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PRODUCT STRATEGIES OF FINNISH PHOTOVOLTAIC TECHNOLOGY MANUFACTURERS FOR AFRICA

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ABSTRACT:

The study reviews the type of product strategies used by Finnish photovoltaic technology manufacturers for Africa. This development examines three dimensions under product strategies: product platforms, product lines and individual products. It also addresses the issues related to product standardization and adaptation as to how it is implemented for the African market, and thus lay emphasis on three alternatives: localized, modified and standardized product strategies.

The theoretical framework is constructed by analyzing the existing theoretical approaches. The framework is adapted from Gabrielsson (2004) and in this, there is the discussion of the economic environment, corporate strategy, firm's resources and decision making amongst others, assumptions were created which were verified in the empirical part of the studies using the case study approach of which two firms were interviewed. It was discovered that unlike the use of discarded or obsolete technology in some fields, photovoltaic technology in use by Finnish firms doing business in Africa is the same to the one used in their domestic market as well as globally.

The research intends to contribute greatly to the poll of research connected to the African market as well as create interest in specialized fields like the energy markets. The research concludes by drawing attention to possible managerial implications and future research in photovoltaic field for the African market.

KEYWORDS: product strategies; photovoltaic technology; standardization; adaptation; Africa.

1. INTRODUCTION

1.1. Background

Changing economies have been driven by the aid of energy resources. In Europe photovoltaic system has taken a dramatic turn to a better scope in the energy market sector all in an effort to increase productivity, predictability and affordability of energy from especially renewable and environmentally friendly sources (Aitken 2003: 33, 35). In discussing the issue of energy and poverty, Holm (2005: 13) argues that improved access to clean modern energy in developing countries is a fundamental step to the reduction of poverty, unemployment and achievement of other economic goals.

By default, developing nations have underdeveloped energy infrastructures, offering a golden opportunity to create new sustainable jobs in the modern renewable energy technologies, rather than investing in sunset technologies or accepting cheap discarded technologies from the developed world. It is also assumed that photovoltaic (PV) technology in developed and developing nation alike can enhance local environments, increase systems and infrastructure reliability and provide for greater security (see also Aitken 2003: 33, 35 and Holm 2005: 24). In Africa due to various factors like the environment, socioeconomic infrastructure, political and the level of technological expertise there is the need for a revised product strategies used in relation to photovoltaic technology for that market. For example in considering the history of energy and accessibility of electricity, it is noteworthy to mention that in West Africa alone out of the region's 234 million potential consumers, only about one in three has access to electricity.

However, demand for energy in the region is expected to grow by 5 per cent annually over the next 20 years. Based on the existing capacity of 10,000 megawatts, the region needs to increase its generating capacity by about 17,000 megawatts by 2023 to keep up with demand (Plunkett, 2004). Most of the countries in the region have small power utilities, each with an installed capacity of less than 1,000 MW, and levels of electrification are low, averaging less than 30%. Electricity consumption is concentrated in Nigeria (54%), Ghana (23%), Cote d'Ivoire (8%) and Senegal (3.2%). The region's industrial sector

accounts for 41% of the consumption, while the residential and tertiary sectors account for 41% and 16% respectively. Consumption in the agricultural and transport sectors is marginal. Apart from Ghana and Nigeria, electricity tariffs in the region are high. As a region, West Africa is well endowed with energy resources, although these are unevenly distributed, but its energy sector is the least developed in the world.

Significant amounts of capital will be required to finance both new hydropower plants and adequate thermal complementation using primary West African fuel sources. However, the power sectors are cash-short and credit-poor. Their small size and investor perceptions of the region's high risk constitute critical constraints, which make their ability to raise the necessary capital in the near future a real challenge (Yartey, 2003). Despite the restraints there is the need to develop a localized plan in making energy as accessible as possible and this calls for a standardized product platform (to reduce cost) but a modified product line (McGrath, 1995 and Gabrielsson, 2004) to enable a flexible offer for the African market.

1.2. Research gap, problem and objectives

Businesses undergoing internationalization has been studied under different levels (Luostarinen 1994). Product strategies focusing on high technology companies have gain a level of recognition (McGrath 1995; Gabrielsson 2002 and 2004). Challenges of developing products and managing them has been discussed by different literatures and journals these includes such specific strategies for conventional internationalizers, multinationals, global and born global firms (McGrath 1995; Kotler 1999; Gabrielsson 2002 and 2004). Globalization internationals are those companies, which have first internationalized after the domestic period and then started to globalize their operations outside the domestic market (Gabrielsson 2004: 16) this as well as their entry processes have been investigated by various authorities in the international marketing field (Luostarinen 2001; Gabrielsson 2001 and Gabrielsson 2004). Product standardization versus adaptation strategies has been studied more extensively including issues related to marketing mix elements as well as product life cycle (see e.g. Kotler 1999; Czinkota and

Ronkainen 2004; Albaum, Duerr and Strandskov 2005). However research on business and management activities in the African region has been limited and most examples available are concentrated to North and South Africa (Larimo, 1989 and Austin, 1990).

Although there are business operations being undertaken in the sub-regions of Africa, documented research conducted on product strategies specifically for the photovoltaic technology field for the African continent as developing economies is nonexistent. This means that the research gap is vast and will require a large number of studies and specific in-depth researches on different levels in the future to close the gap to a reasonable level as seen in other fields of business studies. The research problem can be stated as follows, '*how Finnish photovoltaic technology manufacturers can develop viable product strategies for the African market*'? It is important for the firms in the photovoltaic technology field to be aware of the main drivers that facilitate development of right product platform, product lines and individual products which in this case are viable energy generating systems for the African market.

The aim of this thesis is to answer the following question:

What product strategies are used by Finnish photovoltaic technology manufacturers for the African market and why?

The objectives can be set as follows:

1. To identify and analyze the product strategies available for the photovoltaic technology field for the African market.

2. To consider factors impacting on the selections of a product strategies as well as issues on product adaptation and standardization in the photovoltaic technology field for the African market.

3. To ascertain the product strategies used by case companies in the African market as well as factors facilitating their choices.

1.3. Definitions and limitations

In this thesis, the term product strategy is defined with the following limitations: product strategy dimensions - that includes, product platforms, product lines and individual products (McGrath 1995:14; Gabrielsson 2004). Product platforms can be defined as a collection of the common elements, especially the underlying core technology, implemented across a range of products. A product platform is the lowest level of relevant common technology within a set of products or a product line (McGrath 1995: 39). In this research product lines is defined as a group of products that are closely related because they function in a similar manner, are sold to the same customer groups, are marketed through the same types of outlet, or fall within given price ranges (Kotler, Wang, Saunders and Armstrong 2005: 552). Finally an individual product is considered as anything that can be offered to a market for attention, acquisition, use or consumption that might satisfy a want or need. It includes physical objects, services, persons, places, organizations and ideas (Kotler et al 2005:539).

The research adds minor emphasis on product line strategies (McGrath, 1995; Kotler and Armstrong, 2001) and especially how these are related to different generating capacities of photovoltaic technologies. Another area of focus emanates from the third dimension that is the individual products including specific product category and its content offered to final consumers. Each of the product categories may consist of specific contents that could be divided into three areas: core component, packaging component and support service component (Cateora and Graham 1999: 368).

Limitations of this research are mainly on viable product strategies of photovoltaic technology for the African market and to achieve this the discussion is narrowed down to only specific issues like current market situations, the nature of demand, and issues patterning to the target market group for the systems and how the diversity of these issues amongst others impact on product strategies. This research also assumes that the Finnish photovoltaic technology manufacturers have already undergone the internationalization process thus phases of internationalization will not be discussed in this research. This research without necessarily going into details; would mention some types of entry modes used by internationalizing firms.

According Gabrielsson (2004:51): 'Internationalization of firms may be studied at the target country level or company level'. For the purpose of this research, the framework will lay emphasis and be limited to the analysis of the target country level of internationalization although highlights of the company level would be discussed in the further development of the theory. In considering the firm's level activity, the limitation in the context of the resources base view would be generalized thus avoiding an overly emphasized and detailed description of various types and aspects of resources of a firm. Decision making of globalizing internationals is well examined as well as criticized in the context on the stages of internationalization (Gabrielsson 2004:57), due to the nature of the structure and objectives of this research, these areas would not be discussed, thus presenting another interesting limitation for future studies. Photovoltaic for this research is basically defined as the conversion of energy from sunlight into electricity using a semiconductor material such as silicon (Howard 2005: 22 -23).

African as a continent is considered in this research as an economy made up of 4 geographical regions, North, South, East and West. The continent is made up of 54 countries with over 1,000 languages as well as over 800 million inhabitants (see also Awedoba 2001:19). The focus is on the whole continent and its need for energy and for that matter any reference made would be in the context for Africa except if specifically otherwise stated. Table 1 gives us estimation amongst others about the production and consumption capacity of electricity in all the sectors of Africa. This estimation includes solar energy consumption.

Table 1: Production and consumption capacity of electricity for Africa (Source: Adapted from *ESI Africa 2/2005* Kalala, 2005).

SUBREGIONS	AVERAGE POTENTIAL (GWh)	PRODUCTION OF ELECTRICITY (MW)	CONSUMPTION (KWh)	FORECAST OF DEMAND IN 2005 (GWh)
North Africa	41,000 (3.7%)	134,000 (33.2%)	739	209,300 (36.8%)
West Africa	100,970 (9.2%)	38,033 (9.4%)	143	50,546 (6.8%)
Central Africa	653,361 (57.7%)	10,537 (2.6%)	109	13,052 (2.3%)
Southern Africa	151,535 (13.8%)	208,458 (51.7%)	1,617	279, 409 (49.0%)
East Africa	171,500 (15.6%)	12,281 (3.1%)	68	12,281 (3.0%)

1.4. Structure of the study

The research starts with the chapter one; that mentioned amongst others the real issues pertaining to energy and to that fact electricity and added that inadequate supply of energy could result to the low economic growth and thus poverty in the sub-regions (Holm 2005:13). The point as stated laid the foundation for a renewable source of energy and in this context photovoltaic system with the aim of enhancing the local economic and natural environment; increase systems and infrastructure reliability as well as a provision for greater security (Aitken 2003: 33, 35 and Holm 2005: 24). Due to specific constraints in raising the necessary capital; the background of the studies concludes by proposing the development of a localized plan in making energy as accessible as possible. The background is then followed by a research gap; research problem and research objectives, this is developed in an attempt to consider in brief what has been document by various authorities in the business field thus helping in formulating the research problem and its main underlining objectives. The final aspect of the introduction is made up of specific limitations as well as some definitions of the core components under discussion which amongst others includes all the keywords: product strategies (including its dimensions); photovoltaic technology; standardization; adaptation and Africa.

The chapter 2; starts with a brief introductory literature review and it is then followed by a thorough review of the specific areas for research, there is the mention of internationalization of the firm which is considered as a process and then a brief summary of the pull and push factors facilitating the internationalization process. This is followed by a non-technical description of photovoltaic technology including the architectural set-up (*including specific components making up the system namely modules, charge and battery array as well as inverters*); hybrid system (*a combination of photovoltaic system and other energy systems like a diesel generator or wind turbine*) with the section concluding with the uses and benefit of photovoltaic systems. The photovoltaic technology section is then followed by a definition of product strategies as well as individual description of the dimensions involved in product strategies with specific limitation to product platform; product line and individual product. The chapter 2 ends with *sub-chapter 2.4* that discusses the issue of standardization versus adaptation and the reasons for these options. It goes further to justify the need for a standardized management process and presents product strategy

alternatives for international firm (this includes localized, modified and standardized product strategy alternatives).

The chapter 3 is intended to form the foundation for the core strategies which for a basis for the framework, assumptions and formulation of the interview questions amongst others. The development of the theoretical framework would be thus narrowed to take care of the core issues under discussion by analyzing the target market with the macro and micro-economic variables as well as limiting the firm's level analysis on the basis of the firm's corporate strategy as well as its resources (tangible and intangible). The chapter is aimed at concluding with impacting factors on product strategies as well as a general summary of the theoretical framework.

The chapter 4; is aimed at describing the empirical approach of the studies as to the methods used in reaching to a viable conclusion of the whole research. The aim is to include the research process, strategy and design. The objective of this research is to use some case studies in other to ascertain the accuracy of the theories and assumptions that would be developed. The chapter 5; is aimed at describing and analyzing the case companies in relations to the research framework and this is also aimed at investigating all the keywords as well as other related issues connected to the research. This would then give way to the summary and conclusions at chapter 6; with the aim of presenting theoretical and empirical finding as well as contributions and managerial implications this part as well is aimed at presenting possible expansions and studies for the future.

2. LITERATURE REVIEW

This part of the research presents a review of literatures and previous studies in the photovoltaic field; it also gives some background information as to the content of the photovoltaic system with specific reference to the key components of the research. This part begins with a general overview of the issue of internationalization and for reasons of simplicity the emphasis is on a general perceptive rather than an in-depth description of the process; a detailed account of photovoltaic technology is followed with a definition of product strategies and a description of the three product dimensions (*platform, product line and individual products*) Issues pertaining to adaptation and standardization as well as specific issues related to the management of the firm concludes the literature review. This is aimed at presenting a preliminary premise for the development of the theories for the empirical part of the research.

Previous studies were thoroughly searched using keywords and phrases like 'Product Strategies for photovoltaic technologies' amongst others; the results were overwhelming. Available materials focused on the capacity and applications of photovoltaic technology and systems, which were purely from engineers' point of view (Weedy and Cory 1998). There is a recurring debate about product planning and development that focuses on the question of standardized global products marketed worldwide versus differentiated products adapted, or even redesigned, for each culturally unique market (Kotler 1991; Cateora & Graham 1999; Albaum et la. 2005; Kotler et al. 2005) information from this field would help support the theoretical framework as to factors affecting product strategies. Issues related to product and branding strategies and their classification (Kotler et al 2005) is well presented to add additional value to the core area of this study.

For product strategies related to the photovoltaic technology one has to consider the micro and macro-environmental issues which includes how the firm interacts with other players (competitors and customers) in the market as well as how it manage its activities in the face of environmental, political and other changes (CIM 1999) . There has been some research about specific issues related to internationalization of firms with focus on operation strategies (e.g. Luostarinen and Welch 1990) and channels (Gabrielsson 1999); the specific area of value to this research includes the impact of corporate strategy on product

strategy decisions (McGrath 1995; Kotler 1997; Gabrielsson 2004). Marketing and high technology management literature discusses product strategy and its dimensions (McGrath 1995, Gabrielsson 2004) and product strategies have been studied in the context of globalizing companies (Gabrielsson 2004).

Yip (1992) discusses global strategies with special references to core areas that are tailored to be most suitable for different types of managers as well as researchers. His descriptive points on globalization drivers and the benefits and drawbacks of global strategies although not the core part of this research, nevertheless adds relevant points to the whole material. All the aforementioned research could be adapted for the purpose of evaluating the objective of this research. There has not been much research when it comes to issues like product strategies in the Finnish photovoltaic technology field and especially for developing countries, thus my interest in investigating this area to contribute to the international business field.

2.1 Internationalization of the firm

Different authorities have discussed internationalization process in the international business field; amongst them are Luostarinen (1989 and 1990); Hollensen (2004) and Czinkota et al, (2004). To describe internationalization process, there is the use of the term "growth" Czinkota et al (2004:243) and "expansion" of a firm research and development, production, selling and other business activities into international market (Hollensen 2004:30). Luostarinen (1989:175) analyzed internationalization pattern of a firm as based on three aspects of business activity namely: [1]the product, [2]operation and [3]market strategy of the firm. He further defined the structure of this internationalization as: "the sum of all the products introduced by the company into international market, of all the operation used by the company in the market and of all the foreign market entered by the company at certain point in time."

Sometimes internationalization is evaluated in addition to the type of entry, licensing (licensor's know-how agreement etc), inward (imports, licenses licensee and project importing etc) and corporative operation modes (inter-firms trade, bilateral and multilateral etc) (Luostarinen et al, 1990: 248). Most important in internationalization is the company and target country level of

activity. Although, there is the need to evaluate the pattern of a firm's strategy and commitment to that of the potential capabilities of the target market, this part of the research will lay emphasis on some key issues from the target market perspective and some specific issues of the firm but it is vital to note that there are other issues in connection to internationalization process which are left for further studies in the future.

There are various barriers as well as reasons for internationalization of the firm: Hollensen (2004: 50-51) argues that many of the early literature on internationalization were inspired by general marketing theories amongst others are:

1. *The Traditional Marketing Approach*; this approach discusses about the firm's core competence combined with opportunities in foreign environments. Thus, the main point in this theory is that the firm needs to identify its technological and marketing skills, which could be a key element in its successful foreign entry.

2. *The Uppsala School Approach*; this approach suggests a sequential pattern of entry into successful foreign markets, coupled with different phases of commitments to each market. In this model there is the emphasis on the intensity of firm's commitment towards foreign markets as their experience grows. There is also the popular notion of a "psychic distance" between countries, impliedly the closer the psychic distance; the more attractive it would be for the firm.

3. *The Network Approach* on the other hand emphasizes on an international firm as part of a whole rather than isolated from other actors in an international environment. Thus the individual firm is somehow dependent on resources controlled by others in or outside the market. Thus, a firm's relationship in a domestic market automatically affects that of other networks in the same country as well as other countries. (See also Gabrielsson 2004: 51-54).

Buckley and Hashai (2005:655) explained that firms focus on the advantages gained from internalizing their foreign activities during its international expansion. It is argued that internationalization enables the firm to minimize

the cost of economic transactions by better exploring underutilized firm-specific capabilities (e.g. managing skills and technology), which are superior to those of indigenous competitors. The aforementioned parts just present a basic idea about specific areas of consideration under internationalization process.

Next is a brief consideration of the pull and push factors facilitating internationalization process of a firm and this is discussed under the target market approach and the firm level's approach with specific limitations emphasized. This is an effort to consider issues facilitating the pull and push factors in relation to internationalization. The pull factor approach is usually the case where activities like demand in a foreign market necessitate the movement of the domestic firm to do business abroad.

Nevertheless, according to Brassington and Pettitt (2000: 1006); stressing on the motive of companies undertaking production activities abroad argued that, 'differential labour costs around the world have been an incentive for some organizations to shift production abroad. By producing abroad firms usually turn to save a lot of cost on labour, general operation, transport, import cost as well as government incentives that are used in encouraging inward investment'. The push factors of internationalization is where a firm usually expands to international markets due to eminent and unavoidable saturation in its domestic market as well as opportunities that makes it possible in the course of doing business, for an example for a firm to enjoy economies of scale (serving a large market with high volumes from one plant enables cost competitiveness to be maintained). There is also the issue of market diversification strategies where a firm in its quest to survive, usually ends up serving different markets other than the domestic market (Brassington et al 2000:1005-1007). Some specific impacting factors will be discussed later to help develop the theoretical framework of the research.

2.2. Photovoltaic technology

This part of the research discusses in brief, the technology behind photovoltaic systems and it highlights aspects of the product platform for the system as well as sub-parts that makes the system as a viable standalone package or as standard grid related design and it concludes by pointing out the common uses

and benefits of the photovoltaic system. According to Howard (2005: 22, 23): photovoltaic systems convert energy from sunlight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, exciting the electrons in the semiconductor so that they break free from their atoms. This action allows the electrons to flow through the semiconductor material, in a similar manner to a normal electricity circuit, producing electricity. (See also Weedy and Cory 1998: 18 – 21; and Solar Panel 2006). Sunshine as a fuel is abundant, renewable and free. Solar cells generates electricity without creating emissions, have no moving parts, are highly reliable and requires no additional fuel (Carts-Powell 2006 : 28 – 31).

It is of great importance to mention that, there are hybrid systems that is types of power generation equipment that may be combined with photovoltaic systems. The most common types are:

- Photovoltaic and diesel generator, wind turbines or mini-hydropower just to mention a few.

- Photovoltaic + mains power (for grid connected systems)

Usually when used as a combined unit, the efficiency is high and cost is lower than using each unit separately (Naps 2006).

2.2.1 Photovoltaic architecture

Photovoltaic architecture includes the design platform; modules; charge controllers and in most cases an inverter. Depending on the desired package, the photovoltaic system could include extra accessories like a 12 or 24 volt DC battery which is used as a standby unit for the inverter especially for generating electricity at night when there is no sunlight available to power the solar panel.

Photovoltaic Design Platform: It is a semiconductor device, normally made from silicon. Crystalline silicon solar cells may be made using monocrystalline, polycrystalline or ribbon silicon wafers as well as in recent times the use of silver cells (which needs 90% less silicon than the classical technology). There are still some innovative technologies in this field including the use of nanocrystals and other non-silicon materials like plastic. The cost and performance of these are similar. Thin film photovoltaic cells use much thinner

layers (around 0.001mm) of semiconductor deposited on glass or other supporting material, and this includes amorphous silicon, cadmium telluride and copper indium diselenide. At present they are less efficient than crystalline silicon cells (Howard 2005: 23, 24.) (See also Economist 2005: 18 – 20; Rentzing 2005: 64; Löfken 2006: 65 – 69).

Photovoltaic Modules: Photovoltaic cells produce a low voltage, thus many cells needs to be connected in series to give a useful working voltage. Often 36 cells are connected together to give a voltage suitable for charging a 12-Volt battery. Photovoltaic cells are connected together and protected from mechanical damage and the weather in a unit called a photovoltaic (or solar) module. This is the standard building block for larger photovoltaic systems. A set of photovoltaic modules connected together to produce a required working voltage and current is called a photovoltaic (or solar) array. The array includes any support structure and interconnections necessary (Naps 2006).

Photovoltaic Charge Controller: A charge controller is the heart of the system, and it is vital for preventing the photovoltaic modules overcharging the battery. Charge regulation is needed to prevent excessive water losses and reduction of battery life. The charge controller normally also prevents the load from over-discharging the battery, which is harmful to most battery types. In addition, charge controllers may include features like:

- Display or indications of battery voltage, state of charge and various currents.
- Remote alarm relays to send signals to indicate fault conditions.
- Control signals to start up a back-up generator, etc
- Remote communications.

Designing a suitable charge controller for a particular application requires in-depth knowledge of photovoltaic module behaviour, battery characteristics and the user's needs. Naps Systems (*a Finnish photovoltaic manufacturing company*) is a world leader in this field and has been producing its own charge controllers since 1987 (Naps 2006).

Photovoltaic Inverter: Photovoltaic inverter converts DC (direct current) to AC (alternating current). (D'Errico 2003:13). In other words any unit that could be used to convert a 12 volt be it battery or otherwise solar to 220/230 volt electricity is known as an inverter. Inverters are used in a wide range of applications, from small switched power supplies for a computer to large industrial applications to transport bulk power (Tirumala, Imbertson, Mohan, Henze and Bonn 2002:1009 – 1100). Inverters could be used as a standalone system, but when it is usually part of a photovoltaic system, it serves as a unit that alternate the continuous flow of electricity via the battery unit attached to the photovoltaic system. The battery unit stores excess current generated by the photovoltaic system and with the help of the inverter converts it to electricity usually in the evening when there is no sunshine (Cheng, Cheung and Leung 1997: 279 – 283 and Solar 2006).

2.2.2. Uses and benefits of photovoltaic cell system

There are countless uses and benefits derived from the use of photovoltaic systems namely:

- Water heating systems around the world (see De Winter 2006).
- Domestic usage with multiple applications like powering electric lamps, television set, DVD players, stereos and a whole lot (see Sieg Klaus 2005: 71).
- Adaptability to architectural designs (e.g. incorporated in roofing designs and some window designs) (see IQ Marine 2004).
- Trash can that uses solar energy to automatically compress trash when the can gets full, thus reducing the volume of waste as well as garbage collection frequency. This has a universal advantage (Spaeder 2006:52).
- Uses in Hi-Tech equipments like charging of cell phone and iPods (Armstrong 2006: 90).

Solar energy technologies everywhere has the potential of diversifying energy supply; reducing the dependency on imported fuels, improving the quality of breathable air and even stimulates the economy by creating jobs.

2.3. Product strategies

This part defines product strategies and lays emphasis on the various dimensions available under this paradigm. It also discusses product standardization alternatives that in an overall point of view help to address the impact of photovoltaic systems on the strategies adapted for the African market.

2.3.1. Defining product strategies

A product strategy includes the decision and management of the different dimensions of a product; product platforms, product lines and individual products (McGrath 1995: 14). Product strategy is a core part of the marketing mix (Kotler 1991: 68). Product strategies involve issues pertaining to standardization or adaptation of the product (Czinkota and Ronkainen 1990: 263-265) as well as the decision to modify, imitate or innovate a product (Drummond and Ensor 2001: 207). Product strategies also include the classification of a differentiated product by the firm vis-à-vis the needs of the customers and the satisfaction they intend to derive from the product (Taggart and McDermott 1993: 74). The final justifications of product strategies is anchored on specific parameters which include the technical factors, legal environment, use conditions, income, education and consumer's taste and preference (Taggart and McDermott 1993: 75). Anticipation and solving these aforementioned issues provides an advantage in developing the right product for the right market. Product strategies could also be said to include decisions on product positioning and brand strategy (Trott 1998: 91-93).

2.3.2. Product strategy dimensions

The product strategy of photovoltaic technology can be said to consist of three dimensions: product platforms, product lines, and individual products (see also McGrath 1995: 14, Gabrielsson 2004: 30). The product strategy dimension is a bundle of decisions on first of all, the product platform that decides on how to develop the right platform for an international market. Usually from this product platform different products with their attributes are developed for a

product line. Then from the platform there is the product line, which defines the width, length and depth and the positioning in each line. Finally there is the individual product with its categorization and packaging attributes. (Gabrielsson 2004: 29-30). Figure 1 illustrates the product strategy dimensions and technical points for business operation. This gives an idea of which part of the dimension could be focused for adaptation by Finnish photovoltaic technology manufacturers for Africa.

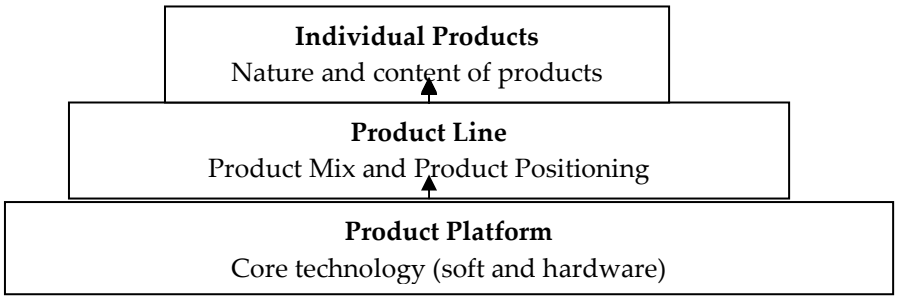


Figure 1: Product dimensions (Adapted from McGrath 1995: 18-20; Gabrielsson 2004: 29-37).

2.3.2.1. Product platform

For a firm to develop a product strategy successfully, it first has to understand what its product platforms as well as strategies for these are. In this session the emphasis is on product platforms, what they are and their role in the product strategy dimension thus differentiating them from other platforms (McGrath 1995: 43). Platforms provide the foundation for multiple products in a product line, thus in the high technology area and in particular the photovoltaic technology field, the product platforms are the core element of product strategy (McGrath 1995: 14).

According to Meyer and Lehnerd (1997: 39), "A product platform is a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced". As much as this aforementioned definition explains the key issues, the definition by McGrath (1995, 39) explains the illustration in *figure 1* above, according to him "A product platform is not a product. It is a collection of the common elements,

especially the underlying core technology, implemented across a range of products. He continues to explain, “in general, a platform is the lowest level of relevant common technology within a set of products or a product line”.

This classifies the reason why the platform is illustrated at the base with the other dimensions on top of it. Thus, with photovoltaic technologies, standardization of the platform is crucial, because the core of every energy system is technology specific. Platforms are what generate the different product lines, not the other way round, thus it is necessary especially in this case to understand at which stage adaptation is needed to suit the African market. Understanding this concept would help Finnish photovoltaic technology manufacturers to respond to the specific needs of the African market, but still keep the core elements in the platform standardized. Still under the issue of product platforms, there is the need for a firm to define the architecture that addresses the modules needed in the product and its function as well as specifics of the interfaces of modules. And finally, there should be a standard of measurability and the testing of modules to ascertain if they meet the design rules (Gabrielsson 2004: 32).

The purpose of product-platform strategy is also essential to facilitate an effective implementation and development of product lines and the final individual products. Strategies created at the platform level first of all help senior management to focus on the most important decisions thus leaving decisions of individual products to lower level management. Secondly, it helps in establishing the right foundation for the resulting product line. Thirdly, it provides the framework for long-term business strategy, thus helping management to be more focused on short-term planning and decisions for individual products. Fourthly, it links a company’s strategic vision with its product line strategy thus avoiding the scattering of ideas in the long run and finally it provides specific direction for technology development as to when new platforms are anticipated and what type of defining technology is needed (McGrath 1995: 47-49).

2.3.2.2. Product line description

A product line according to Kotler, Wang, Saunders and Armstrong (2005:552): "is a group of products that are closely related because they function in a similar manner, are sold to the same customer groups, are marketed through the same types of outlet, or fall within given price ranges." In photovoltaic technology field, the products of the same product line usually emanates from a common platform (see also McGrath 1995: 61 and Gabrielsson 2004: 33). It is at this stage that the product mix decisions are made. Product mix or product assortment consists of the width, length, depth and consistency of products in a line and management and strategies for its success and positioning in the market (Kotler 2005: 555). Product line strategy is defined as a time-phased conditional plan for the sequence of developing products within a product line (McGrath 1995: 61).

There has been a lot of research on analysis; planning, implementation and control of product lines, but amongst other the focus is on what is presented by marketing and high technology management literature which discusses product line strategies (see also McGrath 1995, Kotler and Armstrong 2001 and Gabrielsson 2004). This literature helps in understanding the types of product line decision in the context of photovoltaic technologies by Finnish manufacturers. A technical consideration for product line is the variation it presents and this comes with some characteristics that make its application in the context of photovoltaic technologies practical. According to McGrath (1995: 63): *"The products in a product line may differ based on their capacity,"* An example is the energy generating capacity of a solar panel: each module generates 50 – 64 watts and each line comes with its own bundled package of modules and other accessories like inverters, batteries and charge regulators or controller. Amongst others is the ability to differentiate the set of products in a product line by means of their performance, specific features, packaging as well as quality (McGrath 1995: 63.)

According to McGrath (1995: 65) a product line strategy has four primary purposes. First, it defines products variations aimed at specific segments within a market. For example NAPS (a Finnish Solar Manufacturer) have basically four product line category: industrial solutions; solutions for rural developments; building integrated systems and solar electricity for customers (Naps 2006).

Secondly, a product line strategy should facilitate a schedule of the roll out of products within a product line. This is aimed at providing strategic advantage for a company by being the first to introduce a product at a specific time in a life cycle of a product line as compared to its competitors. Thirdly, it provides guidance to the product development teams and this facilitates their productive response to the needs of their specific markets.

Lastly, product line strategy helps in scheduling the initiation of product development and this in an overall provides the right timing and planning of each product. Due to the fact that limitation on managerial and financial resources restricts the number of product lines, it can be assumed that companies need to rationalize the total number of product lines as well as it mix strategy to compensate for a proper planning, realistic use of resources and managerial expertise and a well planned launching to attain success (Gabrielsson 2004: 35).

2.3.2.3. Individual product categorization

This part considers the term product, its classifications as well as specific attributes, which among others includes its features. Usually this is the last in the series of product dimensions and it precedes or sometimes goes along with the actual branding of products. A product can be thus defined according to Kotler et al (2005: 539): "as anything that can be offered to a market for attention, acquisition, use or consumption that might satisfy a want or need. It includes physical objects, services, persons, places, organizations and ideas."

Products could be classified according to their durability and tangibility as durable and non-durable goods as well as services, or based on two broad classes in connection with the types of customers that use them – customer and industrial products. (Kotler and Armstrong 2001: 295; Kotler et al 2005: 540). Under these popular classifications, there were additional distinctions under each, for example under consumer products there are types like convenience, shopping, specialty and unsought products. And in the case of industrial products are the types like material and parts, capital items as well as supplies and services which are considered as industrial products that do not enter the finished product at all.

In planning a market offer, there is the need for a marketer to consider the content of the product. Kotler et al (2005: 539, 540) explains that a product could be seen on three levels.

The three levels are: the core, actual and augmented product. The core product consists of the problem-solving services or core benefits that consumers are really buying when they obtain a product. In the photovoltaic technology field the core product or service includes generating capacity, performance, technology, as well as the main functional features. The actual product is made up of the physical components. That is usually visible to the customer and this includes the packaging, brand name, features, quality and styling of a product. Finally the augmented part of a product is made up of the after sales service, warranty, delivery and credit as well as installation. In figure 2, the three different levels of a product prevalent in photovoltaic technology field have been illustrated.

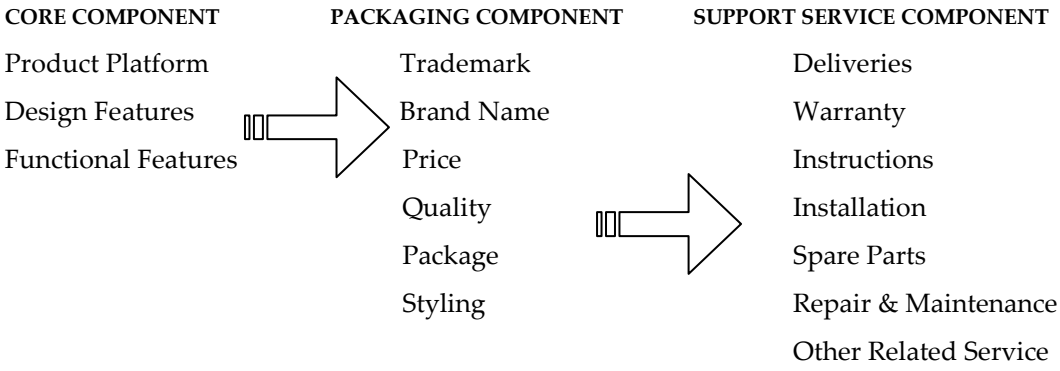


Figure 2: The three levels attributes of a product (Source: Adapted from Kotler et al 2005:539; Cateora & Graham 1999: 368).

2.4. Standardization, adaptation and management process of the firm

The issue of product strategies always raises concerns as respect to product standardization, adaptation as well as the changes needed by the management team to effectively present a good offer to the market. This part of the research addresses these main issues of standardization versus adaptation and gives reasons for each paradigm as well as justification for a customized management process. Finally, the discussion would be on the available alternatives for product strategies in relation to photovoltaic technology for the African market.

2.4.1. The issue of standardization versus adaptation

According to Gabrielsson (2004:38): "The debate concerning whether to standardize or to adapt the product and marketing mix elements has gone on for a long time and does not seem to be close to any conclusive theory or practice." Other top experts in the field of international marketing support this aforementioned notion for an example Cateora et al (1999:358) explained that "An important first step in adapting a product to a foreign market is to determine the degree of newness perceived by the intended market. How people react to newness and how new a product is to a market must be understood." This was further justified by a summary point that was linked to the product life cycle issue, thus for an example, "In evaluating the newness of a product, the international marketer must be aware that many products successful in United States, having reached the maturity or even decline stage in their life cycles, may be perceived as new in another country or culture and thus must be treated as innovations." (See also Calantone, Cavusgil, Schmidt & Shin 2004: 185 – 196).

The issue of standardization or adaptation is discussed on three levels by Albaum et al (2005:400) and the explanation given is that, "Closely related to the product mix decision is the issue of standardization or adaptation of individual products comprising the product mix, thus showing an indication of the choices of either adapting or standardizing a product especially as a mix or in the brand level and in relations to the needs of the market. Secondary, standardization or adaptation can occur for the physical product core, (for example size, function, colour etc.) which supports an aspect of the product dimensions.

The issue of standardization or adaptation is no different in the photovoltaic technology field. Due to the uniqueness of the final product there is the need for management to decide at which point of a product dimension warrants standardization or adaptation. According to Czinkota et al (2004:249) "A firm has four basic alternatives in approaching international markets: (1) Selling the product as it is in the international market place, (2) modifying products for different countries and/or regions, (3) designing new product for foreign markets and (4) incorporating all the differences into one product design and introducing a global product.

In the case of photovoltaic technologies, the market is still young even in the developed economies where electricity and generation of it is in itself not a problematic issue. The need of photovoltaic technology (as part of viable renewable energy sources) stems from the Kyoto protocols a quest to find alternative cheaper, cleaner and reliable source of energy and in this respect electricity (see also Boyle 2005: 60 – 62). The framework to date is to establish a relatively smaller generating system, which is most often than not connected to the grid so as to share excess capacity or make it available for sale. In the case of Africa, the case is different, a large percentage of the population do not have access to electricity.

So primarily, the photovoltaic system is needed for its sake mostly as a stand-alone system. Thus the issue of standardization as well as adaptation is aimed at addressing the crucial possibilities of the presentation of an off-the-shelf product/solution, which is portable, efficient, cheaper to obtain and flexible to install and use. According to Gabrielsson (2004:40), an important distinction should be made between the standardization of products, marketing programs and the managerial processes. A clear and practical solution suggested is to standardize the product platform and only make smaller adaptations for different markets, thus achieving both benefits of adapted offering and of spreading out often large outlays for R &D among a large number of countries.

In creating an acceptable product offer for international markets, it is crucial to scrutinize the aspects that contribute to the 'ultimate' product offer (Hollensen 2001:395). Albaum et al (2005:401) explained that, "standardization or adaptation can occur for the physical product core (for example size, function), package and auxiliary services". Also Kotler (1997) suggests five levels of the product offer need to be considered by a marketer in order to make the product attractive to the international markets, these aspects are well explained under the product dimensions, but another area yet to be considered is the management process, which holds the key to a realistic product delivery. Next is a discussion on reasons for product standardization or adaptation.

2.4.2. Reasons for product standardization or adaptation

There are countless reasons for which firms standardize or adapt their product, but the bottom line is that, there is no firm that is at the extreme end of the spectrum of standardization and adaptation. This assertion is supported and evaluated by Gabrielsson (2004:41): "The standardization alternatives are a spectrum ranging from full standardization to an adaptive approach at different levels of marketing mix elements. This part tries to pinpoint popular reasons for standardization or adaptation.

The paradigm of standardization and adaptation is seen differently from the firms' and consumers' perspective in that, from a firm's standpoint, it is often cost effective and efficient to standardize products. Whereas from the consumer's standpoint a product should not be *almost* what he (the consumer) wants, but rather *exactly* what he or she wants which actually brings to some degree the idea of customization or individualization of products (Albaum et al 2005:401). According to Albaum et al (2005:401):"Adaptation should be mandatory or voluntary''. He further argued that, 'mandatory adaptation would be required because of such things as language differences, differing electrical systems, differing measurement systems, product specifications and government requirements.

Voluntary adaptation on the other hand is decided by the firm as to what to modify and what variation should be made available for the target market". In deciding the form in which the product is to be marketed abroad Czinkota et al (2004:252) explained that there are three sets of factors to be considered namely (1) the market(s) that have been targeted, (2) the product and its characteristics and (3) company characteristics, such as resources and policy". In most cases there is the need to consider the advantages as well as the disadvantages of both the issue of standardization or adaptation with special emphasis on the cost involved especially in adapting a product beyond its required mandatory standards (see also Czinkota et al 2004; Albaum et al 2005; Usunier and Lee 2005). The table below gives overall points in factors encouraging standardization as well as adaptation.

Table 2: Standardization versus Adaptation (Source: Adapted from Czinkota et al 2004:250).

Factors Encouraging Standardization	Factors Encouraging Adaptation
Economies of scale in production	Differing use condition
Economies in product R&D	Government and regulatory influences
Economies in marketing	Differing consumer behavior patterns
'Shrinking' of the world marketplace/ economic integration	Local competition
Global competitions	

In the case of photovoltaic technology and to that respect photovoltaic system (solar power), the argument of standardization and adaptation is only confirmed in the aspects that reveal the best possible options of presenting the ultimate benefit to the end user. Thus the focus is more on the customer characteristics, expectations and preference (Czinkota et al 2004:255) leaving the manufacturer with a choice of standardizing or adapting the best possible options available in designing, producing and presenting the best product with the least effect on its cost factors.

Finally, considering all the aforementioned points, the clear issue of product standardization or adaptation to its fullest sense emanates from a time frame as the learning curve develops to encompass much understanding of the market conditions be it from the firm's perspective or from that of the individual and collective market perspective. For product strategies of photovoltaic technology manufacturers, there is a higher need for standardization in that the importance of understanding the product platform level strategies in the high technology area which is explained by McGrath (1995:42-57) supports the main item under consideration which concerns the photovoltaic technology. In technical terms the product platform for a photovoltaic cell is based on the silicon material (mono or multi crystalline or the use of silver). No matter the choice adapted these platforms are more efficient in the African market due to the large availability of fuel (sun) to power it.

In the case of product lines due to the fact that all the African countries use 220-volt system and the same voltage system is used in Europe and some other

parts of the world with exception to a major part of the U.S.A. which uses a 110 volt system. It would be agreeable that standardization is still suitable on the product line level because the specification and requirement works the same across countries (Gabrielsson 2004:44). The individual product can be adapted at some specific levels in the case of photovoltaic system, in that most of the African countries do not have access to electricity, thus no accessibility to a grid system. With this in mind, presenting the same off-the-shelf package similar to that found in the European market and elsewhere (which usually serves as a backup or supplementary system) would be almost inefficient or even erroneous. Most consumers in the African market would readily accept a standalone system that would power the whole household electrical appliance thus the need to modify the core product and service benefit to increase its range of performance and functionality.

The second aspect is the tangible product; this should also be of a larger design because in photovoltaic system, the number of silicon cells determines the generating capacity of electricity available for consumption. The final aspect of the individual product to be adapted to the African market is the augmented part of the product, which includes warranty, delivery and installation amongst others. The warranty aspects could easily be standardized due to the international market conditions, but then with the issue of installation; it might be always difficult to always use trained personnel to get the equipment installed and running, thus there is the need of a standardized do it yourself manual added to the sales package and an extensive demonstration via print and electronic media (Kotler et al 2005: 539-40; Hollensen 2004: 450 and Cateora et al 1999: 36 – 37).

2.4.3. Justification for a standardized management process

In view of the fact that photovoltaic technology are widely accepted across countries or even globally; there is a different product management that can be said to benefit from standardization. In the context of standardization for globalizing international firms, Gabrielsson (2004:45) mentioned three areas that merit standardization which could be relatively compared to photovoltaic technology market. Amongst others are these examples:

1. The process for defining the customers input in new product requirements based on information gathered form the market as well as the customers;
2. The product development process including the needs for an interlinked and integrated research and development centre across boarders as well as;
3. The products launch process, which in this case could be replicated across boarders and especially in dealing with the African market.

In view of the ongoing discussion as well as the points developed on standardization versus adaptation, it is natural to conclude that internationalization strategy to this context is more prone to a regiocentric concept which consist of the approach whereby a firm tries to standardize its marketing and management programs within its region but not across them, making room for slight modifications where necessary (Hollensen 2004:49).

2.4.4. Product strategy alternatives for international firms

According to Czinkota et al (2004:249), a firm has four basic alternatives in approaching international markets: [1]Selling the product as it is in the international market, [2]Modifying the product for different countries and region, [3]Designing new product for different foreign market, and [4]Incorporating all the differences into one product design and introducing a global product. This viewpoint is also supported in the high technology and industrial markets. This research is focused on product strategy for high technology industry and thus, the explanation given by McGrath (1995:166-173) adds better consistency to the debate in that the main focus is on the standardization or adaptation of the product platform to suit the need of local, regional, international or on global customers and market criteria.

Explanation presented by: (McGrath 1995; Gabrielsson 2004 and Czinkota et al 2004) describes product strategy alternatives as follows:

1. **Localized product strategy**: Where a company may decide to develop products for only a country or a limited area. This is argued to be insufficient; as it does not leverage the often-high development costs in

the high technology area and in that case photovoltaic technologies. The use of this localized product strategy is for the fact that it adapts to the market requirement.

2. **Modified product strategy**: This is more regiocentric in that a company may develop a common product platform that is used across the globe, but allows for product adaptation based on regional or countries specific requirements. Thus, the cost advantages and leverage of research and development investment worldwide makes room for a significant competitive advantage. Thus, due to specific energy requirement of the African market, the conclusion would be a set of strategy that leans to that specific continent more than just a globalize approach.

3. **Standardized product strategy**: This is a more geocentric approach where the firm's strategy is to develop a fully standardized product across the globe. This provides the highest leverage in both development and manufacturing. It is essential when the product requires relatively few or no modifications. In the case of the African market, there is the risk of jumping into such conclusion without necessarily understanding the specific needs and usage requirement of the final consumers in the market.

According to Gabrielsson (2004: 48-49), globalizing internationals first enters the international market (international market entry phase), then penetrate deeper into international markets (international market penetration phase) and eventually enters into a more global scale of activities. Thus as part of the internationalization phase a company may choose to enter a market initially by both utilizing a localized product strategy to gain much knowledge and understanding of the market or to present a domestic market strategy to the target market with little or no adaptation to both the product and management process strategy. Nevertheless, companies in the global phase uses a more standardized product to enter the market. It is also noteworthy that in practical scenarios companies are prone in using a mixture of the aforementioned strategies.

3. DEVELOPMENT OF THEORETICAL FRAMEWORK

This part of the research presents issues that make possible the development of the framework so as to design a realistic questionnaire for the interviews. This part starts with a general analysis of the target market and it is aimed at focusing on macro and micro–economic factors, the criteria is on the basis of developing countries for which most countries in Africa could be considered as such. The framework continues with an analysis at the firm's level this is aimed at presenting two specific issues of the firm namely: the corporate strategy as well as the resources of the firm. These issues does not in any way give the implication that they are the most essential factors in the context of product strategies but rather it lay emphasis on the researchers limitations. The concluding parts of the framework highlights the impacting factors of these aforementioned points and a general summary of the key issues making up the framework of the study.

3.1. Target market analysis

According to Luostarinen et al (1990:253), there is a basic tendency for companies, particularly those in the early stage of internationalization, to approach, market which appears simpler, more familiar and less costly to penetrate. Thus, the target market chosen are usually those that are more close to the domestic market (geographically and culturally). International activities require both general knowledge and market specific knowledge.

The standardized aspect is the general knowledge of firms own operation especially in the areas of marketing and management. These forms of knowledge could easily be replicated for operation in the target market. In the case of the markets' specific knowledge, it is learned, thus the general assumption is that it takes time to acquire such knowledge (Hollensen 2004:53). Gaining knowledge about market facilities is a key to the reduction of risk (Czinkota et al 2004:243). As part of the internationalization process, the firm needs to evaluate its capabilities (domestically) and then the target country level of activities possibilities and strategies. Although the company level would not be discussed in details; aspects of the corporate strategy and points

about the firm's resources would be discussed alongside with their impacting factors on product strategies.

At this point we assume that the target market is the whole the of Africa continent. Although, the continent is made up of different countries and thus have different taste and preference, we have to assume that their demand for electricity supply via photovoltaic system would be the same based on the argument developed in the introductory stage. To be certain of the viability of the product strategies to the continent, this part of the theoretical evaluation would consider the economic environment, which according to Jain (1987:173) could be measured from the macro or micro-level of the countries.

According to Khanna, Palepu and Sinha (2005:65), "companies that choose new market systematically often use tools like country portfolio and political risk assessment, which chiefly focus on potential profits from doing business in developing countries but leave out essential information about the soft infrastructures there."

3.1.1. Macro – economic factors

Macro-economic includes the assessment of a country's source of livelihood and the allocation of resources to help develop the appropriate marketing-mix (Jain 1987:173). This includes the analysis of a country's gross domestic product (GDP) and per-capital income growth rates, its exchange rates as well as purchasing power parity indices (past, present and future) (Khanna et al 2005:65). Developing and under-developing countries features a low gross domestic product (GDP) which is less than $3000 and have limited amount of manufacturing activities and a very poor fragmented infrastructures (Hollensen 2004: 180). Apart from this Khanna et al (2005:65) advised that, "it is essential for managers to consider the nation's standing in the World Economic Forum's Global competitiveness Index, The World Bank's Governance Indicator, and Transparency international's Corruption ratings, its weight in emerging Market, funds investment and Perhaps, forecast of it's next political transition."

With the ongoing discussion, it is notable to say that this parameter makes it possible for only a handful of countries to be considered in the African

continent. Nevertheless, there is much hope than despair given the potential the continent presents as an important market for the future (Jain 1987:175).

3.1.2. Micro – economic factors

Micro-economic factors examine the level of competition and the type of demand they satisfy. In this case, a firm needs to consider its competitors those locally and those from abroad. In this case the competition would be based on the type of energy generating infrastructures available. Popular among these is the use of hydroelectric power, biomass and some other generating capacities which is fuelled by diesel etc…. on the other hand, the competition could be evaluated from the competitive product in the market. This involves the assessment of competitor's strengths and weaknesses and especially areas related to the excellence of personnel or that of resources (Jain 1987: 183).

According to Jain (1987: 182), the following questions should be considered by a firm:

1. Who are the competitors now, and who will they be in the future?
2. What are the key competitors' strategies, objectives and goals?
3. How important is a specific market to the competitors, and are they committed enough to continue to invest?
4. What unique strength do competitors have?
5. Do they have any weakness that makes them vulnerable?
6. What changes are likely in the competitors' strategies?
7. What are the implications of competitors' strategies on the market, the industry, and one's own company?

In answer to these questions, Jain (1987:182) continued to explain that a demographic profile about the industry amongst others should be drawn.

3.2. Firm's level analysis

This part of the research briefly disclose the firm's level of activities in the internationalization phase, the emphasis is narrowed to two main areas namely

the corporate strategy and issues relevant to the resources of the firm (tangible and intangible).

3.2.1. Corporate strategy of the firm

There are different strategies that a firm could adopt to enable it to compete in a given market, as well as to have favorable returns on its investments. Grant (2000:24) argues that the firm needs to identify "what business or businesses it should enter" (Corporate strategy) as well as "how it should compete''? (Competitive strategy). Corporate strategy is defined as the scope of the firm in term of the industries and market in which it competes and decisions including investment in diversification, vertical integration of resources between the different businesses of the firm (Grant 2000:24). Corporate strategies was further explained by using arguments and studies by Henry Mintzberg and his colleagues at McGill University into the process of strategies (Grant 2000: 25; See also Gabrielsson 2004: 86, 87).

Grant (2000:26) explains the following:

1. Intended strategy involves a process of negotiation, bargaining and compromise, involving many individuals and groups in the organization and it is usually initiated by top management.
2. Realized strategy is usually the actual outcome of intended strategy and they tend to be as less as 10-30 percent of what was originally intended. In the course of executing the intended strategy, there could be some new strategy (ies) emerging.
3. Emergent Strategy is the pattern of decision that emerges from individual managers adapting to changing external factors. (See also Mintzberg 1978: 934 – 948 and 1985: 257 – 272).

Unrealized strategies are usually discarded. In a summary strategy at a corporate level represents the cumulative direction of the firm in connection to the nature of industry, the competitive environment and internal factors related to production, finance, marketing and personnel (Bradley 1991:89).

The definition by Grant (2002:24) expanded on internationalization alternative as agreed by authorities in this field of business studies in that, it mentioned expenditure or investment decisions on:

1. Diversification: This involves the growth of a firm through the development of new production or area which is clearly distinct from current business and new market activities. (See also Bartol et al 1991:203 and Gabrielsson 2004:88 - development on *Ansoff* matrix).
2. Vertical integration: This involves growth through the production of inputs previously provided by suppliers or through replacement of a customer role by disposing off one's own output (See also Bartol et al 1991:201.)
3. Acquisition and new entrant: in order to gain specific market assets or other resources. A firm may acquire another firm that possesses information, asset, brands, distribution network or skilled management which can be used to improve its own performance in a given market or industry (Bradley 1991:363).
4. Allocation of resources for different business unit (competitive or business strategy): The sum total of resources and investment made in management functional areas (product line strategy, pricing and the development of strategy, positioning strategy etc synergies of strategies business unit)
   (See also Aaker 1988:4-5)

The argument on corporate strategies further identifies according to Griffin and Pustay (2003:299); is that there are three different forms from which a firm could adopt for business activities:

1. The single business strategy: that calls for a firm to rely on a single business, product, or service for all its revenue. The advantages presented in this case is that, the firm can concentrate all its resources and expertise on that one product or service. The main disadvantage is that, this form of strategy usually leaves the firm vulnerable to competition from other firms and competitive products as well as external environment. Thus the need for a firm to diversify in various fields, this leads us to the second form of corporate strategy.

2. Related diversification: the fundamental principle behind this strategy is found in the firm's ability to operate in several different but fundamentally related business, industries, or market at the same. In conclusion, this

form of strategy enables a firm to leverage a distinctive competence in one market to strengthen its competitiveness in other market. An example is NAPS (*solar electricity solution*) a Finnish company whose core product is photovoltaic system but then apart from selling to different market groups, it also have a hybrid compatibility systems that connects it to other energy market like wind, small hydro-plant and diesel generators etc.

The advantage in this strategy is more, first the firm depends less on a single product or service, so it is less vulnerable to competitive or economic threat, and second, related diversification may produce economies of scale for a firm. Related diversification, in addition, may allow a firm to use technology or expertise developed in one market to enter a second market more cheaply and easily.

Thus in this case a photovoltaic technology manufacturer using this strategy in sampling few countries in Africa could adapt and replicate the outcome for the rest of the countries in the continent. The popular disadvantage is found in the cost of coordinating the operations of the related divisions. And the possibility that the firm's business units may be affected simultaneously by changes in economic condition.

3. Unrelated diversification: this strategy is whereby a firm operates in several unrelated industries and markets. This is highly discouraged primarily because of the lack of potential synergy across unrelated businesses. This makes it difficult for a single style of business operation to be adopted usually ending up with a complicated way of monitoring individual operations. (See also Gabrielsson 2004:88-89).

Finally, corporate strategy instigate the building up of sets of businesses together to what is popularly known as strategic business units (SBUs) (Griffin et al 2003:301). Bartol et al (1991:205-11) argues that strategic business units needs a method of analyzing them as part or organization's mix of businesses in term of both individual and collective contributions to strategic goals, thus the term portfolio strategy. The portfolio strategy is then followed up with the overall business level strategy and the approach used in measuring the business-level strategy is the Porter's competitive strategy that is made up of:

a. *A cost leadership* this involves organizational efficiency to the extent that overall cost of providing products and service is less than those of competitors).
b. *Differentiation Strategy* this involves the development of products and services that are viewed as unique in the industry), and
c. *Focus Strategy* this emphasizes on specialization by establishing a position of overall cost leadership, differentiation, or both, but only within a particular portion, or segment, of an entire market also referred to as niche strategy. (See also Griffin et al 2003: 301-302).

This research does not intend to investigate these forms of strategies but only mention it as part of the reference for different strategies available to a firm and what makes sense especially in the field of photovoltaic technology as well as the African market.

3.2.2. Resources of the firm

Bradley (1991:55-69) explains the issue of a firm's resources in two parts: the production and firm's advantage as well as the expertise and characteristics of strategic decision makers of the firm (management).

Gabrielsson (2004:97) put it in a simpler form as tangible and intangible assets, which are tied to the firm. Grant (2002:137) explains that resources and capabilities are sources of profit and argued that the resource-based view emphasizes the uniqueness of each company and suggests that the key to profitability is not through doing the same as other firms, but rather through differences. Thus for a firm's resource to impact on product strategies, the firm in question need to identify and evaluate and effectively utilize these resources, this would help it gain a competitive advantage over others in the same industry (Grant 2002:141).

Grant (2002:141) further categorized a firm's resources into two main parts tangible and intangible and then these two categories into five common classifications:-

Table 3: Resources of the firm [Tangible and Intangible Assets] (Source: Adapted from Grant 2000:140)

Tangible Assets	⇒ *Financial resources* (Firm's borrowing capacity as well as fund generating capacity) ⇒ *Physical resources* (Reserves for raw material, equipments and plant) (See also Gabrielsson 2004:97)
Intangible Assets	⇒ *Technological resources* (Intellectual property, patent portfolio, research facilities etc) ⇒ *Reputation* (With customers through ownership of brands name and trademarks; suppliers (Bank, government and employees etc)) ⇒ *Human resources* (Education, adaptation of employees commitment and loyalty)

There are others key areas of resources that are discussed by authorities in this field of studies for example; Gabrielsson (2004:98) discussed about the development of competencies and resources for the future, which emphasized how this aspect is of importance to the globalizing internationals. Grant (2000:166) also discussed issues pertaining to the development of new capabilities; even so this area of studies is not included in this research. This research is interested in the preliminary points to support the development of impacting factors on product strategies of Finnish photovoltaic technology manufacturers for Africa. Future investigation could help narrow the gaps under the potential nature of resources of the firm and how it affects product strategies.

Nevertheless, the assumption is that by analyzing the resources and capabilities, the company may choose the correct product alternative

(Gabrielsson 2004:100); he added that, it may also be useful to plan and develop certain resources combinations for exploiting the strategy in the future. Finally, he argues that, the managerial demands of operating an international company is based on how the firm is able to reduce cost and optimize investment thus companies operating on the basis of international strategy need to possess skills and the capabilities to achieve the desired local responsiveness.

3.3. Impacting factors on product strategy

This part of the research is focused on the impacting factors of product strategies. The issues to be considered are impact of the target market analysis (micro and macro) on product strategies and then the impact of specific firm's level activities corporate strategy and resources of the firm (tangible and intangible) on product strategies. The theories and discussion will touch on general points leaving the in-depth analysis for further studies in the future. This part concludes with a summary on the objective and framework of the studies.

3.3.1. Impact of target market analysis on product strategy

In summary, a favorable economic climate generates a spirit of optimism among consumers and this instigates the willingness to spend (Jain 1987:185). With this in mind managers are advised to always look out for ways of monitoring the uncontrollable variables which varies from country to country and most importantly amongst those is the political risk which Hollensen(2004:170) explains as consisting of three major types namely:

1. Ownership risk, which exposes property and life;
2. Operating risk which refers to interference with the on going operations of a firm and;
3. Transfer risk, which is mainly encountered when, companies wants to transfer capital between countries.

These factors in conjunction to the sub-topic discussed usually have direct or indirect impact on product strategies adopted by a firm. These impacting

factors are sometimes classified as the PEST factors (Political, Economical, Social and Technological). Concerning internationalization strategies and processes; the points thus developed lay emphasis on specific aspects of especially external factors facing the firm's decision due to the fact that every firm has some form of internationalization activities. Jain (1987:16); argued that a firm's overseas involvement usually falls into one of several categories namely:

1. No marketing overseas
2. Infrequent marketing oversea
3. Regular marketing oversea
4. Worldwide marketing operation

These assertion is supported by different authorities in this field of studies, for instance Gabrielsson(2004:83); 'emphasized on operation strategies which happens to be an aspect of firm's internationalization strategies and in that instance he explained that firm with reference to Finnish companies usually use operation strategies in this order: Non-direct Marketing Relationship Operation (NIMOS), Direct marketing Relationship Operations (DIMOS), Non-Direct Investment Production Operations (NIPOS), and Direct Investment Production Operations (DIPOS).

In this case the assumption is that Finnish photovoltaic technology manufacturers are entering the African market based on the objectives of this research, on a non-investment mode which most often than not is exporting be it direct or indirect. Hollensen (2004:277) argued that even when the mode of entry is known, the firm needs to form a realistic strategy based on a thoroughly investigated options available and in connection to the three factors of the firm: The availability of: company's resources, risk and non-profit objectives. Thus, the internal factors, which could be controlled to some extent, need to be good enough to counteract the external factors that is political and legal, technological changes and expertise, socio-cultural variables as well as economic climate- past, present and future (See also Rosenzenweigh, Gilbert, Malnight and Pucik, 2001.)

3.3.2. Impact of corporate strategy on product business options

In determining the strategic direction of a firm, this research under the analysis of corporate strategy deduced that companies may internationalize using one of this three strategies (a) single business strategy (b) related diversification or (c) unrelated diversification. Using unrelated – diversification as a business strategy is often discouraged especially due to its lack of potential synergy across the unrelated businesses. On the other hand, related diversification is championed by a lot of firms and is seen as highly favourable in terms of its flexibility in management decisions. Considering the fact that firms are endowed with limited resources (financial and managerial), this research pointed out in brief the need of Porter's competitive strategy (cost leadership, differentiation and focused strategies) as a means of measuring the business-level activities to ascertain what business activity, strategy or option would be more desirable and profitable in terms of the firm's capabilities (See also Griffin et al 2003: 299, 301 – 302; Bartol et al 1991: 205 – 11).

With all the aforementioned point, it is justified to conclude that corporate strategies and its subdivision have much weight in an organization's decision-making and business choice and has a greater impact on the type of product business option. To this end, the assumption is that, photovoltaic technology manufacturers for the African market would initially opt for a single business strategy (which is more focused in nature according to Porter's competitive strategy) so as to make good use of scarce resources and managerial skills and as the firms learning curve and activities in the chosen market or segment grows, they would slowly adapt to related diversification to improve on their market competitiveness (Griffin et al 2003:299). Nevertheless, it is noteworthy that the aforementioned point is only a typical example of the various strategic planning tools available in the market today (See also Taggart et al 1993:50).

3.3.3. Impact of firm's resources on product strategy

In this research the assumption is that a firm's awareness of its own resources (tangible and intangible) and the ability to analyze, manage and utilize these resources would aid the firm in choosing the right product alternative in its operation in an international setting. This helps the firm to identify the gaps

(resource, capability and competitiveness) in the market needed to be filled and thus gain advantage over others in the industry (See also Grant 2002: 137 - 141). Thus for a firm to be unique as well as profitable in a competitive market; there is the need for the firm to ascertain the potential strengths as to the type of resources and capabilities available to them and thus channel them to its own advantage (Bradley 1991; Grant 2002; Gabrielsson 2004). Finally in this context it is noteworthy that competitive advantage can be sustained, only if the firm's managerial and other capabilities are supported by resources that cannot be duplicated (Hart 1995).

3.4. Summary on theories and framework of studies

This part of the research tries to summarize the key aspects of the theoretical framework making it possible for a realistic development of suitable framework, questions for the company interview as well as promoting an overall understanding of the theories. Product strategy was analyzed highlighting the distinction in its dimensions: platform, product line and individual products. The conclusion drawn from this was as a result of evaluating the issue of standardization and adaptation. The points developed from this chapter later gave clarity to the part of the product that is usually prone to standardization or adaptation as well as the need for a standardized management process. (See chapter 2.4 for full details).

The internationalization process of a firm was analyzed on the basis of three aspects of business activities namely: product, operation and market strategy of the firm and it is said to involve the total number of products, the operations used in the market as well as the number of foreign markets entered by the company at certain point in time (Luostarinen 1989: 175). It was clarified that there is a difference between the company level and the target country level of internationalization activities. The research laid emphasis on the target market environment (as an impacting factor on product strategies) a subset of the whole activity faced by an international firm (see also Gabrielsson 2004:114).

It can be questioned whether the target country pattern is similar in each country and if so how it impact on product strategies. In this particular case the material developed under target market level created an assumption that the

target country pattern was similar as the whole continent was treated as one single market (which could be broken down into various regions and geographical positioning/segments). The argument was leveled on the fact that demand for electricity supplied via photovoltaic technology package should be the same on the platform level with differences limited to the usage capacity (product lines and its bundled dimension for household, commercial and industrial applications). The reality of this assertion would be confirmed or denied by the results of the companies' interview.

Furthermore, based on the points developed under internationalization process and its impact, it is assumed that the development of markets, operation strategies and the international business experience would have an impact on the product strategies for the African market. It was also considered that, there were essential changes needed by a firm moving from its domestic market to an international environment and these changes were considered under the chapter discussing the standardization and adaptation issues. It was concluded that, it is vital for a firm to keep the product platform standardized and the product lines adaptive enough to suit especially the need capacity of the consumers found in the African continent. (*See chapter 2.4*). This area also brought about issues pertaining to the strategic levers of economies of scale and scope and their role as impacting factors to product strategies.

The discussion of the macro and micro economic factors suggested an evaluation of the target markets' purchasing power (from the general GDP perspective and an investigation into the market's indicators of economic growth and regulatory policies of trade. On the other hand this parameter discussed the actual and potential present and future competition a firm could face and the assessment of the strength and weakness of these competitors. (See also Jain 1987: 175, 182; Hollensen 2004:170; and Khanna et al 2005:65).

It is noteworthy that, the discussion on corporate strategy and issues patterning to a firm's growth strategies as well as diversification theories helps in explaining options available to firms in decision making concerning its internationalization strategies (see Grant 2000: 24 and Griffin and Pustay 2003: 299). It was proposed that in theory - *related diversification strategy* would be more suitable for Finnish photovoltaic technology manufacturers as to which of Porter's competitive strategy could be adopted; the assumption was narrowed

to the use of a focused strategy (this assumption is left for further investigation). The issue of resources (tangible and intangible) of a firm was discussed to ascertain its impact on product strategies. It was concluded that for the firm's resources to impact on product strategies positively or negatively, the firm needs to identify, evaluate and effectively utilize these resources. (See also Grant 2002:141; Bradley 1991: 55 – 69 and Gabrielsson 2004:97). A general overview of standardization and adaptation of product, revealed that some characteristics like market, product, legal restriction (micro economics) and internal firm factors (corporate and resources) can affect product strategy (standardization or adaptation). Table 4 below presents a summary of the theories concerning international product strategies.

Table 4: Summary of theories explaining product strategies (Source: Adapted from Gabrielsson 2004: 117)

Theory	Objective	Underlying Reason	Impacting Factors	International Product Strategy
Internationalization Process	Explains the internationalization process as a dynamic concept	Organization expansion and learning	Market, Operation Strategies and Business experience	Development of product categories, choice of product strategy
Corporate Strategy	Explains the business portfolio strategies and selection of business to be internationalized	Corporate business portfolio	Business portfolio strategy	Choice of product business to be internationalized
Resource –Based View	Explains the impact of resources and capabilities on product strategy	Products are based on company's resources and capabilities	International or local technology, marketing and management capabilities	Choice of international product strategy alternative.

In further development of the framework, in the context of *the product strategy alternatives for Finnish photovoltaic technology manufacturers entering the African*

market, there are the following to consider: (a) economic and industry environment (b) corporate or and business level strategy (c) product strategy at business level (d) strategic levers, resources and decision making variables. A framework explaining the development of product strategies is presented in Figure 3.

The economic and industry environment: The economic environment in this research is specifically limited to the target market pull environment (macro and micro environment); however, it is noteworthy that due to the smallness of the Finnish domestic market, the companies are always pushed to exploit synergies outside by undertaking business activities in international and global markets (Luostarinen 1994: 7). The large markets are especially important for Finnish photovoltaic technology manufacturers, because achieving economies of scale and scope would usually help them cut down cost and thus be highly competitive with other market players in the industry.

This research developed especially the economic environment by emphasizing the need for manager's to efficiently monitor the uncontrollable variables under this, there was the mention of three risk variables namely ownership, operating and transfer risk. The industry environment considered in this research is connected to the micro – economic factors; it is developed in the context of not only the photovoltaic technology sector but also on a wide range of conventional and non-conventional energy systems that serves as a source or basis for competition in the general energy market. It is vital for managers to know and understand competition in the same product line or category as well as the influence of players in other product categories other than photovoltaic systems (i.e. wind-turbine; hydro-electric power, diesel generators etc.) so as to create a realistic competitive strategy in the Africa market (*more details at 2.2 and 2.3*).

Corporate or and business level strategy: This includes the business portfolio strategy, market, operational strategy and in this research an aspect of competitive strategy is mentioned to stress on the fact that the firm is not working in isolation but rather is competing with other viable firms in the same or other related industry (see also Grant 2000; Bradley 1991 and Aaker 1988). (*For more discussion on the possible business portfolio thus to be developed see page 3.2*)

A well planned corporate strategy would directly influence the choice of products and businesses to internationalize. According to Taggart and McDermott (1993:50, 63): 'There are many similarities between domestic and international strategic management, and many of the traditional models can be used or developed for international scenarios.' The main points for this research is not to elaborate on these different strategies but rather to emphasize its existence and the fact that they are in use one way or the other by internationalizing firms. Thus the area of concern would be derived from what the empirical part would present; as to what strategy (ies) is used by Finnish photovoltaic technology manufacturer's and why they opted for such and such specific strategy.

Under this same construct, the research mentioned the method of analyzing the strategic business unit and in a summary uses Porter's competitive strategies (cost leadership; differentiation and focus strategies) to explain the argument (See Bartol et al 1991 and Griffin et al 2003 *as well as refer to 3.2 for more details*). Decisions on the aforementioned points have some form of influence on product strategy and business options to chosen by an internationalizing firm. The section also includes decisions on the market(s) to enter.

The assumption has been given that the market is the whole of the African continent, logically there is a start-up point, and thus management needs to ascertain which of the countries in the continent would prove more viable in terms of production, marketing and extensive management activities. Taggart et al (1993:118) argues that for a firm's international presence to be successful a number of important managerial issues have to be resolved in terms of procurement of not only parts and components, but also most often, even finished products. With this in mind, it is often international subcontracting that has been recommended as having been mutually beneficial to both parties.

Nevertheless, there have been instances where firms either undertake a 'greenfield investment' or an acquisition of domestic or an international company. In all case scenarios there is the need for an extensive managerial evaluation as to the product and business portfolios to be used in the market and how to control them. This issues mentioned usually brings to the fore the value chain evaluation of the firm, this research is not considering the aspects of

the value chain of an organization as to what is done and how it connects to the other parts of the organizational activities (Taggart et al 1993 : 119).

Product strategy at business level: This aspect of the research presented the dimensions of product strategy laying emphasis on the three main aspects namely product platform; product lines and individual products. This aspect was later connected with the standardization or adaptation alternatives possible for an internationalizing firm: localized; modified and standardized product strategy (*See 2.4.4 for more details*). According to Taggart et al (1993: 74, 75), explains that, a firm need to have enough justification for product standardization or adaptation and this could be done by evaluating six aspects of the market namely:

- ***Technical factors***: a product must be technically consistent with any environment it is sold into in terms of determining factors like voltage of electricity or units of measurement or then in a broader sense the presence of skills, capital or raw materials.

- ***Legal environment:*** product standards in terms of safety, efficiency or pollution control which may have strict policies from host-country government. In the energy market the regulations are much flexible especially for the implementation of renewable energy systems.

- ***Use Conditions:*** The variations of use of a product is different from country to country; in the context of photovoltaic system, the principle as to use conditions is considered to be the same, rather it is the usage capacity that would vary from domestic, commercial and industrial level.

- ***Income:*** Personal income of potential customers could be a determining factor as to what to buy; in the case of energy usage, income although a factor is not necessarily a hindrance, due to the emergence of credit schemes by financial institutions to promote the accessibility of electricity to even the poor in societies of developing nations.

- ***Education:*** Due to the complex nature of high-tech equipments like a full package of photovoltaic system, it is assumed that the more literate in

society would easily understand and be able to handle those complex systems. In the context of installation and possible periodic services of photovoltaic system the issue of literacy is not necessarily an impediment to owning the system.

- ***Consumer tastes and preference:*** It is noted that consumers aspirations are often driven by cultural and other societal factors; in the case of energy and for that fact electricity consumption, the question of taste and preference is not a main issue, because as mentioned in the introductory part of this research in the West African region alone; only about one out of three have access to electricity (Plunkett 2004). Thus the main focus for consumers in this context is rather gaining access to the best generating capacity at an affordable price.

This aforementioned points does not give the impression that anything at all could be thrown into the market, the main implication is how standardize the need of electricity and for that fact photovoltaic system would be for the African market.

Strategic levers, resources and decision making variables: This part discusses strategic levers from the firm's perspective then moves on to consider the importance of resources of as well as the decision-making of the firm. In the internationalization strategies of the firm, the firm's competitive advantage amongst others is derived from its ability to use its resources to achieve economies of scale and scope in a given market (Grant 2000; Czinkota et al 2004; and Gabrielsson 2004). Economies of scale is explained as the ability of a firm to perform activities more efficiently at a larger volume and in a number of different functions of the firm (e.g. advertising; research and development and in the cost of other intangibles of the firm) (Porter 1998: 71 and Gabrielsson 2004: 121).

According to Panzar and Willing (1981: 268): 'There are economies of scope where it is less costly to combine two or more product lines in one firm than produce them separately (See also Czinkota et al 2004: 42). Thus, it is obvious to conclude that the level of economies (scale or scope) achieved by a firm would automatically impact on the product strategy and business options or choices to internationalize.

The resources of a firm are also expected to impact on product strategies. This is not a mere understatement especially if internationalizing firms are aware and could manage the threat and opportunity of the market by utilizing their strengths and suppress their weakness in an effective way. This is a typical SWOT analysis of a firm so as to gain competitive advantage in the chosen market (Bradley 1991; Grant 2002). As part of the framework the resources factor is explained extensively at *subchapter 3.2.2* to include the tangible and intangible assets of the firm. Thus it also lay emphasis on the firm's managerial skills and ability to learn and adapt in a given market situation.

The final part of the framework discusses the *decision-making variables of the internationalizing firm*. This area argues that an organization international market activity includes its ability to ascertain certain risk and uncertainty factors in their market of operation. This could be achieved by organizational learning of the market and competitive situations. A firm with an awareness of its strength and weakness should, to some extent, be able to control the predictable variables internally and as well manage the unpredictable and changing situations of the market as a whole rather than on its different level of business activities.

This could be possible based on the type of organizational structure put in place; the attitude of management; the roles of the functional areas in the organization as well as the organization's relationship with governments of the markets they have entered business relationship (See also Griffin et al 2003 and Taggart et al 1993). Based on the aforementioned discussion, this research now looks into the actual phenomenon of Finnish photovoltaic technology manufacturers for Africa. This is made possible by a careful evaluation of two case companies with extensive product and marketing projects of photovoltaic systems in Africa. The figure 3 discussing the framework bundled the various aspects of the theoretical part of the research thus identifying the micro and macro factors that impact on product strategies.

Assumptions to be verified in the empirical part of the research are as follows:

1. In a more liberalized environment, where by default the market(s) in question have less or no technical know how; they turn to pull firms from industrialized countries. In this research the assumption is, Finnish

photovoltaic technology manufacturers are being pulled by the target market's huge customer base (be it potential or actual).

2. The second assumption is that granted, the photovoltaic industry's market(s) needs and available level of competition would work together to achieve one common goal, that is, an extensive availability of electricity/energy to the African continent.

3. The aforementioned scenario, would promote the implementation of the right corporate strategy which in turn would facilitate the desire for a modified product strategy (standardized at the platform level, but customized at the product line and individual product level to meet the need specifications of customers (domestic, commercial and industrial).

4. When points 1 – 3 have been satisfied, the assumption is that there would be an effective utilization of firm's resources, promoting economies of scale and scope and reduction of risk and avoidance of uncertainty in decision making.

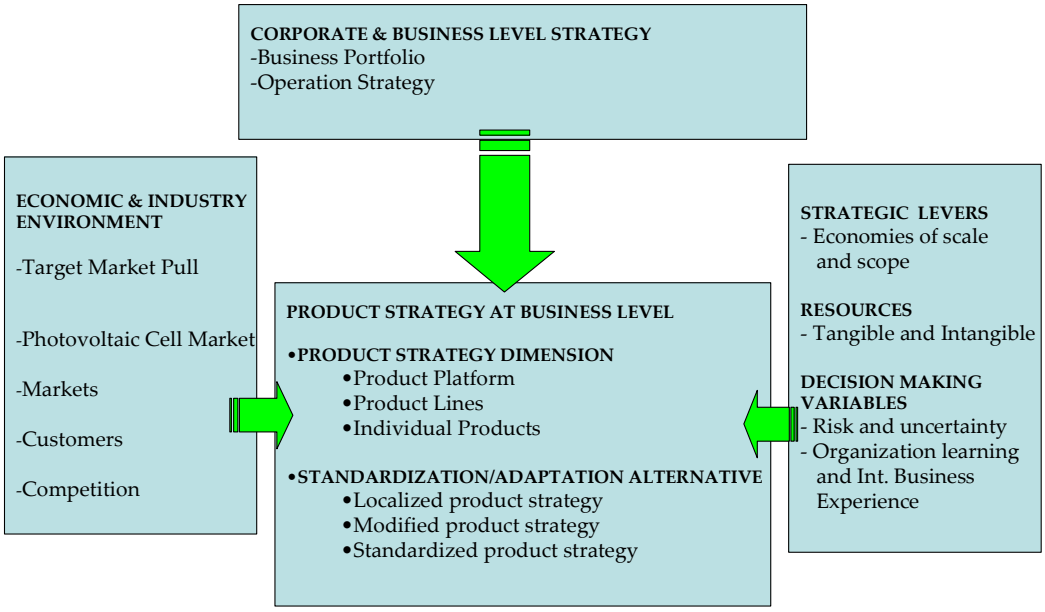


Figure. 3. **Product Strategy – Framework** (Source: Adapted from Gabrielsson 2004:124)

4. RESEARCH METHODOLOGY

This part of the paper discusses the research approach to be used to evaluate the theoretical part and to answer some key facets of the objectives of this part in relation to the firm's part (product strategies, issues of standardization and adaptation as well as strategies of the firm). Yin (1989: 28 – 29) discussed the need for a research design and argues that a research design is more than a work plan, but rather the purpose is to help a researcher avoid the situation in which the evidence does not address the initial research question.

Yin (1989: 29) suggested that the form of questions in terms of 'who, 'what,' 'where,' 'how,' and 'why', provides an important clue regarding the most relevant research strategy to be used. The research question in this case is stated as '*what product strategies are used by Finnish photovoltaic technology manufacturers for the African market and why?'*, this is further broken down into two main objectives; identifying and analyzing product strategies available for photovoltaic technology field for Africa as well as impacting factors to achieving this strategies with specific limitation as discussed in the introductory chapters and in the development of the theories.

4.1. Research process

The whole research process looks like a wheel as displayed in Figure 4. In developing this thesis, there are three things a researcher needs to be clear about: the theory, data and methods. These three aspects were considered separately then as a link to one another in producing the research plan. The most difficult part of this research from the initial stage was the collection of data especially from the Finnish companies, due to the fact that I am not well acquainted with the language as well as the actual process of product strategies undertaken by the firm. Data for the firms' part is from photovoltaic manufacturing firms in Finland with one already having a working branch in Africa.

Initially the topic for this thesis was to consider 'western photovoltaic technology manufacturers for Africa', with the main product in the context of all renewable energy systems. The topic had to be changed limiting the whole

discussion on only photovoltaic systems and also from the perspective of Finland being the country of origin of this systems and their internationalization to the African market. The reasons for the adjustment was due to the fact that all the other European and US photovoltaic manufacturers contacted for interviews were either busy or on holidays as well as the magnitude of expenses incurred by researcher due to the fact that this was a self sponsored research was getting greater. The theoretical part was much more flexible as there are countless literatures and journals covering the core part of the studies. The courses of international business program, research methodologies as well as guidance from Professor Gabrielsson my thesis supervisor alongside the thesis group opponents' discussion shaped my thinking to the right direction as to narrowing my thoughts to the core points of the objective of the research.

As a researcher my association and work with the university based energy consulting group VaasaEMG (Vaasa Energy Marketing Group) deepen my understanding in the energy market and especially photovoltaic systems from where the idea of developing the research around photovoltaic technology came. It was from one of the numerous projects undertaken by VaasaEMG that I coined the topic and ideas for this research.

4.2. Research strategy

This involves strategic decisions including areas such as: selection of setting; industry; and level of activity or focus to be considered (Maylor et al 2005). The theory of the study discussed product strategies of Finnish photovoltaic technology manufacturers. The construct for this study is limited to one level of the energy industry that is the photovoltaic sector. And the main focus is to investigate the product strategy (ies) used for the African market.

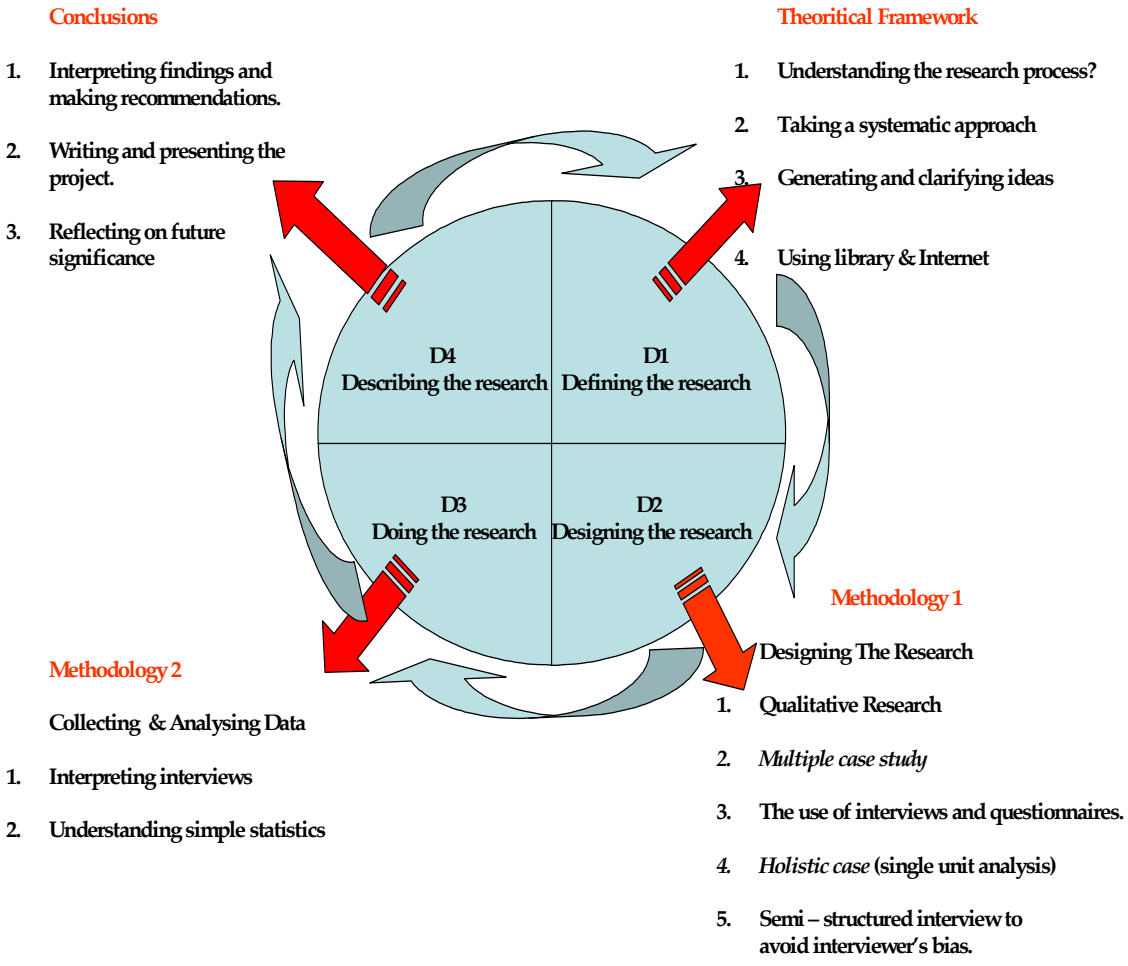
4.2.1. Qualitative research

Burns and Bush (2000: 230) discuss the use of qualitative, quantitative and pluralistic research depending on the objectives of the research to achieve a desired result. In a summary, qualitative research is said to involve observing

and/or asking open ended questions, usually with a small number of informants. Quantitative on the other hand involves a structured questionnaire and a large sample. Pluralistic research combines the advantages of both qualitative research and quantitative research. It is explained that with pluralistic research, the qualitative phase is the foundation for the quantitative phase (Burns and Bush 2003: 230, 231).

For this study, the research choice is qualitative, which the aforementioned points explained to be involving observation as well as asking of open ended questions. Method for answering the research question is based on an in-depth interview of some Finnish companies manufacturing and marketing photovoltaic systems.

Figure 4. Methodology of the study (Source: Adapted from Maylor and Blackmon 2005)



4.2.2. Case study approach

Case study is defined as a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence and it is holistic in nature (Yin 1989: 23; Yin 1994: 3; see also Saunders, Lewis and Thornhill 2003:93.)

In sampling, this study utilized a multiple case approach, this helps for effective comparative analysis of results and to ascertain the clarity of the theories developed. To avoid an extensive use of resources and time which is currently beyond my reach, this method is employed to investigate the core issue at stake and generate insight for further analysis (Yin 1994: 45).

The questionnaire for the company interview is adapted from an existing and well tested questionnaire of Gabrielsson (2004: 355, 356). The content and weighting of the questionnaire presents a realistic overview for asking questions about product strategies used by Finnish photovoltaic technology manufacturers as well as why they use such strategies and whether impacting factors discussed in the theoretical build up have any influence on their strategic decisions. The final criterions for choosing the firms for the case study are based on:

1) Location of the firm – which finally was Finland.
2) Business line and its scope – photovoltaic systems manufacturing and sales – especially in Africa.

The initial plan as explained earlier was to have different western photovoltaic technology manufacturers and from their interview analyze a common trend of the product strategy (ies) in use by them in the African market as well as the impacting factors to this strategy (ies). Thus company **W** Finland, **X** Finland, **Y** Germany and **Z** U.S.A. were contacted initially by e-mail and then phone. The entire firms in question show enthusiasm and willingness to participate, but they gave varying excuses later (due to heavy/overcrowded schedules of top management as well as initial or no actual activities in Africa). *Naps Systems* who had activities in Kenya (Kenya is the branch office from where other activities in Africa was undertaken) referred me to their manager at the Kenya branch who was very willing to help. And *FinnSolar Limited* had just started its

international activities in Africa specifically Ghana, the manager was willing to help with the core part of the questionnaire which had to do with product dimension and issues patterning to possible strategic scenario if they were to start business in Africa in the immediate future. Thus, the title and perceptive of the thesis was adjusted to make do with the type of interviews available, so as not to waste more time in developing the empirical part.

4.3. Research design

This involves the issues of getting research access and it includes the gathering and analysis of data as well as validity and reliability of the study. This part would also highlight on the technique for data collection, handling and analysis. The study is exploratory with some flavour of a descriptive style added. The concept of exploratory which is usually flexible and adaptable to change (usually answering questions like e.g. 'how' and 'why'). The use of descriptive approach helps in dealing with the question of 'what' and presents an accurate description of an organization etc… and mostly a means to an end rather than an end in itself and that is exactly what was required from the case firms (Burns et al 2000 : 130 – 133).

4.3.1. Data gathering

Data for the case study were obtained from two in-depth interviews with two people involved in addition to the company's profile. An in-depth interview gives clear ideas of aspects to be explored and it is particularly suitable for exploratory research due to the nature in which the probing of questions yield desired results (Burns et al 2000: 251). One point of clarity is that the second Finnish firm who had not yet started real business in Africa was interviewed primarily to add value to the core part of the studies in the areas of product strategies, dimensions and related issue of standardization and adaptation. Although this was the case, there was a set of questionnaires adapted from Gabrielsson (2004: 355, 356) used as a preliminary guide to get the interview going in the right direction. The interview for the companies is carried out *personally, through phone calls and by permitting on request the Kenya branch of Naps systems to fill out the standard questionnaire designed for the research via e-mail*. The

one conducted personally lasted for an hour. The interviewer allowed the interviewee to express himself freely on the core points discussed. Although there was a voice recorder that enables the recording of the whole interviewing session, some key points of the interview were also written down manually. The use of a voice recorder helped in presenting an accurate documentation electronically using Microsoft Word.

4.3.2. Data analysis

Analyzing data, according to Yin (1994: 102, 103) depends on an investigator's own style of rigorous thinking and the sufficient presentation of evidence and careful consideration of alternative interpretations. Burns et al (2000: 488 – 89) argues that having gathered the data, the problem confronting a researcher is usually the reduction of the coded data. It is explained that descriptive data analysis is a common means of data reduction. In actual sense data reduction begins at the very early stage of the research. The process of data reduction includes the interpretation of the interviews and documents as well as summarization and integration of information derived from them (see also Miles and Huberman 1994:10 - 12). For the fact that one of the interviews was written down originally by respondent, the work left was to analyze, interpret and summarize the finding in conjunction with the research objective. Training session on the program NVivo 7.0 made it possible for the data to be coordinated and be divided into the actual themes of the questions asked. (See also Saunders et al 2003: 394 – 408.)

4.3.3. Reliability and validity of the study

This part of the studies explains the reliability of the data and research as well as the validity of the whole construct. The issue of reliability is explained as the ability to duplicate or replicate the results of the research and the ability to draw the same results like the original construct (Yin 1994: 33.) To avoid interviewer bias, research errors, channel noise in the case of recording (technical error) etc… all the questions were written down in the order in which it would be asked. To avoid the issue of misinterpretation from the side of interviewer, the company's website were checked as well as other news update

posted on the internet. The issue of validity was considered from two points of view: construct and external validity. (Yin 1994: 33.) Construct validity refers to the building up of correct operational measures for the concept being studied. In this instance the tactics applied were:

1. Multiple sources of evidence
2. Clarifications in the interviews
3. Feedback from interviewees and
4. Exact responses of interviewee.

The multiple sources of evidence for the case studies came from different sources: interview; internet and other documentation of the company. And the interviewees were send copies in advance so as to help familiarize themselves with the wording, phrasing and content which were to be considered. In addition to this all the main themes of the questions were explained briefly during the interview thus clarifying the content and context for the interviewing process. Some short memos were made and the answers given by the interviewees were re-phrased back to them to ascertain what was meant exactly under each theme and question.

Furthermore, e-mail and phone calls were initiated after the interview to verify if all the points and information given by the interviewees were correctly documented. The exact responses were recorded digitally in the one case and then later transcribed by a word processor. On the other hand the second interview was already in the form of a word document as the interviewee was unable to have a phone interview, but also additional points was derived from the website as well as from the headquarters in Finland. External validity is explained as the domain to which findings can be generalized (Yin 1994: 33). To achieve a realistic result, there is the need to compare the empirical findings to that of the theoretical framework and this would be discussed in details under the chapter five, thus presenting a clear managerial implication of the results.

5. CASE DESCRIPTION AND ANALYSIS

This part of the study gives a basic background of each of the two case companies and it goes on to comparatively analyze the interviews conducted. Thus this part could be considered as the results of the empirical research.

5.1. Background of case companies

Two case companies were finally selected from Finland namely; Naps Systems Group and FinnSolar Limited. A general background of these companies would be presented with emphasis on a brief history, time the business took off to specific issues like core business and international activities.

5.1.1. Naps' background

Naps Systems Group was established at the beginning of the 1980s when the Finnish oil and gas company Neste started research into alternative energy technologies. The abridged version Naps would be used to refer to Naps Systems Group, this goes for any other mention of the company in previous text. Naps Systems Group is headquartered in Finland with sales offices located in France, Kenya, Norway, Sweden and UK. Naps claim to have a worldwide distribution network. Naps' close connection to Neste's battery industry resulted in deep understanding of energy storage, especially lead-acid batteries, from which our customers benefit still today. In the beginning the company engaged in constant research and development, emphasized system development and quality in its operations.

The research work involved cell, electronics and battery technologies. The process of first manufacturing separate wafers and cells and then assembling them into modules was also thoroughly studied. Naps spent time learning how cells should best be assembled into a module. Further, splitting hydrogen from water with solar electricity, storing it and later converting back to electricity, represented a natural part in their developmental work, as it is potential technology for chemical storage and the intensification of solar electricity. Having been in the development work for a long time, Naps today offer high quality products for various applications.

Since 1981, Naps have delivered solar electricity systems to more than fifty countries worldwide. Naps system solutions consist of hardware such as solar and photovoltaic modules, control units and batteries as well as full service packages. Naps are fully involved in the whole process from design to installation, and in addition provide extensive consultation and supervision. Naps claim to have superior expertise in the value-added items that they include in their systems as requested by their customers and this is case specific. Naps intelligent design systems, system sizing program and extensive weather database assure the optimal solution for every location on earth.

5.1.2. FinnSolar's background

Founded in 1998, FinnSolar Limited is a high-technology Finnish company, which manufactures; plans and markets high-efficient solar energy collectors for multi-purpose specifically tailored to every customer's special needs. FinnSolar Ltd is able to deliver functioning and first-rate systems for any customers needing alternative electricity sources. Notable cost-savings are guaranteed. FinnSolar Ltd has an exceptional technology in the current market: the efficiency ration of FinnSolar solar energy collectors is as high as 80%. The efficiency ratios of other solar systems average from 40% to 60%. FinnSolar Ltd is currently working out possible partnership deals in Africa.

5.2. Internationalization stage of case companies

This part of the research tries to provide first hand information about the case companies' activities outside Finland and it concludes by presenting a brief discussion about the company's internationalization (which is mainly based on sales and other international activities.

5.2.1. Naps internationalization stage

Naps' Systems have been in international business since 1981 starting form Europe and in different sectors of the photovoltaic and energy markets. The company has gained much experience over the years and has delivered over

200,000 systems to some 110 countries worldwide mainly through exports. According to the African subsidiary in Kenya; Naps systems is in full or partial scale business in over 20 countries in Africa (East, Southern and some West African states). The percentage of sales derived outside Europe when compared to the total net sales of Naps or its total subsidiary units gives the implication that Naps is more of a global player than a mere international/multinational operative. The table below gives the idea of some selected and specific timeline as to when and where Naps started its international/global business operation and with what core product/business category as well as for what usage the systems were designed for. From the table; the conclusion could be drawn that within 22 years Naps had appeared on the international market with its entire 4 core product category: industrial solutions; solutions for rural development; building integrated solar electric system and solar electricity for consumers. According to the interview with Mr. James Fanning (Regional Director for Naps Kenya) the Kenya branch is responsible for all sales and marketing activities in East and South Africa plus some few activities in West Africa as well as some specialized customers from the Japanese market and other international activities. This international control covers about 20 countries.

Table 5: An Internationalization Timeline for Naps Systems (Source: Adapted from Naps References Naps 2006).

Location	**Year**	**Core Product Category**	**Usage**
Iraq	1981	Industrial Solutions	Telecommunication
Greece	1985	Building Integrated Solar Electric Systems	Building Integrated Systems
Tanzania	1987	Solutions for Rural Development	Hospital and Water Pump
Sweden	2003	Solar Electricity for Consumers	Hybrid Solar-Diesel Systems for remote located non-grid connected residential houses

5.2.2. FinnSolar's internationalization stage

FinnSolar entered the international market in 2000; they are currently developing contacts especially in Africa (South Africa; Namibia and Ghana) but have already through exports made some sales in neighboring countries in Europe like Estonia; Latvia; Ukraine and Central America (the latter is supported by Finnish Foreign Affairs). The managing director mentioned: *'The entry into the African market starting with South Africa actually started as a mere coincidence when personal contacts in that region expressed interest in doing business with me'*. At the moment FinnSolar is undertaking confidential talks with a potential partner in Ghana with the aim of making Ghana as the gateway to the West African region. There has not been any major sale in the African region but according to the managing director, the prospect for the region looks bright. The current trend is more restricted to education and knowledge transfer as well as a comprehensive evaluation of the market's potential.

5.2.3. Discussion of internationalization stage of companies

The internationalization process of Naps and FinnSolar is considered to be similar to the classical model of internationalization discussed in the theoretical part of this study in that; they focused their resources in doing business firstly with nearby countries emphasizing on the psychic distance as well as a significant touch of ethnocentricity in that; these firms like all others in their internationalization phase approached markets that appeared simpler, more familiar (geographically and culturally closer) and less costly with home country management style, methods, values, practices and products which they perceived to be superior to anything abroad. The companies after gaining some knowledge and experience about international business operations then moved to geographically distant regions/market outside Europe (adapting global approach)(Taggart et al 1993: 54; Luostarinen et al 1990: 253; and Hollensen 2004: 50, 51).

The international operations for these companies also started mostly with a small scale non-investment mode which included exports, they then gradually moved to full scale international activities including assembling of solar panel and thermal systems and some local manufacturing activities (an example in

the case of Naps was the development of solar powered lanterns which was unfortunately unsuccessful in the African market) (see also Luostarinen 1990; and Gabrielsson 2004: 182).

To this end; there is enough proof to support Naps activities in Africa and the direction they are going in terms of their operation in the sub-regions, on the contrary much cannot be said of FinnSolar as there is no tangible evidence of actual activities in terms of sales as well as assembling or manufacturing activities, the only points gained from the interview was to that effect about what the company has been doing since 2003 when interest in the African region was evaluated thus currently FinnSolar is undertaking a feasibility study of the African market and initial negotiations with potential partners in South Africa; Namibia and Ghana. This research is more focused on what product strategy is used by Naps and FinnSolar in the African market, than in the evolution of their strategies (product, management etc), so the next stage to be developed would be focused on product dimensions and what is involved in it in shaping up the firms' strategy to the African market.

5.3. Product dimensions

Product dimensions discussed in this research is limited to the product platform, product lines and individual products, thus the product strategy dimension is a bundle of decisions that involves the three main aspects found in the limitation. This includes decisions about the platform; lines and individual products as well as the decision-making process involving the market, marketing issues and competition. This part of the research touches specifically on the type of platform, lines and individual products of the case companies on an as it is basis without plying into any extensive technical details.

5.3.1. Case analysis for Naps and FinnSolar's product platforms

A product platform is said to be the underlying core technology, implemented across a range of products; thus a product is the lowest level of relevant common technology within a set of products or a product line (McGrath 1995:39). A firm needs to determine and define the architecture that addresses

the modules needed in the product and its function as well as specifics of the interfaces of modules (Gabrielsson 2004: 32). Thus this part of the research would then analyze the platforms of these companies on an as it is basis.

The conclusion deduced from the interview is that the product platform for photovoltaic systems are basically the same globally; thus this part of the research presents a combined analysis of the product platform adding specific variations where necessary, this combined analysis adds up to the simplicity of the research so as to avoid being overly technical in presenting definitions and meanings. Photovoltaic cells are made of special materials called *semiconductors* and in this particular instance the most common is silicon. Popular amongst this fundamental component is crystalline silicon that is made using mono or poly crystalline and in some cases ribbon silicon wafers.

In photovoltaic systems; the solar cell made from silicon are usually placed in *modules* (modules are simply group of cells electrically connected and packaged in one frame) these modules are then grouped together to form the *panel array* (the array includes any support structure and interconnections necessary). The modules grouped together actually make it possible for a required or useful working voltage to be achieved. Often 36 cells are connected together to get a voltage suitable for charging a 12-Volt battery (see also Howard 2005: 23, 24; Rentzing 2006: 49; Naps 2006 and Aldous 2006).

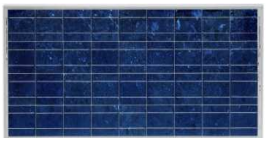
5.3.2. Product lines and individual products

As defined in the limitation of this research; a product line is a group of products that are closely related because they function in a similar manner, are sold to the same customer groups, are marketed through the same types of outlet, or fall within a given price range and the development of this research discovered that products of the same line usually comes from a common platform (McGrath, 1995 and Kotler et al 2005 – *see 2.3.2.2 for more details*). Individual product on the other hand laid emphasis on physical objects and their attributes, services and gave various classifications to a product (Kotler and Armstrong, 2001 and Kotler et al 2005 – *see 2.3.2.3 for more details*). This part of the research gives an overview of each company's product lines (number of

product lines/ categories) as well as individual products that forms part of a product line/category.

Due to the extensive nature of specific offerings, this research would focus on only the basic product mix (especially things involved in a single photovoltaic package). For the fact that photovoltaic cell is not used in isolation it is necessary to consider as part of the product line and mix, the whole system that makes it possible for the generation of electricity. Thus the mention of photovoltaic cell system basically comprises of the photovoltaic/solar array (set of modules and supporting structures); charge controller; battery and in most cases an electric/power inverter (converting 12/24 volts to 230 volts). (*See 2.2 for more details*) The table below contains an example of a solar cell; charge controller; battery and inverter.

Table 6: Photovoltaic components (Source: Developed by researcher from the websites of case companies).

NAME & COPYRIGHT	COMPONENT
Solar Cell (This single cell is grouped with other cell often 36 altogether to form a solar array) ® Naps Systems	
Charge Controller (Naps NC 5) The physical dimensions (W x H x D) 146X90X33 MM ® Naps Systems	
Batteries (The batteries get charged by the photovoltaic cell and they store the power till it is usually ready for use. ® FinnSolar	
Inverter (DC –AC power inverter usually changes a 12/24 volts power from a battery or solar array to a useable 220 – 230 volts). **CR1524 Model.** ® Xantrex Technology Inc.	

5.3.2.1. Naps product lines and individual products

Naps currently have four product line categories which includes;

1. **Industrial Solution**: a complete and reliable custom-designed solar electricity system for professional needs. The application includes telecommunications, weather stations, cathodic and corrosion protection and military applications as well as complete stand-alone systems for obstruction lights, navigation lights and traffic control lights. The industrial solution category comes with five separate product mix namely industrial solar power systems; cathodic corrosion protection using solar electricity; solar obstruction light system; backup diesel generators and Nokia-Naps GSM solar solution. (Refer Naps website for more details)

2. **Solutions for Rural Development**: A Naps system can light up a house in a village, operate radio equipment, provide electricity for refrigeration and pump water. Alternatively the system can be used for many other kinds of power needs in rural locations this includes the testing malaria or AIDS (health centers and clinics); schools; clean water; lighting; shops and workshops; community equipment etc. The solutions for rural development product category comes with two main products mix namely *Naps universal power pack* and *solar vaccine refrigerator*.

3. **Building Integrated Systems**: Naps systems for the urban dwellers is grid-related (connected to the main electricity supply), this makes it possible for excess energy to be fed into the grid. The systems could be used as a backup system in case of black and brown outs. This system also comes either as a standard packages for smaller systems such as residential houses, or as custom-designed systems for larger projects such as commercial and public buildings. As the electricity is generated where it is consumed; transmission and distribution losses are avoided thus saving enormous amount of money. The building integrated system category comes with four product mix namely: solar electricity for building; Naps PVIB mounting methods (for grid connected systems); Naps solar glazing (NSG) systems and Naps solar roof systems. (for details see appendices)

4. **Solar Electricity for Consumers**: This is the Naps systems custom made for customers in need of small scale electrification for their boats, caravan or recreational home and vehicles. This option is also case specific with module version ranging from 12 or 24 – watt system or a 50 watt module. The solar electricity for consumers has two main categories namely: *Naps customer kit* with three product ranges (Naps 50 Standard; Naps 80 Medium and Naps 125 Super) and *Naps marine system* with four product ranges (NP22RSS; NP33RSS; NP44RSS and NP33GK modules and charge controllers.). These four product line also stress on the business unit portfolio for which decisions are made as to the choices viable for internationalization.

5.3.2.2. FinnSolar's product lines and individual products

FinnSolar currently have two main product categories made up of;

1. **Solar Thermal System:** The system is designed with domestic and commercial water heating capabilities. The solar thermal package includes; centralized control unit for energy calculations, alarms, pump controls and water circulation controls. The featured benefits of this system include cost efficiency; short pay-back periods; practically free energy after installation and just a minimal maintenance is needed to keep the system running.

2. **Photovoltaic systems:** This is made up of systems specifically for electricity production and more. A photovoltaic basic component includes panels; charging controller/assembly unit; battery; inverter and other electricity equipments. Solar electricity panels produce mainly 12V. In addition, it is possible to produce 24V. For producing 230V, an inverter is needed for changing 12 V tension to 230V. Electricity from photovoltaic system is an excellent energy source alternative for the rural areas that are not yet connected to any power lines (non-grid related applications). The solar systems will reduce the dependence of rural areas on non-renewable energy sources like oil and coal. Photovoltaic electricity systems are also excellent alternatives in the countries with

expensive electricity price. Pay-back periods are short and cost-savings are notable for the customers.

Advantages of FinnSolar's Solar/Photovoltaic Systems

- The ability of the solar panels functioning despite of part-shades; recent text indicated efficiency to be approximately 30% better than the average solar electricity systems in the market (Thus high efficiency at low charge).

- The panels are lightweight, easy to install and has no glass components.

- The photovoltaic system boasts of a reliable and automatic charging controller and it has a 20 years limited warranty on the power output. (Photovoltaic systems usually have lower maintenance and reliability.

FinnSolar's Technology Applications:

- House and street lighting
- Cooling and heating combination
- Production of warm water
- Real estate heating
- Pool heating and
- TV, radio, fridge and cellular loading

FinnSolar's User Segments:

- Hotels and restaurants
- Residential building (domestic applications)
- Hospitals, health clinics (commercial applications)
- Resorts and
- Meat industry

FinnSolar's all round options makes it a very good competitor in the photovoltaic industry as well as gives preferable value for money in terms of variety.

5.3.2.3. Case analysis of product lines and individual products

The product lines and individual products for Naps and FinnSolar give a realistic view about the photovoltaic industry and the components that make up a photovoltaic system. For these firms as well as any other internationalized or global firm it is important for them to decide which of their strategic business unit, product lines (including product category and mix as well as individual products in a line) to put on the market. The number of product lines and products in each line offered to the African market varied per case company interviewed.

In the case of Naps out of their four product line with its associated category and mix they are currently offering a slimmed down package of three of their product lines (industrial solution, rural solution and specific customer needs) all signs indicates that they will soon start marketing intensively their building integrated system, at the moment that is not an issue for this research. FinnSolar on the other hand proposed in the interview their intention to market two main product lines (photovoltaic package for mainly electricity and solar thermal system for heating).

The interesting aspect of the photovoltaic technology market and as far as the interviews conducted for this research is concern; the basic individual components making up a total photovoltaic system are the same with the differences limited to in-house built hard and software as well as own brand names. A complete basic photovoltaic system includes in all cases: *the panel array that is usually 64 watts; a battery (with specific technical calculations to meet customer's specific needs); charge controller and an inverter.* These happened to be the same for both Naps and FinnSolar. In the case of FinnSolar the additional component for the solar thermal system were the automatic control unit (regulating the flow of power) and a pump unit.

The other similarities were also found in the case of the nature and content of the product package; this includes the free maintenance, long warranties and educational program for the customers. The differences were that in the case of Naps everything (from documentation and installation) is made in-house whereas in the case of FinnSolar they intend to give autonomy to their local partner.

Analysis of the case companies at the corporate and business level revealed that they had all stuck firmly to their related field of interest and operation which is in most cases the generation of electricity via photovoltaic systems. As to whether they intend to diversify in the future to other business unrelated to their core business was not really explored in this research. The discussion of product lines and individual products in a summary reveals that, firstly, from a number of strategic business units usually one or a few is selected for international expansion and in this case the pattern was the same to the African market. Secondly, the international markets are entered with a few product lines as well as individual products. There is evidence in this case for the fact that Naps Systems after entering the African market expanded its product line by including solar power lanterns as well as small lighting kits for stronger economies in the market.

Thirdly, the aforementioned points adds to the regiocentric approach in some product lines by Naps so as to deliver viable options for the firms operations, it is also noted in the development of the discussion of product lines and mix; the platform used in this context cut across all the product line with the exception of when considering the whole issue outside just *photovoltaic cell* but rather as a bundled system (which would then contain different component that has nothing to do with the designing and production of photovoltaic cell for an example *inverters*.)

5.4. Product strategy and management standardization

Management for internationalizing firms usually is faced with special product and packaging challenges and decisions. They must decide on how to manage their product strategy which includes decisions on the product dimensions. They need to decide on how much of the product to be standardized or adapted for world market and decisions on other market and marketing activities. (Kotler et al 2005: 596). According to Naps systems subsidiary in Kenya:

'We are ISO-9001 certified company which requires specific project management processes'.

Thus the implied points gathered is that in the photovoltaic industry, the companies involved in development and manufacturing the technology for the photovoltaic systems follows a set of standardized protocol to meet both domestic and international market demands. FinnSolar's manager also emphasized on the replication of technical know-how to the African market to help cut down cost on research and development and marketing activities. The end use of photovoltaic system could be said to be the same globally and for that fact management usually make decisions to cover what they are able to manage internationally; thus decisions made in terms of product platform; product line and individual products would be considered as a manageable extension of a firm's international activities. When asked about the similarities of product management processes across countries in Africa? And Why? The manager for Naps Kenya branch answered with the following.

'Professional, international companies from the developed world tend to operate quite similarly in management processes and have to behave professionally in accordance with international norms (e.g. , ISO-9001), while those from the developing world, typically Asia, tend to have a more cavalier approach to business and take short cuts in order that they can gain advantage (price , typically) over competition. '

The aforementioned points in one hand supports the theoretical principles developed in this research under the issue of justification of a standardized management system. On the other hand, it also reveals the opportunist tendency of some international firms especially in less developed economies thus resulting in mass exploitation of the market.

5.4.1. Standardization and adaptation of product strategy

The issue of standardization and adaptation has always remained a crucial variable in the decision making and management process of any internationalizing firm. It often spells out the possibility of a success or failure story by firms. Kotler et al 2005:569 argue that standardization helps a company to develop a consistent worldwide image. It also lowers manufacturing costs and eliminates duplication of research and development, advertising and product design efforts. As much as this is true, consumers around the world differ in their culture and preference etc. It is worth mentioning that even

markets vary in their economic conditions, competition, legal requirements and physical environment. Thus companies are always called upon to respond to these differences by *adapting* their product offerings. The issue is similar in the context of photovoltaic technology; whilst customers everywhere may use electricity be it generated from photovoltaic, wind or water. Firms need to consider some basic things like the power conversion or base unit of 110 volts for US and 220 volts for Europe and most parts of Africa as well as electrical outlet structures (in Europe alone Philips, the world leader in electrical appliance produces 12 kinds of irons to serve just the European market due to lack of a universal [electrical] standard. So although they could be numerous benefits in standardizing, there are equally good reasons why internationalizing firms should adapt some of the component and total offerings to the African market.

In this particular issue of standardization and adaptation; both case companies directed attention to the core need (electricity) rather than the way the packaging looks like (physical attributes) and they also offered a flexible adjustment system that addresses the issues pertaining to the needs of markets.

5.4.1.1. Product strategy alternatives for case companies

In the theoretical framework, the assumption presented is that there are at least three product strategy alternatives for international firms: localized; modified and standardized product strategy (*see 2.4.4 for more details*). The research has also been more focused on the product dimensions than any other constructs related to the product strategy of the firm. The interviews did not specifically spell out the issue of product strategy alternatives, but the idea was bundled under various points of the product dimension developed during the interviews. The deduced responses in this context gave an implication that, due to the nature of photovoltaic technology, the case companies developed a modified product strategy approach in especially the product line and individual product for the African market. It is also noteworthy that although there was a degree of modification in the product line and individual products, Naps systems so far has launched a replicated strategy across different regions in Africa (i.e. country to country product, marketing and sales have been positioned with the same concept and country specific modification).

5.4.1.2. Case companies' rationale for choices of product strategy

The rationale for the choices of product strategy could be considered from two different angles. The first point of view, is to consider the motivational factors (promoted by firms domestic market, referred to by expert in this field as domestic/home market push) making it possible for them to undertake an international operation. The second point of view for firms' rationale for choices of product strategy could be considered in this case from the needs and other variables in the African market (target/host market conditions attracting foreign firms these includes: types of customers, demand, competition and market situations amongst others).

By popular opinion of the case companies interviewed, photovoltaic technology has been more attractive internationally than locally due to three main factors: number of ***domestic consumers*** (with a population of approximately 5.2 million, Finland's photovoltaic market has been relatively small); ***weather conditions*** (photovoltaic systems needs more sunlight to make it work efficiently, Finland enjoys almost about three to four months of full sunlight in the relatively short summers, the advantage is that this condition has made Finnish photovoltaic technology manufacturers one of the most efficient developers of that technology in the world) and finally ***competition*** (photovoltaic technology is competing alongside other viable sources of energy both renewable and conventional, this makes it difficult for photovoltaic to attain a good market share domestically). When asked about the percentage of sales distributed per different regions, In the case of FinnSolar the manager again laid emphasis on the fact that the company is still in its initial stage of operation in Africa. The manager for Naps Kenya branch on the other hand answered with the following statistics:

'Europe: 30%, Asia: 40%, US: 0%, Africa: 30%'

As discussed previously under the case companies' internationalization stage; the implied picture presented is that the companies both started international operation, be it by *sales or partial to full investment mode*, at a very early stage of their business activities. These international activities were concentrated on neighbouring countries helping them gain first hand experience about international business and operation as well as viable options available to them.

For the target market level activities (target market pull) ; the arguments developed was that of the attractiveness of the target market and especially for this research *the inadequate supply of electricity created a need and this also made it possible for the photovoltaic systems to be considered as a viable option due to its many advantages*. So the focus is thus narrowed to the question: *why Africa?* The introductory part of the theoretical part of this research made mention of the huge demand of energy available in the African market.

The argument also considered the fact that the firms in question are pushed by the smallness of the Finnish market to exploit synergies outside by undertaking business activities internationally or even globally (Luostarinen 1994). It was considered that for a firm to be certain of the viability of the product strategy to be used for the continent, there is the need for the firm to analyze the market using the economic environment of the countries in the continent (Jain 1987: 173), this included an assessment of each country's portfolio and political risk and a focus on the potential profits from doing business in the market (Khanna et al 2005: 65).

Whilst considering the potential benefits of doing business in Africa; an evaluation of the competition in the market as well as the firms own capabilities in terms of corporate strategy and resources (tangible and intangible) became a crucial step in ascertaining the potential strength available to the firm to counteract the opportunities and threats in the market. This was considered important in understanding the customers in the market. To that end, the reasons for case companies' product strategy choices also emanate from the fact that there are specific energy needs for domestic, commercial and even industrial use across the sub-regions of Africa. As much as the product platform is standardized, a clear picture was given during the interview to express an explicit rationale behind the choices of the case firms in that when the question about the product lines (with its mix and positioning) was asked. The manager of FinnSolar allegedly mentioned that:

'Product lines and in most case individual product bundle needs modification to meet customer needs due to technical calculations involved in determining wattage and voltage capacity. It is necessary to even know the average set of gadget and equipment used by a domestic, commercial or industrial consumer to enable the determination of photovoltaic package needed, thus this is case dependant/specific.'

In the case of individual products' nature and content, specific reference were connected to the issue of warranty, after market/sales service and other services across countries in Africa. The manager of Naps Kenya branch rather gave a little sour picture about the current market situation:

'Warranties in Africa are generally not often honoured due to the chaotic nature of the market and the irresponsibility of many customers and suppliers alike. These services vary much however, and depend on the integrity of the supplier. Naps Systems prides itself in honouring all legitimate warranty claims. We also offer a high level of market service and consequently concentrate on the larger high profile customers such as Government institutions, Donor Agencies and large Commercial International Corporations. We regard ourselves as the best in the African market for service. Some of our competitors are little more than opportunistic (hit and run) companies looking to take maximum advantage of the low level of organization, competence and general chaos of African markets.'

On the other hand, the manager of FinnSolar explained:

''There is a well planned system which is the same across the countries we have entered in Africa that is free maintenance, long service warranties and other after sales service handled by partner which included installation, there is also educational workshops for the local people. For example in the case of Ghana current market survey shows that the country have very competent and experience people so less trouble''.

Apart from these points deduced from the interview, some other points justifying the rationale for the case companies' choice of product strategy was due to some impacting factors affecting the firms operations and decisions. This would be discussed next.

5.5. Impacting factors to product strategies

In this research the researcher in considering points presented by various literatures deduced an assumption that; there should without doubt be some specific issues both *internally* (firm's angle: corporate strategy and resources) and *externally* (specific target market variables like economic, political and competitive environment amongst others) that would impact on product

strategy. These parts of the research analyze the impacting factors especially from the firms' viewpoint to shed light on the reality of this assumption.

5.5.1. Internal factors (corporate strategy and resources)

The theoretical part focused on the corporate strategy and the resources the firm, this research created an impression that amongst other things; these two internal factors were crucial for any firm who has the goal of doing business in developing countries or to that extent any other international activities. For corporate strategy the theory reviewed the issues of; intended, realized and emergent strategy not as a process but on an as it is basis, thus the idea was that in a summary, strategy at the corporate level represents the cumulative direction of the firm in connection to the nature of industry, the competitive environment and internal factors related to production, finance, marketing and personnel (Bradley 1991: 89).

The theory went on to mention the choices available to a firm as it grows (diversification; vertical integration, acquisition and new entrant and competitive strategies). The final analysis was based on the three different forms of corporate strategy from which a firm could choose its business activities: *single business; related diversification and unrelated diversification strategy* (Griffin et al 2003: 299) and from any of these options a firm could choose any of these three Porter's competitive strategy: *cost leadership, differentiation or focus strategy* (*for more details refer to 3.2.1*).

Then again, there is the issue patterning to the firm's resources (tangible and intangible; the assumption is that by analyzing the resources and capabilities, the company may choose the correct production alternative, thus the issue was more focused on how the firm is able to reduce cost and optimize investment to achieve the desired local responsiveness (Gabrielsson 2004: 100). The next part lay emphasis on the individual firm's corporate strategy specifically from the interviews conducted. Points developed were as a result of using some specific questions (one main question and five sub-questions – *see appendices*).

5.5.1.1. Corporate strategy and resources for Naps and FinnSolar

In answer to the question: '*What has been the influence of **corporate strategy** in the development of product strategies? And why?* The reply was as follows:

''Very important! Naps have a much defined corporate strategy policy whereby all product development is discussed and planned internally before commercial product development can begin. In many cases ideas for product development will be rejected at this stage if it does not fit in with the corporate strategy'.

In answer to the question: *'What has been the influence of resources (technological, marketing and managerial capabilities)? And why? The explanation was as follows:*

In the context of resources (tangible and intangible), the ideas presented by Naps' Kenya branch manager was that the branch office in Kenya could only function efficiently with back-up support (financially, marketing and technically) from the headquarters in Finland. He also admitted that the frontline of sales and marketing action had always been with the sales people. FinnSolar's manager explained that the aim of the company is to adapt their managerial skills and technological know-how to meet the needs of the market. To that end; the firm's resources has been channeled to create a niche in the African market targeting exclusively the non-grid system option in two main strategic business units: thermal and photovoltaic system.

5.5.1.2. Production and marketing operations of companies

In general, the impression created by the case companies was that; major components that make up photovoltaic system are manufactured in Finland and the components are then shipped to the designated subsidiary in Africa. Currently, Naps main branch is in Kenya where most of the assemblage and customization of the systems is done before it is send to different distribution outlet. FinnSolar heavily relies on local partners in the implementation of the technical know-how, so FinnSolar at the moment is concentrating on educating his partners as to how to address the market's needs and demands.

Marketing activities (including different promotion; workshops and after-sales services) are tailored to the local environment and some specific local languages are used to explain the viability of the systems. The issue of marketing operations of the companies was also connected to the level of autonomy in decision making by partners/subsidiary in target market and to this the reply were the same for both case companies. Naps Systems Kenya branch manager added the following:

'I play a major role in decision making as I understand the market in Africa better than anybody in the company – this is why I have been employed by the company. I have a high degree of autonomy although on large value customers (big projects, etc) I need to get agreement on price issues from top management at head office before dealing with the customer on sales approaches and bids.'

The manager of FinnSolar explained amongst other issues, that it was vital to give a level of autonomy in decision making to the local partners, in that, they usually understand the customers better and are able to explain things to them in a *layman's language*.

5.5.1.3. Economies of scale and scope of case companies

Economies of scale as explained in the theoretical part of this research is the ability of a firm to perform activities more efficiently at a larger volume and in a number of different functions of the firm (e.g. advertising; research and development and even administrative cost amongst others) (Porter 1998). Nonetheless, economics of scope is the case where it is less costly to combine two or more product lines in a firm than to product them separately (Czinkota et al 2004). With this explanation in mind, when asked about the influence of economies of scale and scope on product strategies; Naps' Kenya manager explained:

'Very much. There is no point in developing a product for which there is only a small market and the possibility of this market growing is also small. We will not develop a product unless there is a very high degree of certainty that the market for this product is either already large or it has good prospects for developing into a large future market.'

FinnSolar's manager revealed the current situation in the African market as a less regulated one and he explained that photovoltaic system is actually a small segment of the whole energy market. So the implication given was that, there were other competitors in the market from different segment/branch of the energy industry. He finally explained:

'The key goal is to adapt a niche strategy, where there is the optimized utilization of resources and optimized minimization of cost, there is also a need to have the most efficient pricing system to enter the market'

The explanation was given by both case companies that, due to the fact that electricity generated by photovoltaic system is basically the same; the architecture of the platform is kept the same (standardized), the only modification is with the technical calculations and that forms part of the product line and individual product package delivered to the customers (domestic, commercial and industrial usage have different capacity and specific gadgets that they use in their day to day activities). Thus the need for economies of scale and scope was agreed to be appropriate. Naps' Kenya branch manager added the following:

'Cost risk. If the development cost for a new product is going to be very high , despite good prospects for large future sales (e.g., Solar Powered Lanterns – we have already learned this from bad experience) we will not enter the development process.'

The aforementioned addition gave a clear implication that as vital as the economies of scale and scope may sound; there is a need for a firm to evaluate and make good decisions as to what additional business units or products to add when operating internationally, in other to optimally utilize its scarce resources.

5.5.2. External factors (market expansion and others)

The external factors for this research included some various aspects of the economic environment (macro and micro environment) and to that end specific areas of interest were narrowed to issues associated to market expansion; economic, political and competitive environment. Comments from the

interview were both explicit in some cases and implicit in some others. In most cases the facts pointed to political and competitive issues. Both case companies avoided the questions related to similarities across countries in Africa and Naps Kenya interviewee added this fact:

'External factors like the global growth of the photovoltaic market (and the global electronics industry market generally) has lead to shortage of the raw material (semi-conductor grade silicon) leading to shortage of solar cells and modules which are the basic building blocks of the solar/photovoltaic industry. We have had to limit our product development and customer reach in the past 2 years.'

There has been a tremendous influence from international market expansions on the development of product strategies and according to the interviewees this factor has been the single main reason in their choice and development of specific products and management style for the African market. FinnSolar's interviewee added:

'The solar power industry has its major markets in Europe (Grid-connected AC systems) and in the developing countries, most notably, Africa. These are outside Finland so we must react to these international forces as the basis for our product development.'

The next to be discussed is the economic and political atmosphere of the African market.

5.5.2.1. Evaluation of economic environment

When analyzing variables typical to the target market, an overview of the economic environment (macro and micro factors) was discussed in the theoretical part of this research. The researcher reasoned amongst other points, that a firm needs to understand the target market's source of livelihood and the allocation of resources in other to ascertain the appropriate marketing mix to be used (Jain 1987). The macro-economic analysis thus included in this respect the evaluation of the countries in Africa to issues related to their *per-capita income growth rate, its exchange rates and purchasing power parity indices* (past, present and future) (Khanna et al 2005).

Then again, the micro economic factor dealt with the *level of competition* present in Africa's energy industry as well as the type of demand to satisfy. Thus, during the interview the issue of economic environment and its influence on product strategies was discussed and the case companies in response directed attention to the pricing mechanism in Africa as being dictated by the forces of demand and supply, thus with competition in the picture it made it necessary for the Finnish photovoltaic technology manufacturers to adopt a niche strategy to gain a fair share of the market. The interviewee for Naps Systems Kenya in support of the effect of competition on product strategy stated:

'We have left markets and discontinued products where competition became too stiff – typically this is in commercial private sector products market (e.g., solar lanterns, small lighting systems, small AC power systems, etc) where cheap (and low quality) products undercut our prices making the market unviable for us. We concentrate on a core niche market where we have maybe not more than two or three other serious competitors.'

5.5.2.2. Evaluation of political environment

Although political issues and their influence was not mentioned or discussed in the development of the theoretical part; the interview brought up a discussion on the topic. When asked about how political and other regulations in the African market have affected the product strategies of the case companies, they mentioned specifically that political issues and interference from government have been rather positive. Naps manager emphasized that:

'There has not been much interference. The solar industry is regulated by international standards norms and once meeting these standards the end-user countries pay little attention to any other factors and allow the technology to be imported and used without interference. Apart from requiring international quality norms to be met (at least on paper) African countries have very few regulations of their own to influence the market.'

The manager for FinnSolar also mentioned that:

'A lot of the countries in the African market have deregulated their energy industry. The provision of open market operations in this industry also makes it easier for competition. For an example, the Ghanaian energy market has been fully liberalized thus it makes it possible for investors to work much easily on any energy system and thus help extend electricity to the non-connected areas especially in the rural areas, this has always been a laudable idea and it is good for business to have less interference from governments and other regulatory bodies.'

The manager for Naps Systems Kenya called attention to other influential factors to product strategies:

'The possibility / reality of a commercial take-over, buy-out or merger by / with another company in the offing – either real or rumoured – will generally influence product strategy. This has happened to this company three times during my 18 years tenure.'

6. SUMMARY AND CONCLUSIONS

To conclude, this research first of all gives an overall summary of the theoretical and empirical objectives and findings. This is followed by the theoretical contribution and managerial implications and finishes up with future study suggestions.

6.1. Theoretical and empirical objectives and findings

This research started by giving an overview of the energy situation in the African continent. It then presented a problem as to how Finnish photovoltaic technology manufacturers can develop viable product strategies for the African market. For the fact that the African market lack enough research in areas related to product strategies as well as photovoltaic technology in the energy market; the assumption created by the researcher is that, the topic would be of interest and relevance to academics and especially Finnish photovoltaic technology manufacturers who would like to do business or *even expand their business* in Africa. The preliminary literature review was presented at 1.4 and was compounded with additional background points of studies in the development of the theories. The research then continued with an in-depth definition and explanation of the photovoltaic technology with its bundled components to make it viable for grid and non-grid related applications. Amongst others the system included basically: *modules; charge controller, battery array and inverters.*

The main question for this research is: *what product strategies are used by Finnish photovoltaic technology manufacturers for the African market and why?* So the idea was to investigate the type of product strategy, on an as it is basis, being used by Finnish photovoltaic manufacturers currently operating in the African market. The main objectives for the research were thus put as follows:

1. To identify and analyze the product strategies available for the photovoltaic technology field for the African market.

2. To consider factors impacting on the selections of a product strategy as well as issues on product adaptation and standardization in the photovoltaic technology field for the African market.

In developing the first part of the objectives, the discussion was narrowed to product dimensions consisting of product platform; product line and individual products (see McGrath 1995; Cateora et al; Gabrielsson 2004 and Kotler et al 2005). The product strategy was expected to develop as the company internationalized. Thus the second objective was developed using three different product strategy alternatives derived from well explained theories of McGrath 1995; Gabrielsson 2004 and Czinkota et al 2004; these alternatives are based on the degree of standardization and they are as follows:

1. Localized product strategy
2. Modified product strategy
3. Standardized product strategy

For details on product strategy dimension; standardization/adaptation as well as product strategy alternatives see 2.3 and 2.4. To further solidify the theory, specific impacting factors to product strategies were considered. The development of the research then created assumptions with the notion that; factors causing a firm to internationalize could facilitate and impact on the type of product strategy in use by the firm in its target market. Additional points discussed under the impacting factor paradigm were: internal (corporate and resources view) and external (economic environment of the target market). The focus was then placed on the economic environment narrowing it down to the macro and micro economic factors of the target market *(for more details see 3.1).*

Internationalization theory revealed the type of phases a firm takes without necessarily explaining a firm's evolution from domestic to international activities; a hint of inward operations (imports, licenses and project importing) and corporative operation modes (inter firms trade, bilateral and multilateral etc) were mentioned in passing to give supporting evidence of alternative internationalization option available for a firm (Luostarinen 1990). The discussion then reviewed the importance of company and the target market in issues of internationalization strategies.

The economic environment in this context dealt with issues pertaining to purchasing power and customer needs description as well as competition in the market amongst other issue (see also Jain 1987; Hollensen 2004; Czinkota et al 2004; and Khanna et al 2005). This was explained with the issues of decisions at the corporate level by first giving a brief explanation of Grant's (2006:26) intended, realized, emergent and unrealized strategies. This in turn brought about the discussion of the expenditure or investment decision by the firm relating to issues of diversification, vertical integration, acquisition of firms and allocation of resources for different business unit (competitive strategy). The aforementioned discussion was then followed by portfolio and business level strategy which is well explained.

The research objective finally made it possible for a framework to be formulated with various assumptions and the areas focused in the framework were: economic and industry environment; corporate or and business level strategy; product strategy at business level and strategic levers, resources and decision making variables, these served the basis for developing a suitable questionnaire for the interviews and also help to ascertain the actual facts of the research question and objectives of the studies asked in the beginning of this research.

It was discovered from the empirical part that the case companies developed interest in the African market due to their huge demand of energy and to be specific electricity, thus the target market needs and the flexibility of regulation created a stronger pull factor. In the same line of argument, it is noteworthy to say that, due to the small size of the domestic market of Finnish photovoltaic systems the firms in question thus developed the desire to explore international markets to create synergies and economies of scale and scope. Photovoltaic system is also considered to be one of the most practical systems for the African continent due to the abundance of natural fuel (sunlight) in powering the system. It was also discovered that reasons for the choice of a *modified product strategy* (standard platform, but customized product line and individual product packages) was mostly related to the economic situation and purchasing power parity of consumers in the sub-regions. Although there were other issues pertaining to photovoltaic systems like the technology life cycle as well as specific issues like geographic market and marketing integration, the researcher focused on mainly the *corporate strategy and resources of the firm*.

The direction chosen by the researcher was based on the assumption that energy systems are almost the same everywhere, thus in theory the technology and products positioned in the African market *would not* amongst other things be obsolete. The empirical finding gave valid justification for this assumption based on points deduced from the interview to that extent that the product platform (hard and software) are actually developed the same way globally and in this case are usually brought from the domestic market straight to the African market for further production or as individual components ready for assembling and use.

Thus from the aforementioned discussion the conclusion drawn is that the theory to some degree match up with the empirical findings and is suitable in cases of actual operations and practice (although issues discussed were not conclusive in themselves, and thus more gaps had to be bridge) it could be said to be a clear starting point in issues pertaining to the African market and especially in the energy sector.

6.2. Theoretical contributions

This research could probably be a wake up call to experts in the international business field, in that it is relatively unique in its own rights as well as interesting for further investigation to an in-depth level. The following theoretical contribution amongst others can be deduced:

1. It is noteworthy that, in earlier studies topics like internationalization process has been well described and explained (Luostarinen 1989 and 1990; Hollensen 2004; and Czinkota et al 2004), and globalizing internationals and born globals have had an extensive research and attention in recent times (Gabrielsson 2002; Gabrielsson & Gabrielsson 2003 and Gabrielsson 2004), nevertheless, those issues in one way or the other hardly mention or give much extensive description about internationalization process to Africa and even the ones that touch on this issues merely scratch the surface due to the fact that they are very selective with special attention to South Africa and the Northern parts of Africa etc (Larimo 1989).

2. This research was able to adapt original works in issues pertaining to product strategy dimension and standardization alternatives (see Czinkota et al 2004; Gabrielsson 2004 and Albaum et al 2005) although the issue was not handled extensively in the research it stressed on the fact that these aspects could be put in a fresh light when considering product strategies for the African market.

3. This researched also revealed that firms entering the African market also needs a strategy; in that, there was the need for technical calculation and tailored made panel and battery arrays as well as knowledge of the usage capacity of the diverse customers in the continent (domestic , commercial and industrial usage of electricity). Although the need for technical calculation as to wattage and voltage usage of equipments is not new, the issue presented in this research created a new dimension for further studies as to how each household, businesses and industry's energy needs could be calculated.

4. Instead of sticking to the classical models of discussing the issue of product standardization and adaptation (Kotler 1997; Hollensen 2004 and Albaum et al 2005), this research amongst others tried to marry the two together, explaining the theories and also giving reasons why there could be product standardization or adaptation. Although, this in any way does not credit the researcher as to any break-through, the research in itself gave a clear picture as to what needed standardizing and what needed adapting to suit market needs in the case of photovoltaic technology for the African market.

5. The research applied well known theories in discussing the international product strategies. For example, the internationalization (Luostarinen 1989; Hollensen 2004 and Buckley et al 2005), corporate strategies and it various aspects (Grant 2000; Griffin et al 2003; Bartol et al 1991), resource of the firm (Bradley 1991; Grant 2002 and Gabrielsson) and the economic environment, which appeared under target market level approach (Jain 1987).

6. Finally, the theoretical framework which was adapted from Gabrielsson (2004: 124) although not extensively illustrated, gave room for assumptions to be created which was further investigated during the interviews

conducted to ascertain the connectivity of the theories and practice, thus creating a new building block for future studies.

6.3. Managerial implications

The managerial implications deduced from this research are as follows:

1. This research has, if nothing at all, created an awareness of the energy needs in the African market, it has also presented an opportunity for not only Finnish companies but also other western firms to investigate further the issues of energy demand and supply in the African market, thus creating opportunities for investment and re-evaluation of the market and marketing activities of Africa.

2. This research established assumptions from which a clear theoretical development was made as to what a firm could focused its attention namely its corporate strategy and its resources especially when dealing with a technology platform that is standardized as well as new in terms of its usage. (I.e. if technology to be internationalized is the same used in the domestic market, which was the case in photovoltaic technology).

3. A better understanding of the continent's energy needs through probably market survey including selected focused group activities would help a firm better serve the demands and needs of the market.

4. Due to extensive cost that could be incurred in management decisions and other marketing activities, it would be important if firms focus on replicating strategies that has been well tested in domestic market as well as employ the ingenuity of local experts to better serve the market.

5. The understanding of the current market situation would help management to avoid costly investments and experiments, thus focusing on core businesses.

6.4. Future study suggestions

This research was an attempt to test a modified version of the framework presented by Gabrielsson (2004: 124), although it was not extensively covered due to lack of financial support as well as enough time to text on a wider scale, it served as a basis for further investigation in future of the same or similar topics for the African market.

The research focused on internationalized firm with hints that these firms could be on a global scale of operation, thus another future study suggestion could be the comparison of international/multi-national firms as against globalizing internationals as well as born globals (see e.g. Gabrielsson 2004) This would likely present a clear back-to-back analysis of the phases taken by firms from their domestic setting to global settings or even create an option theory for which investors could choose as to the mode of their international activities (Cateora et al. 1999: 319 – 325).

This research could also be used as a basis of creating a forum with the intention of setting up a focus group in discussing pricing policies and best options in the photovoltaic industry as well as to create awareness of the needs and energy requirement of people in the African continent.

This research also gives a vivid impression as to how many different components are supposedly involved in photovoltaic package (panel array, charge controller, battery array and inverters), thus a future study suggestion could be in the area of determining methods and process of financing the system.

To conclude, another area of interest that could be researched in the future is the extent of standardization or adaptation undertaken by a firm and the caliber of local personnel used when working with the African market.

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APPENDICES: Framework for Interview Questions

A. Background of interviewee:

- Name:
- Position:
- Education:
- How long have you been in current position?

1. What is the scope of your international /global operations?

a. What is the share of sales outside Finland?
b. How are sales distributed per different regions i.e. percentage for Europe, Asia, US and Africa etc…?
c. How many international countries do you have your presence in and when did you start your international operations?

2. Please describe how XXX has expanded to the African market:

a. What international businesses have you focused on and why?
b. When and how did you enter the African market?
c. In what countries are you selling in Africa? Please name them.
d. What type of international strategy/orientation do you have? (geocentric , regiocentric , polycentric and ethnocentric)

B. Product strategy and its development

3. Please explain your company's product strategy based on the following:

a. Product platform (Use of software and hardware)?
b. Product lines (number of lines, products in each line and positioning of products).
c. Individual products category (Nature: physical goods, services, systems and know-how)
d. Product management processes?

4. How similar are the following product dimensions globally and in Africa and across countries in Africa, and what are the changes if any in the process of internationalization? And Why?

a. Product platforms
b. Product lines
c. Individual products

d. What are the similarities of warranty, after market service, and other services across countries in Africa? And Why?
e. What are the similarities of product management processes across countries in Africa? And why?

C. Impacting factors of product strategies

5. What has been the influence of *internal factors* in the development of product strategy and its similarity across countries in Africa?

a. What has been the influence of ***corporate strategy*** in the development of product strategies? And why?
b. What has been the influence of ***resources*** (technological, marketing and managerial capabilities)? And why?
c. What role do you play in ***decision making*** or what is the level of autonomy of the partners in the target market and why?
d. How have ***economies of scale*** and ***scope*** influence the development of product strategies? And why?
e. Are there any others factors that influence the development of product strategies? What are these and why?

6. What has been the influence of *external factors* on the development of product strategy and its similarity across countries in Africa?

a. What has been the influence of your *international market expansions* on the development of product strategies and why?
b. What has been the influence of the *economic environment* (micro and macro economic factors?) in the development of product strategies and why?
c. How have *political and other regulations* in the Africa market to that much specific countries affect your product strategies and why?
d. How of have issue of competition affected your product strategies and why?
e. Are there any other external factors that known to your organization, that have direct on indirect impact in the development of product strategies? What are these and why?

7. As an expert in this field, please do you have any additional information to add on the product strategy which I forgot to mention?