provides the foundation for transitioning from traditional B2B alliances to a modern, e-commerce form, of international business transactions. By laying

the foundation to identifying what trust elements are currently contributing to the success of international food supply chains, it is the hope that efficiencies can be gained by conducting more international B2B affairs via the internet.

Beyond the interests of application within the realm of e-commerce, the data collected and presented in this research can provide valuable information to all players of the US-EU fresh grapefruit supply chain. Producers now are focusing on (and can expect their competitor to focus on) the price-performance ratio while meeting the requirements of such private control institutions as EurepGap and ISO 9000. By disseminating the conclusions of this research, producers will be better able to meet the needs of exporters whose demands are being driven by European consumer tastes and preferences. Regardless of the transition towards the B2B use of e-commerce, the results of this research are valid and can aid in gaining greater demand driven efficiencies throughout the existing fresh grapefruit supply chain.

Future Research Needs

To assist in the transition towards the use of e-commerce within international B2B trade, more supply chains must be analyzed in order to gain a broader picture of the presented model. Each industry is unique which may result in a change of the priority ratings within the AHP. By conducting an analysis similar to the one presented in this research within numerous supply chains as well as directly interviewing buyers throughout the world, a greater understanding of the macro international supply chain trust picture can be derived.

Coupled with this is the need to interview fresh grapefruit buyers in Europe directly. This will provide the final dimension needed in order to obtain a complete picture of trust within the US-EU fresh grapefruit supply chain. This will also provide the opportunity for the results from each side – both the buyers and the sellers – to be compared. If the conclusions are synchronized, it can be concluded that US exporters have the knowledge needed to meet the

needs of European buyers. However, if the results vary future work should focus on educating domestic exporters on what attributes European buyers of fresh grapefruit are looking for in an exporter. Through the sharing of information, fresh grapefruit exporters in the US will have a direct understanding of what European buyers expect in purchased product. This information can be passed throughout the supply chain so that the product, the selling company, and the degree of the market environment that is in the control of US exporters, can parallel the demands of European buyers.

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BIOGRAPHICAL SKETCH

Ellnor McKenzie Dahl, also known as Ellie, is a sixth-generation Florida agriculturalist. She was born in Lake Wales, and was raised in Fort Meade, Florida. After receiving her associate's degree from Santa Fe Community College, she transferred into the Food and Resource Economics Department at the University of Florida. During her time as an undergraduate at the University, she was actively involved with the Agricultural Economics Club and was member of the 2006 award-winning National Agricultural Marketing Association student competition team. Ellie was also hired by BayerCrop Science to participate in their Temik Monitor internship program, where she relocated to Fort Myers for the spring semester of her Junior year.

In Spring 2006 Ellie graduated with honors with her undergraduate degree and began her graduate work within the Food and Resource Economics Department in Fall 2006 on a USDA National Need Fellowship award. During her two years as a graduate student, she traveled to professional meetings in Germany, Austria, Oregon, and California. These experiences allowed Ellie to gain the international perspective she needed to better understand the global economy coupled with the importance of academic research. Upon graduation Ellie strives to find a career that will use her inborn fondness for agriculture and unshakable determination for making a positive impact within Florida's agricultural sector.