SWITCH-Asia Project: activities SO2 and SO3

Research proposal to strengthen supply chain and stimulate demand for sustainable housing products in Nepal.

Research developed by IHS/Erasmus University and UN-Habitat Nepal

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Abbreviations

4P	Product, Price, Promotion and Place
AMA	The American Marketing Association
BEES	National Institute of Standards and Technology Building for Economic and Environmental Sustainability
EDI	Electronic Data Interchange
EFT	Electronic Fund Transfer
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
GHG	Green House Gasses
GSCM	Green Supply Chain Management
MRP	Material Requirement Planning
MRPII	Manufacturing Resources Planning
NLSS	Nepal Living Standards Survey
RM	Relationship Marketing
SCM	Supply Chain Management
SCO	Supply Chain Orientation
SCP	Sustainable Consumption and Production
SCS	Supply Chain Sustainability
SME	Small and Medium sized Enterprises

1 Introduction

Stimulating behaviour changes and promoting green approaches to implement more sustainable consumption and production practices became one of the key targets for cities, countries and international organizations in the tentative to reduce GHGs to minimize future climate change impacts and to promote a more sustainable and green development.

Sustainable Consumption and Production (SCP) are key terms used in the searching for achieving sustainable development. Several theories and models such as behaviour, demand theory, sustainability, economic and market theory among others have been developed, applied and tested to try to understand aspects involved with sustainable consumption, and production (Bergh et al 2000, Prinet, 2011 and UNEP, 2013).

The housing sector (in this research also called construction or building) consumes and produces huge amounts of natural and anthropogenic resources which makes this sector a key target for policies and initiatives to promote sustainable consumption and production. A well planned, implemented and managed housing sector can be an important enabler to promote sustainable development, addressing the simultaneous needs for housing, workplace, public buildings and services, communications, energy, water and sanitary infrastructures (UNEP 2014).

The application of the SCP concepts for the housing sector gave birth to the development of the concept of Sustainable Construction and more recently to the concept of Green Building or Green Home. Both concepts apply a holistic thinking to the construction and management of the built environment, taking a lifecycle perspective and covering all aspects of sustainable human settlements and urban sustainability.

This research uses the terms green housing, green building and green home as synonymous. All these terms include not only new environmentally orientated construction designs and approaches, but also new environmentally friendly operation and maintenance procedures. The terms adopt the concept whereby not only construction materials and components must be produced in a sustainable way, but their use must also answer to new requirements deriving from holistic environmental prerequisites.

The green building/home concept addresses factors such as resource use; energy, water, and materials, waste reduction including re-cycling, and efficiency in processing and construction, storm water re-use strategies, preservation of biodiversity and the natural environment. It also includes the consideration of social and cultural heritage issues, building-user amenity (e.g. indoor air quality, light, acoustics), and the conservation and selection of low energy, renewable, construction materials and processes.

The context of this research “housing sector” encompasses activities along the whole building value chain from design to end-of-life, which includes architects and engineering services, manufacturers of construction materials and technologies, onsite construction companies, property developers and facilities managers, energy companies as well as building users, households, offices, etc.

The term housing sector is also referred to in this study as building construction sector or sometimes as only construction sector. The term includes both residential and commercial buildings.

The housing sector causes many direct and indirect impacts on the environment. These impacts derive from many different areas, including extraction of raw materials, assembly of components, transport and construction. To manage and promote SCP concepts in this fragmented sector there is a need to know and understand the supply chains of the sector.

Many works have defined supply chains, we have selected two definitions that we think are appropriate to the context of this study: the alignment of firms that brings products or services to the market (Lamberet et al 1998); and the network of organizations that are involved through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher 1992). In this last definition it is important to emphasize that the ultimate step of the supply chain is the consumer or the customer.

The first studies try to understand that the supply chains were conducted in the manufacturing sector. In studying these chains Vrijhoef et al. (2001) demonstrated that these supply chains consist of a chain of elements such as suppliers, manufacturers, assemblers, retailers and customers and that these elements interact among themselves through information, material and financial flows.

A supply Chain refers to receiving the product from suppliers and dispatching it to a final destination (clients). All the parameters required in this process come under supply chain. In this process the product is dispatched as it was received from the supplier. In general no value is added to the product. Supply chains are put in place by companies to improve coordination of goods and services from upstream suppliers to downstream consumers, to reduce costs and increase time-efficient movements.

The building construction sector is very fragmented and includes many elements and actors across the different phases of constructing a house. These phases in general are: design, construction which includes structure, envelope, (equipment/products and services) and demolition. Each of these phases may contain different supply chains of products and services.

In this sector, from the design concept through to the construction and the use of the buildings, diverse and complexes supply chains both upstream and downstream of the construction site exist. A study conducted by UNEP in 2014 found that the upstream part of the building construction sector is characterized by a proliferation of relatively small and local actors with a high degree of fragmentation, and non-integration between its many elements. The same fragmented situation is found downstream of the construction site with many small landlords, corporate property owners and public housing authorities managing multiple buildings typically in local or regional markets.

In a tentative to simplify these complexes supply chains, this same study proposed to divide the sector in two broad parts: building delivery and management process, and the materials supply chains. In the first part the following elements are included: concept definition, design, construction and end of life. The second part includes the material supply chains that are organized to provide the construction site with the needed materials and services to build the houses or infrastructure (UNEP 2014).

Pryke (2009) studying the supply chains of the building construction sector divided the construction sector into three phases: (1) design, (2) site production and (3) component manufacturing. The design phase is carried out by architects and engineers; the site production is led by contractors and the component manufacturing is led by suppliers for industrialization. The client who needs a building, first selects a consultant, who prepares overall designs and specifications. Then the designs for structural and mechanical projects are prepared. Therefore, back office operations are crucial for the accomplishment of the construction tasks. Eventually construction is the responsibility of a general contractor under contract to the client. This study will focus on the supply chain that exist in the phase 2 (site production/construction site) and on the phase 3 (component manufacturing). The ECTP (2012) article which is focuses on energy issues divides the supply chains of the construction sector in design, structure, envelope, equipment, construction processes, performance monitoring and end life phases.

The systematic management of the processes and/or relationships between these chains with the objective to improve the quality of the final product is known as Supply Chain Management (SCM). One important distinctive part of effectively managing a supply chain is the existence of the collaboration between the different parts of the chain.

Supply-chain management as defined by Christopher (1998) primarily addresses the integrative management of operations through which resources move from source of supply to the final point. This integrative perspective of supply-chain management points out that it is not just procurement, inventory management or logistics management, but a combination of all these functional aspects as well as other corporate activities and relationships such as the organization's operations and processes that impact the movement of products or services from its source to the final point of use (Edum-Fotwe, 2001).

The promotion and implementation of sustainable consumption and production into the housing sector is known as greening the housing supply chain. Greening supply chain management (GSCM) integrates environmental thinking into supply chain management (SCM). This integration includes introducing technical and innovative processes into materials sourcing and selection, delivery of the final product to consumers, and end-of-life product management. The intended result is to improve a business' environmental impact while increasing efficiency and growth within its own supply chain.

In the building and construction sector the GSCM practices most often include: energy efficiency; reduction of greenhouse gas (GHG) emissions; water conservation or processing; waste reduction; and green procurement practices.

Many barriers exist to implement GSCM approaches into the building sector supply chains. According to Charter et al (2001) these barriers include: the fragmentation and complexity of the interaction among the different stakeholders, the lack of standardized materials and preconfigured building components for building work, and engaging designers in specifying less resources and energy intensive materials for contractors to work with.

In a supply chain, one of the most important actors is the consumer. When dealing, for example with greening the housing supply chains and especially marketing green products, the consumers are important actors to be studied. Questions such as what makes consumers prefer green housing products are very relevant for these studies. Studies focusing on consumer preferences include many factors and subjects such as the Marketing-Mix concept which includes the 4 Ps (product, price, promotion and place), satisfaction, behavior, life style and attitudes.

The EU approach to greening the housing supply chains is to facilitate more sustainable consumption and production in the sector through a higher uptake of so-called green products and greener practices by companies in the building sector. This approach puts more emphasis on the production and service production of supply chains than in the process as a whole. Energy, water, waste, wastewater and materials are the elements targeted by the EU to achieve this proposal.

Greening the housing supply chains is also being pursued in transition and developing countries. Many small and medium size enterprises in these countries are already producing many green products especially in the energy, water, wastewater, drainage and construction material sectors.

The EU financed SWITCH-Asia project is one of the many international initiatives created to promote the adoption of sustainable consumption and production in developing countries. The SWITCH-Asia Nepal project is focused on the housing sector having small and medium-sized enterprises and consumers as target groups.

The project also recognizes the important role that the government plays in promoting sustainable consumption and production. The government can for example, use its substantial purchasing

power and the capacity to develop and implement policies to promote green products, services and guide the local and national markets to a specific model of economic development

Sustainable production in the Nepal SWITCH-Asia project relates to materials, water, energy efficiency, pollution emission and encompass processes that can improve the economic, social and environmental impacts of the production as well as the sustainable consumption where it addresses the demand side, recognizing the role that retailers and consumers can play, and the enormous consumer potentials for driving change through the choices they make.

Very little or practically no information exists in Nepal on how the green housing sector is organized. The Nepal Switch Asia proposal has however identified some problems affecting the sector such as no market information and knowledge on sustainable housing that allows SMEs and policy makers to understand consumer's needs, wants, desires, attitudes and practices regarding sustainable housing related products and services; SMEs are scattered and lack capacity to work strategically to strengthen supply chains, lack knowledge to increase their profits by replacing conventional products for green housing components, lack knowledge on how to improve their products and services in order to cater for the aspirations of the consumers and lack knowledge on marketing tools to attract customers.

When it comes to the housing supply chain in Nepal, very little information is available. This research has conducted a quick survey on the web and has found very little information covering supply chain issues. We have found only one article on rural sanitation supply chains and finance which used a value chain methodology to identify the main actors and barriers (Progress Brief, 2012).

This research is being proposed to fulfil the general requirements of the activities SO2 and SO3 of the Nepal SWITCH-Asia project which aims to strengthen the Nepalese supply chain for sustainable housing and to stimulate the demand for green housing products and services.

The results of this research will be used to prepare the following specific outputs as requested in the Switch Asia project:

- A strategy for strengthening the supply chain and marketing of green housing products and services in Nepal
- The provision of technical, managerial and market knowledge support for SMEs to improve green products and services
- To prepare a promotional strategy to raise awareness on sustainable housing concepts, products and services

In a more broad sense we expect that the outcome of this study will contribute to improve the Nepalese housing market, functioning in a way that the local SMEs and their green supply chains are strengthened making them able to produce and market better consumer oriented green products and services for a variety of consumer needs and preferences.

This research focuses on the supply chains of the building construction sector and on the perception of the actors involved in these supply chains with regard to green housing products and services. It uses a system perspective looking at the performance and the interactions of the diverse actors and elements of a green housing product chain from its upstream part (suppliers and producers) to the downstream part including retailers and costumers. It is not only about improving products, services and capacity of the private sector (SMEs) but also about instruments for better regulating and stimulating the green housing market.

In dealing with the building construction sector one of the most important challenges is to identify the boundaries (delimitation) of the study. According to the literature the building construction

sector is very fragmented and contains complex relationships. The boundary of this study was designed taking into account the following aspects: the complexity organization of the building construction supply chains, the fact that very little information is known in Nepal about housing supply chains and on the consumer/actor perception regarding the use of green housing products/services, and the objectives of the Switch Asia project.

The delimitations of this study are:

- Most of the theoretical and empirical data in this study comes from international studies
- Even though many of the observations are of a general nature, the focus is on residential and commercial houses
- Key supply chains of a short number of building construction companies dealing with the building and reform of residential and commercial buildings will be selected to be studied. Although the whole supply chains of these selected organizations will be quickly studied, the research will focus on the identification of the green products and services used in these supply chains and their respective suppliers
- The relationships in these supply chains to be investigated are those between a supplier and its main customer/buyer (in a business to business relation) from the suppliers' perspective
- Green housing products/services included in this study are those dealing with the increase of energy, water, waste and wastewater efficiency, and the use of renewable energy and material sources
- Consumer or clients for this study are defined as those actors of the supply chains that can buy or use green products and or services. They can be contractors, constructors, distributors, suppliers, producers, retailers, engineers, architects, customers and representatives of private associations such as the chamber of commerce, architecture and engineer associations and representatives of public organizations responsible for housing policies, regulations, certifications, etc.
- A green product or service for the purpose of this research is defined as the one containing one or more than one of the following attributes:
    - They are made using natural and/or renewable resources or contains minimally processed products
    - They incorporate recycled content (post-consumer and/or post-industrial)
    - They are obtained from local resources and manufacturers: If it is wood, it needs to be certified wood or bio-based products, they employ "Sustainable Harvesting" practices
    - They are durable (long-lasting) compared with the traditional products
    - They are biodegradable
    - They promote good indoor air quality (typically through reduced emissions of VOCs and/or formaldehyde);
    - They do not contain highly toxic compounds, and their production does not result in highly toxic by-products
    - They are energy efficient (both in use and in production)
    - They reduce heating and cooling loads
    - They conserves energy and manages loads
    - They are Water efficient (both in use and in production)
    - They are porous allowing storm water infiltration and or reduce storm water pollution

Research Objectives

The objectives of this study were formulated taking into account the following sources: literature reviews conducted for this study (see part 2 and 3 of this proposal), the Switch Asia Project proposal containing the project objectives, and this studies delimitations.

The main objective of this research is two-fold:

- To understand the organization and the factors affecting the relationships of the supply chains of a selected number of construction companies, and to identify the green products and services used in these supply chains and their respective suppliers;
- To understand the perception of the actors of these supply chains on green/sustainability issues, and to explain the factors influencing the attitudes of these actors regard to the buying and using of green housing products and services

More specifically the research will try to identify and explain the following aspects and factors:

- The meaning , the actors and motivation of companies to organize and manage Supply Chains
- The types of relationships and the factors influencing the relationships within the supply chains (in a business to business relation) from the supplier's perspective.
- The barriers to implement relationships and improve the management of supply chains
- The perception of the actors of these supply chains regard to the concepts of green home, green products and green services
- The green approaches and green products being implemented and used by these supply chains
- The obstacles these organizations face when implementing green and sustainability approaches into their supply chains/organizations
- The existent legal, institutional and financial gaps that hindered the development of green products and services
- The problems facing the SMEs (suppliers or producers) to market the green housing products and services.
- The factors influencing actors' attitudes (4 Ps, and satisfaction) with regard to the purchase (buying and using) of green housing products and services

The research proposal has been divided in five parts: introduction containing a summary of the many topics covered in the studies and the research objectives; Sustainable housing problems in Nepal; Literature review containing a short overview of the state of the art on key topics linked to the research such as Sustainable Consumptions and Production (SCP), Supply Chain and Green Supply Chain Management (GSCM), Green Market, Green Consumption, Green housing products, Defining Green Housing Materials, Products and Services, Methodology which include the research approaches, sampling and analysis methods and the References.

2 Sustainable housing problems in Nepal

The construction sector is a major sector for the Nepali economy. It consists of a few large and a lot of small construction companies. According to the Federation of Contractors' Associations of Nepal, the sector contributed around 10-11 percent to the GDP and it uses around 35 percent of the government budget. It is estimated that this sector is creating employment opportunities to about one million people so it generates employment next to the agricultural sector in the country. Similarly about 60 percent of the nation's development budget is spent through the use of contractors.

In 2001, the National Census showed that the growth rate of urban and national population in Nepal was 3.56 % and 2.27 % respectively, with total urban population recorded at 3.25 million (14 % of national population of 23.15 million) (Rajbhandari, 2006). The results of this census also showed that in recent years Nepali cities have experience an accelerated process of urbanization. This fast urbanization process is increasing the deficit of dwellings in Katmandu and in other cities, and putting huge pressure on the national government and the constructor sector to provide enough and better housing facilities.

The Nepali housing sector as in many other developing countries has several problems and gaps. The status of the building safety structures is one of the key issues facing the housing sector. This problem deserves special attention since Nepal is subjected to earthquakes. The Nepal Living Standards Survey (NLSS)/ (Rajbhandari, M. 2006).), pointed out that 23 % urban households fall below poverty line, compared to 44 % rural households and 42 % Nepalese as a whole This study indicated that because of this level of poverty, people cannot consult structural engineers to design earthquake resistant structures. They construct their houses with the help of local labor contractors, who themselves do not know sufficiently about the construction of safe structures. Moreover, due to a low budget, they are forced to use low quality construction materials, resulting in the construction of weak structures.

In an attempt to improve this situation, the government has recently made it mandatory for all new constructions to adopt The Nepal Building Code. This Building Code covers all aspects of buildings. It has 23 volumes of design requirements, material specifications, guidelines, architectural, electrical, sanitary and safety requirements.

The poor technical skills of the construction labor force_is another important problem facing the sector. According to Rajbhandari (2006), the vast majority of the labor force working in the sector is made up of members of the farming community, without any training in the basic construction trade. The sector also surfers with a general lack of co-ordination and concerted approach amongst the various organizations involved with the planning and construction technology.

As Nepali economy is growing, an emergent middle class has started to appear. The concept of sustainable housing and green homes are beginning to gain importance and space into the national and local government agendas. Recently the Nepali government adopted two important policies linked to the field of sustainable housing: a draft of a National Shelter Policy and the National Climate Change Policy to promote green technologies with low carbon footprints. There is also a proposal in discussion to update the national building code to embed sustainable and green practices.

Some positive green initiatives have been reported from the private sector. Several SMEs are already actively engaged in producing and selling some green products and services. Some SMEs from the solar energy field are for example exploiting the on-going energy crisis to market green products, others are promoting comprehensive products and services linked to eco-housing, rain water harvesting, waste management services, etc. In the construction sector some SMEs are

involved in the production of hollow blocks, soil cement blocks and offering passive energy designs and other related services (SWITCH-Asia Nepal, 2012).

Very little or practically no information exists with regard to the construction supply chain management in Nepal: how these chains are organized, relationships between companies, suppliers and customers, main actors, information products and financial flows, and specially how the green issues are being perceived and incorporated into the management of these chains and into the products and services.

Beside these positive initiatives, the country has not yet developed and put in place a comprehensive, transparent and clear legal and institutional enabling environment to promote sustainable housing, green products and services. Several gaps remain and need to be addressed. Among them include the following: the absence of an enabling environment to promote green technologies and products in the market, for example the use of more environmental-friendly materials such as hollow concrete blocks and VSKB bricks which are greener and more economic than conventional bricks; the absence of quality control mechanisms to build the confidence of consumers on such products; the absence of reliable data and information on the existing supply and demand chains for sustainable housing products; the absence of supportive policy frameworks, concessions and incentives to the SMEs; the absence of a national strategy to stimulate the demand for sustainable housing products, and consumer education on the advantages and availability of green products and services. (SWITCH-Asia Nepal, 2012).

The absence of reliable data and information on the existing and in the process of developing green housing supply and demand chains as cited above are among the major important gaps to promote sustainable housing in Nepal. The Nepal Switch Asia project contains two activities dedicated to address these issues. These activities aim to conduct a market assessment for sustainable housing related products and services and to analyze existing supply chains for sustainable housing related products and services in order to prepare a strategy for strengthening the supply chain and the marketing of green housing products and services, to provide technical support to SMEs for improving and better marketing their products and services and finally to prepare a promotional strategy to raise awareness on sustainable housing.

3 Literature review

Sustainable Consumption and Sustainable Production (SCP)

Sustainable consumption involves many issues. Most of the academic and practical researches focus on studying the relationships between consumption, behavior, environmental impacts, social status and life satisfaction. In these studies the theory of behavior, the demand theory and some demand models have being used in trying to understand and explain these relationships.

Results of these researches have shown that consumption has a central place in economics, where it is regarded as the result of individual or household decision making under constraints; population size is an important determinant factor for consumption; consumption depends on many factors such as lifestyle, which has three types of determinants: objective and personal individual (or household) characteristics; the social context or environment; and technological characteristics of the available products; the extension of the environmental impacts and resource problems caused by humans are ultimately the result of consumption and life-styles (Bergh et al, 2000).

In another important study Von Weizsäcker et al. (1997) pointed out that the total environmental impact of consumption is determined by the combination of buying, use and waste behaviour, in combination with the expenditures on the various goods and services, and the technological characteristics of the products.

The outcome of the studies pointed out that sustainable consumption implies not only purchasing behaviours, but includes all types of interactions between individuals and infrastructures which together make up lifestyles and livelihoods and to achieve sustainable consumption there is a need to converge the current consumption patterns, and a necessity for all to consume with responsibility. These results have been used to propose, develop and implement more specific policies and instruments to promote and to achieve sustainable consumption.

The term of sustainable production became famous worldwide after the publication in 1987 of the Con Brundtland report, "*Our Common Future"*. After the publication of this report many definitions of sustainable production were introduced. In general, all of these definitions propose to create goods and services using processes and systems that include one or more of the following elements: non-polluting; conserve energy and natural resources; economically viable; safe and healthy for workers, communities, and consumers; socially and creatively rewarding for all working people.

In studies involving sustainable production three main theories have being used: the theory of production which tries to measure the influence of labour and capital in the production of a certain amount of goods as well as to understand the existed relationships between labour, capital and product, the theory of sustainability which includes theories on social, economic and environmental aspects and the market theory.

The new knowledge acquired with the new studies on sustainable development and sustainability and the new technological development on energy efficiency allowed for the development of the eco-efficiency concept.

This concept had an important contribution in the shift of the business sector to apply environmental approaches within its production chains. In a broad definition it can be said that the concept proposed to decouple economic growth from environmental degradation. In other words, the concept proposed to increase the production of goods and services and at the same time reduce the environmental burden (impacts). The important entry points for the concept are the efficient use of energy and material resources, the minimization of waste in production, and the creation of a durable, useful, and recyclable product. The application of the concept demands a greater investment for the business sector, in the long term it can also contribute to reduce production costs, improve the company image and increase profitability.

Although sustainable consumption and sustainable production can be studied and applied individually the most effective impact of these terms is produced when both are implemented and studied together, what is known as SCP concept (Sustainable Consumption and Production). As for sustainable consumption and for sustainable production when studied individually, there are also many definitions of SCP.

In this study we have selected the definitions proposed by Prinet (2001), that defines SCP as a whole-systems approach through which to consider the practical means of aligning economic systems to meet the needs of current and future generations within the ecological carrying capacity of the earth. In this definition he included our needs and values as a society, and applies a lifecycle and value chain perspective to the production and consumption of goods and services.

The application of SCP approaches is beneficial for developed and developing countries. It can among other things create new business, employment and reduce dependence on fossil energy. For developing countries SCP can also offer an opportunity to "leapfrog" from the use of traditional technologies to more resource-efficient, environmentally sound and competitive technologies, allowing them to bypass inefficient and polluting phases of development (UNEP 2013).

Supply Chain and Supply Chain Management

Since the fifties, studies began to point to the importance of understanding the interrelationships between separate company functions and between the company and its markets, its industry, and the national economy. This relationship between companies, suppliers and consumers became known later as supply chain (Mentzer 2001).

In studies involving the search for understanding the relationships between the different elements of a supply chain, the theory of distribution management has played a prominent role. This theory recognizes the integrated nature of organizational relationships. It argues that because organizations are so intertwined, the system dynamics can influence the performance of functions such as research, engineering, sales, and promotion.

Academic and practical studies have formulated several definitions of supply chain: Handfield (2002), for example, defined a supply chain as essentially a series of linkages between suppliers and consumers until products reach the ultimate costumer; Christopher (1992) defined a supply chain as the network of organizations that are involved, through upstream (i.e., supply) and downstream (i.e., distribution) linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer. Mentzer, et al (2001), defined a supply chain as s a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finance and information from a source to the costumer. What is common to all of these definitions is that there is a flow of products services, information and finance from the suppliers to the costumers.

A supply chain can be short, long and sometime very complex. In the Mentzer, et al study of 2001, Mentzer identified and defined three degrees of supply chain complexity: “direct supply chain,” an “extended supply chain,” and an “ultimate supply chain.” A direct supply chain consists of a company, a supplier, and a customer involved in the upstream and/or downstream flows of products, services, finances, and/or information. An extended supply chain includes suppliers of the immediate supplier and customers of the immediate customer, all involved in the upstream and/or downstream flows of products, services, finances, and/or information. An ultimate supply chain includes all of the organizations involved in all the upstream and downstream flows of products, services, finances, and information from the ultimate supplier to the ultimate customer.

Crucial to understanding these degrees of complexity and to manage it, is the identification of the key actors involved in a supply chain and the understanding of the relationships between these actors. Studies have showed that a supply chain encompass the flow of products and services from suppliers, raw material manufacturers, intermediate goods manufacturers, finished goods manufacturers, distributors and wholesalers, retailers and customers. Five key elements are present: suppliers, manufacturer, distributor, retailer and costumers.

The management and control of the flows of material, information, and finances in a supply chains is called Supply Chain Management (SCM). Definitions of SCM differ across authors; Mentzer 2001 defines a supply chain management as “... an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user .In this same article Mentzer citing Monczka, Trent, and Handfield“ (1998) see SCM as a concept, “whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers.” They suggest that effective supply chain management is made up of a series of partnerships among firms working together and mutually sharing information, risks, and rewards that yield a competitive advantage and Ross, 2011 sees a supply chain management as the act of taking those organisations in a supply chain and develop integration by, establishing trust, reducing the distance between firms by improving

communications, engaging early collaborative engagement and finally by alignment of systems and processes

Classification of Supply Chain Management

Supply Chain Management (SCM) can be classified into three categories: a management philosophy, implementation of a management philosophy, and a set of management processes.

As a philosophy, SCM takes a systems approach to viewing the supply chain as a single entity, rather than as a set of fragmented parts, each performing its own function. Ross (2011) states that a SCM as a management philosophy seeks synchronization and convergence of intra-firm and inter-firm operational and strategic capabilities into a unified, compelling marketplace force.

In implementing a supply chain management philosophy, firms must establish management practices that permit them to act or behave consistently with the philosophy. In this category researchers see SCM as a set of activities to implement a management philosophy. Several academic and practical studies have identified various activities necessary to successfully implement a SCM philosophy: integrated behaviour, incorporating customers and suppliers, mutually sharing information, mutually sharing risks and rewards, cooperation, having the same goal and the same focus on serving customers, integration process and partners to build and maintain long term relationships.

The implementation of SCM needs the integration of processes from sourcing, to manufacturing, and to distribution across the supply chain. Mentzer et al (2001), identified four stages of supply chain integration: Stage 1) Represents the base line case. The supply chain is a function of fragmented operations within the individual company and is characterized by staged inventories, independent and incompatible control systems and procedures, and functional segregation. Stage 2) Begins to focus on internal integration, characterized by an emphasis on cost reduction rather than performance improvement, buffer inventory, initial evaluations of internal trade-offs, and reactive customer service. Stage 3) Reaches towards internal corporate integration and is characterized by full visibility of purchasing through distribution, medium-term planning, tactical rather than strategic focus, emphasis on efficiency, extended use of electronics support for linkages, and a continued reactive approach to customers. Stage 4) Achieves supply chain integration by extending the scope of integration outside of the company to embrace suppliers and customers.

The third category of SCM focused on management process instead of focusing on the activities that constitute supply chain management. In this sense, La Londe (1997) proposes that SCM is the process of managing relationships, information, and material flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption.

Other authors including Mentzer introduced the concept of Supply Chain Orientation (SCO) to define supply chain management. In this approach a SCO is defined as the coordination of a supply chain from an overall systems perspective, with each of the tactical activities of distribution flows seen within a broader strategic context. The supply chain management using this concept is defined as the implementation of this orientation, across the various companies of a supply chain.

Supply chains can exist even if there is no management of their elements what is described as distribution channels. A supply chain management however requires overt management efforts by the organizations within the supply chain.

Well managed supply chains can reduce costs (especially logistical costs) related to procurement policy, material requirement, planning, supplier qualification, selection process, contract, and supplier development.

Recently a broader concept of supply chain called 'value chain' is being promoted by academics and practitioners. In this concept a value chain includes all points and activities directly related to a company's products, from the extraction of raw materials through to processing, manufacturing, distribution, and sale.

How companies define their SCM

According to Charter et al (2001), there are a wide variety of interpretations of SCM in organisations. Many companies tend to focus almost exclusively on purchasing function, and for those the supply chain usually ends with themselves, (as they are the customers to their suppliers). Some companies focus more on logistics, and SCM is primarily about making sure that the internal operations are lean and efficient.

In a study conducted by Martin Charter (2001) on Supply Chain Strategy and Evaluation, only a very few companies stretch their supply chain from their suppliers' supplier to their customer's customer, or include an end-of-life management of their products and reverse logistics or take-back services. In addition, even within a single company there appear to be differing interpretations of SCM and much depends on the background and a position of the person in a company. For example, it is quite common for the environmental department (working on the incorporation of environmental issues in the supply chain) to interpret the supply chain quite differently than a person in the purchasing or logistics department.

From the literature it can be concluded that the concepts and definitions of Supply Chain Management (SCM) diverge from logistics, management of distribution channels from suppliers to end users, to good relationships with business partners.

Studies such as those conducted by Renko (2011), Jabbour et al (2011) and Quezada et al (2012) have pointed out that the main interest of companies to organize and manage their supply chains are: delivery time reduction, improved financial performance, greater customer satisfaction and building trust among suppliers.

Factors affecting Supply Chain Management

The management of supply chains can be affected by different factors. The literature survey conducted for this study has showed that these factors broadly can be classified in three groups: factors affecting the adoption (creation) of a supply chains, factors affecting the management of supply chains and the factors affecting the relationships within these chains. It is also important to emphasise that all these factors may directly and indirectly affect (influence) the relationships within a supply chain.

Many reasons may lead a company to decide to adopt the concept of supply chain management. Jabbour (2011) describes these factors as the size of company, its position and its field of operation (economic sector) in the chain, the industrial sector and the relationship between SCM practices and elements of the operational capacity portfolio such as competitive priorities.

In his article Jabbour (2011) pointed out that large companies are more likely to adopt SCM concept than for example SMEs. He also emphasised that SMEs are more likely to adopt SCM concepts if they are partners of large customers or other organizations.

The position of the company in the supply chain plays an important role in the company perception regard to its performance. Jabbour affirms that the relationship with customers and quality of information exchanged are affected depending upon the location of the company on the SC and its proximity to the consumer.

With regard to the factors affecting the management of the supply chain Quezada et al, (2012) and Jabbour et al, (2011), mentioned the following factors: company environment, government support, environmental uncertaintity, information technology, communication and planning tools.

A short description of these factors is provided below:

Company environment: this factor is related to the company's relationship with suppliers and their level of trust and commitment. It is also related to the company's expectations of quality, on time delivery, competition in the sector, and the level of rivalry among firms. The article states that while uncertainty negatively affects company performance, this can be reduced by implementing strategic relationship with critical suppliers.

Government support influence supply chain management in many ways: facilitating importing and exporting of raw materials and other components but companies are also directly influenced by the use of norms, regulations, policies, and incentives.

Other important factors influencing supply management is the Environmental uncertainty which refers to the environmental issues in the product chain. As the costumers perception of environmental issues is changing very fast, companies are being forced to adapt themselves by for example changing their suppliers, technology and making strategic new relationships with critical suppliers.

Information technology, communication and planning tools are also important factors affecting supply chains management. Telecommunications and computer technology allow all the actors in the supply chain to communicate among each other. The use of information technology allows suppliers, manufacturers, distributors, retailers, and customers to reduce lead time, paperwork, and other unnecessary activities. Information can also improve customer and supplier relationships, inventory management and procurement. Communication tools are used to facilitate data transfer and communication between the trading parts and this might include EDI, Electronic Fund Transfer (EFT), intranet, internet, and extranet. Electronic Data Interchange (EDI) is used for procurement (purchase orders, order status, and order follow-up). Planning tools are intended to integrate the resource planning activities in a firm or organization. Some of the most common planning tools are: Material Requirement Planning (MRP), Manufacturing Resources Planning (MRPII), and Enterprise Resource Planning (ERP).

Main actors of a supply chain

The actors of a supply chain varies in size and scope, depending on the products involved, geographic dispersion of the supply and demand, and customer service requirements. Key aspect in the identification of these actors or participant networks is the identification of the direct stakeholder also called the end user of the goods. Supply chains are organized to serve the end users demand. If there is no demand then there is no need for the supply chain network to exist. That is why so many supply chains focus on the end user demand to drive planning and activity.

In a consumer product supply chain for example, the end user is the retail consumer while in an industrial set the end user is the company that buys materials, goods, and services to support its operations. In the building and construction sector the end user is the constructor who buys materials, goods, and services to construct the build.

Factors affecting relationships

The term "relationships" covers a lot of ground in supply chain management. There are strategic relationships, tactical relationships, transactional relationships, collaborative relationship, internal relationships, and many others. The management of these relationships affects all areas of a supply chain and has an important impact on the performance of a company. It is very often said that supply chain management is directly related to relationship management, which includes suppliers and customers.

Relationships between parties, or partnerships, are seen in the literature as a commitment between the client and supplier, cooperating to meet separate but complementary objectives (Petrovic-Lazarevic et al 2006). He argues that partnership approach results in greater accuracy, speed and flexibility in responding to consumer and environmental demands, development of new technology and products as well as more cooperation in maximising profits at chain level.

Companies create supply chains in order to facilitate the achievement of their own goals, improve performance and to satisfy their customers. The essential element of a supply chain is the degree of collaboration among their members. This collaborative way of organizing a supply chain brings several benefit for the company such as improvement of the flow of materials throughout the chain, increase speed of the deliveries, reduce stock levels and provide quick response to customer changing demands.

Collaboration is defined by Renko (2011), as two or more companies sharing the responsibility of exchanging common planning, management, execution, and performance measurement information, Collaboration is the ultimate step of a relationship within a supply chain.

According to Bowersox et al (2012), the driving force underlying the emergence of collaborative relationships among firms in a supply chain is the recognition of mutual dependences. When a firm acknowledges dependency with its suppliers and/or its customers, the stage is set for cross-organizational collaboration. The degree to which dependence is mutually recognized and acknowledged by all parties in the relationship defines the nature of the resulting relationship

Supply chain relationships include the coordination and integration of activities with suppliers and understanding of customer's needs results in greater benefits for companies. Especially important for a supply chain management is the relationship between suppliers and consumers.

The relationship with suppliers **c**ompanies are inclined to work with different suppliers in different ways. It is important that the relationship with suppliers satisfies their company needs. Quezada (2012), mentioned that in commodity products, it is common to find an adversarial relationship mainly based on the price between buyer and supplier. This type of relationship with suppliers maybe beneficial to network the supplier to develop partnerships and alliances that will benefit both partners but does not bring a cost in the supply chain but does not allow for cost reduction in the supply chain.

In the relationship with customers companies are always competing and trying to reduce costs and improve quality. This relationship is guided by the fact that customers are continually searching for more choices, better service, higher quality, and faster delivery making the relationship with customers one of the key strategic issue for today's companies.

Relationship marketing and key attributes

Davis (2008) defines that Relationship Marketing (RM) is an approach to marketing that draws on traditional/transactional marketing and incorporates thinking that makes it materially different from its traditional founding. RM refers to a strategy where both parties voluntarily remain loyal to

each other by retaining the relationship. Essentially, RM attempts to create value for customers and share that value with the key stakeholders in a venture.

According to Davis (2008) there are several considerations when developing a RM strategy within an organization. These considerations can affect the relationship market and the supply chain and can be classified as focus on client retention; orientation on product benefits; long-time scale; high-customer service emphasis; high-customer commitment; high-customer contact; and quality is the greatest concern.

Key attributes of relationship marketing

From the literature the variable that appears most consistent in relationship marketing are: commitment, trust and performance satisfaction: Commitment is the desire to continue a relationship and may be defined in three dimensions; inputs to it, its durability and its ongoing consistency; Trust is the belief that a party's word or promise is reliable and a party will fulfil its obligations in an exchange relationship; and customer satisfaction is positively associated with repeat purchase intentions and considerable evidence suggests relationships remain intact if the parties are continually satisfied, receiving added value (Peter 2008).

Characteristics of the supplier firm relationship that increase the buying firms trust in a supplier

The characteristics of the supplier firm relationship that increase the buying firms trust in a supplier include: willingness to customize which is defined by the willingness of a supplier to provide specialist equipment or adapt existing processes to meet with the buyers' needs; confidential information sharing defined as the extent to which the parties are prepared to share private information, and length of relationship defined as the outcome of past ventures provides predictability to the process, the outcomes of previous business records provides a framework for subsequent interaction.

Type of supply chains and relationships

With regard to their length and complexity supply chains can be classified Mentzer et al (2001) study, identified and defined three degrees of supply chain complexity: "direct supply chain," an "extended supply chain," and an "ultimate supply chain. The description of these different types of complexity follows within this section.

Many types of relationships exist in supply chains. The different types of inter-organization, integration and partnerships among the companies in a supply chain is broadly divided into vertical (e.g., buyer-seller) and horizontal (e.g., parallel or cooperating). This classification is sub divided according to the degree of partnerships (relationships) in transactional (cooperation), coordination, strategic alliance, collaborative and others.

Transactional or cooperation partnerships means that both parties in a supply chain (vendor) relationship have the same level of importance. This kind of relationship involving few suppliers with short contract time and target one functional area. Coordination involves a share of key information flows and exchanges with a long term contract and target multi-functional areas. Collaborative relationship involve direct and indirect collaboration among the organizations of the supply chain. In a collaborative relationship companies may implement for example joint planning, technology sharing over the long-term, and how firms see each other as extensions of their own firm. Collaborative relationships can also involve strategic alliance where two or more business organizations cooperate and are willingly to modify their business objectives and practices to help achieve long-term goals and objectives.

Collaborative relationships, both vertical and horizontal, have been identified as highly useful to the achievement of long-term supply chain objectives. Vertical collaboration includes direct collaboration between suppliers and customers. These refer to the traditional linkages between firms in the supply chain such as suppliers of parts and materials, retailers, distributors, manufacturers, while horizontal collaboration also includes collaboration with competitors and other supply chain actors, This kind of collaboration can be very often seen in the logistic supply chains. They include those business agreements between firms that have "parallel" or cooperating positions in the logistics process. Vertical collaboration is more common and easier to implement than horizontal collaboration, but they are not exclusive ones.

This review of the literature has showed that developing trust on both sides of the partnership is the critical factor to success in a supply chain relationship. Bowersox et al (2012), affirms in his article that no real collaboration can exist in supply chain relationships without meaningful trust. He explains that *w*hile a powerful firm may be able to influence the behaviour of a less powerful organization, the change in behaviour may be temporary and certainly entered into unwillingly. In fact, while research shows that issues such as technology compatibility, information exchange, and appropriate measurement systems are all key issues to be resolved in collaborative alliances, the human behaviour issues related to culture and trust are very important and much more difficult issues to solve.

While several types of trust exist, a meaningful way to understand trust in supply chain collaboration according to Bowersox et all (2012), is to distinguish between reliability-based trust and character-based trust: *Reliability-based trust* is grounded in an organization's perception of a potential partner's actual behaviour and operating performance. Essentially, it involves a perception that the partner is willing to perform and is capable of performing as promised. If supply chain participants cannot rely on partner performance as promised, all efforts to develop collaborative relationships fail. Character-based trust is based in an organization's culture, leadership, and philosophy. Essentially, it stems from perceptions that supply chain partners are interested in each other's welfare and will not act without considering the action's impact on the other. When this aspect of trust is developed, participants do not feel vulnerable to the actions of one another. Trusting partners believe that each will protect the other's interest.

Petrovic-Lazarevic et al, 2006. Says that trust as the willingness to rely on an exchange partner in whom one has confidence has many dimensions. It indicates that partner can be trustworthy in one dimension but not in another. He suggest that traditionally, trust develops from specific events and repeated interaction in relationship development. Thus, trust is strongly associated with commitment and loyalty.

In this same article Petrovic-Lazarevic et al (2006), citing other authors says that within a supply chain, inter-organisational trust is important in maintaining a competitive advantage. If trust is developed through contacts between parties, it then becomes a bond or a tie that brings partners together.

Bonding can take two forms: structural and social. Structural bonds are those economic and strategic ties that link buyers and sellers, such as legal contracts and agreements. On the other hand social bonds are made up of personal and social ties between individuals in organisations (Petrovic-Lazarevic et al, 2006).

Structural bonds are important in any business relationship, but those organisations that have strong social bonds generally have a greater commitment in their relationships. Social bonds focus more on the interpersonal relationships between and in organisations; they may include creating a family type atmosphere and consideration for the other party when making decisions.

Reasons to implement a relationship and factors contributing for a successful relationship

Many factors can contribute to the establishment and the success of the partnership in a supply chain. Renko (2011) mentioned the following factors: 1) the compelling reasons (driving factors) for forming partnerships are cost reduction, better customer services), 2) the supportive corporate factors (facilitator factors) that encourage partnerships, such as having a similar management style, compatibility of operations, and 3) the join activities and operations (component factors) used to build and sustain the relationship, such as communication channels and investments. In summary according to the literature production, inventory, distribution, marketing and selling costs are often cited as major factors influencing the implementation of supply chain collaboration. Collaboration can improve performance of the companies and it is the result of a joint effort of the suppliers, retailer and the company to attain mutual benefit and it does not happen overnight. According to Deloitte (2008) some preconditions needed to be in place for the achievement of a successful vertical collaboration: financial conditions - trade terms relating to cost reduction and joint profitability; relationship characteristics – personal relationships, mutual trust, interdependency and commitment; compatibility of strategies - jointly developing goals and strategies; effective negotiations – efficiently use the negotiating time and active participation during negotiations; quality of account management – account managers need to have the relevant facts and figures to hand, and to be well aware how their company performs. Other important preconditions or characteristics cited in the literature are coordination and planning, mutual benefits and sharing of risks, a recognition of mutual interdependence, shared goals and compatibility of corporate philosophies.

Renko (2011) affirms in his article that good relationship between supply chain members leads to important benefits such as improved communication and information sharing; elimination of activities that waste time or do not add value; improve performance, reduced time delivery, reduced inventory costs, better asset utilization, lower cost of purchase items; more accurate forecasts and better planning; improved material flow; better customer service, with shorter lead times and faster deliveries; more flexible organisations reacting faster to changing conditions, higher product quality, ability to handle unexpected events, etc.

The development of the relationship between trading partners can be divided into three levels: 1-Initial level of collaboration, where chain members exchange information mostly to complete day-to-day transactions; 2-cooperative collaboration, where chain members have simultaneous access to information needed; and 3-cognitive collaboration, where chain members share information to jointly gain knowledge in order to joint decision making.

Criteria to select suppliers and barriers to implement supply chains

In the past, companies such as retailers for example used to have a large number of suppliers and they were competing against each other for an individual order. The current trend is to reduce the number of suppliers and to develop long-term relationships with a small number of them.

Software packages were developed over recent years to help companies to select their optimal suppliers. These tools take into account the different suppliers and company capabilities to make the selection.

Renko (2011) describes in his article some of the criteria and indicators used to select a good supplier. These criteria are divided into four main areas: 1-product range and quality with the quality and variety of products available, where the retailer assesses the supplier's production specialisation and flexibility, design capability, technical capability, etc., 2-prices of products and

discounts available for large quantities and for rapid payment, where the retailer assesses the supplier's financial stability, willingness to negotiate, scale economies, etc., 3-delivery in accordance with the retailer's specification in terms of timing, quantities and product variety, 4-service by which a supplier is adding value to the retailer, where the retailer assess the supplier's speed of new product introduction, its handling of queries and complaints.

From the literature the main barriers concerning implementation of supply chains are: inadequate information sharing, poor conflicting measurement, inconsistent operational goals, organization culture and structure, resistant to change, lack of trust, poor alliance management practices, lack of sustainable chain vision (understanding), lack of managerial commitment, constraint resources

The housing (construction) sector and supply chain management

The building and construction sector is fragmented including all the activities needed to create any type of building or other fixed structures. Many of these activities are carried out before the materials and components arrive at the construction site. Working at the construction site is only the last stage of the production process. The sector is also characterised by long supply chains starting with the formulation and specification of product delivery.

Koçtaş (2013) studying the construction sector found that the sector has important different characteristics compared with the other sectors: uniqueness: every construction project is a one-off. Clients have different needs and priorities. Construction sites have unique conditions (ground, climate, surroundings). Architectures offer various designs and solutions; site production: construction production is carried out at a construction site which changes for every building; temporary multi-organization: construction is a project based production and in every project, project- specific teams are assigned. Regulatory intervention: regulations and laws about construction are usually country-specific or territory-specific. Buildings and other structures are usually made to meet the requirements of each customer.

The fragmentation of the sector leads to many problems such as lack of communication and problems in maintaining relationships among members of the construction industry (contractors, subcontractors, suppliers, clients etc.), lack of integration between those who design and those who construct/ deliver and at the same keep these relationships over time and from one project to the other project. These difficulties cause delays and complexities creating disputes among supply chain members and increasing costs

Organization of the building and construction sector supply chains

Several studies have tried to understand how the sector is organized and how the actors communicate among themselves. A study conducted in the UK by Martin Charter et al (2001), found that the construction chain starts with the clients who usually engage engineers and architects as the designers in a construction project. They, in turn, hand the construction activity over to the construction managers. The construction managers may hand the construction project over to contractors, or they may be the contractors themselves. A final link in the chain is the use of sub-contractors who may be involved in some or possibly all of the construction activity. In another study, Pryke (2009) divided the construction sector into three phases: (1) design, (2) site production and (3) component manufacturing. The design phase is carried out by architects and engineers; the site production is led by contractors and the component manufacturing is led by suppliers for industrialization. The client who needs a building, first selects a consultant, who prepares overall designs and specifications. Then the designs for structural and mechanical projects are prepared. Therefore, back office operations are crucial for the accomplishment of the construction tasks. Eventually construction is the responsibility of a general contractor under contract to the client. Petrovic-Lazarevic et al (2006) Manufacturing Resources Planning (MRPII), in

a study conducted in Australia over the organization of the building and construction sector found more less similar results as the study conducted in UK. In Australia the building construction process involves three main actors: client, designer and contractor. The client is an initiator of the building and construction process. Designer is a planer of principal activities. Contractor executes the building and construction job in residential sector, non-residential sector and engineering construction.

In this same study Petrovic-Lazarevic et al, (2006) described the building construction sector in Australia as the one which is based on projects. Each project incorporates several organisations sub-contractors that operate with their own objectives and pressures. In order to organise a building and construction process to function smoothly, the project manager has to control overall costs, time and quality of actions undertaken. Project management activity is temporary, but exposed to a constant pressure of time and cost constraints, competitive tendering and a practice of awarding contracts to the lowest bidder.

The construction firms consist of large organisations with usually over 20 employees and small to medium enterprises with 5 to 20 employees. Large organisations have their project management sectors with appointed project manager for each project. The project manager is then in charge of organising the whole building and construction process including the supply of materials and equipment and upon completion of the object follows a special legal procedure to deliver the object to the client

O'Brien W.J. (2009) compared the building construction supply organization with the manufacturing sector and found that both sectors are organized in a very similar way however the building construction sector contains some specific characteristics. According to him, both sectors consist of different parties which are connected via transactions, sourcing, information flows and funds. The main difference is that the Manufacturing Supply Chains move not only raw materials and semi-products to the production plants but they also move finished products throughout the distribution channels and finally to the end customers while in the construction sector throughout the supply chain there is a need for materials and equipment to converge at the construction site to create a building but there is no need for further distribution channels after the building has been finished.

In making a review of the literature on the organization of the supply chains in the building and construction sectors Koçtaş (2013) found that the sector is characterised by various practices and disjointed relationships very often resulting in transient relationships rather than long term risk sharing partnerships. He pointed out that these disjointed relationships make the construction supply chain work as a disparate collection of separate organisations rather than as a unified team. The supply chains of the building and construction sector suffer from lack of integration and as a consequence, there is a lack of trust between construction clients, designers, main contractors and suppliers.

SCM in the building and construction sector: relationships

The importance of applying Supply Chain Management to improve the performance of the building construction sector started to be emphasized in the nineties. In 2000, Vrijhoef and Koskela defined SCM applied to the construction sector as a network of facilities and activities that provide customer and economic value to the functions of design development, contract management, service and material procurement, materials manufacture and delivery, and facilities management.

SCM in the building and construction sector deals with the management of materials, information and financial flows between contractors, designers and clients as well as with the relationships between contractors, suppliers, and distributors

Partnerships in the construction sector can take many forms. According to Petrovic-Lazarevic et al, (2006) supply chain partnerships in this sector can be at the company level or the project level. At the company level supply chain partners can have stable and long-term working arrangements within a limited number of firms. This is known as permanent networks. The project level relationships are more temporary, as they are usually established until the duration of the project. In his article Petrovic-Lazarevic et al, (2006) citing Koskela and Vrijhoef (2001) argue that temporary partnership is an inhibitor to innovation.

Another type of partnership is identified in this article refers to alliances as being either strategic or project. In this instance project partnering is a relationship that is established for a single project which "focuses on short-term benefits•. whereas strategic partnering is a long-term relationship across many projects which •seeks gains for the long term". From these definitions of alliances. the terms cooperative and collaborative have been linked by some authors to project and strategic alliances. Collaborative strategic alliances refer to parties working together for the short term and cooperative strategic alliances are for longer term partnerships. Although partnership plays an important role of SCM in BCI the development of trust and commitment are also important factors affecting the relationship.

As supply chains can be so immense in the construction sector, the development of more collaborative working practices with suppliers and designers is quite common now. This in turn can lead to greater efficiency (called 'lean construction'). Lean construction is a philosophy based on the concepts of lean manufacturing, based on managing and improving the construction process and its profitability to deliver what the customer needs Charter et al, 2001)

Supply Chain Management and Subcontractors

According to the literature the building construction sector consist of many contractors and subcontractors. The subcontractor in general consist of SMEs enterprises. In studying the relationship between contractors and sub-contractors in construction supply chain Ross (2011) affirms that is an arm length approach between subcontractors and suppliers. Very little research was conducted on how SCM affects the subcontractor when intertwined with these long lasting relationships, in particular Small to Medium Enterprises (SME's).

In his research Ross citing other authors found that there are significant difficulties facing SME's when attempting to play a fuller role in supply chains and that larger firms normally have greater access to resources 'which enables them to dominate the production and market environments and occupy more favourable positions along the industry value chains'. He stated that the problem SME's have in these supply chains is their lack of capital and skills required to compete in modern construction procurement so they are limited to traditional price competition and cost reduction.

Main actors in the construction supply chains

As a result of the fragmentation of the sector, construction supply chains consist of many actors including many medium and small enterprises as well as many contractors and sub-contractors.

Two important factors should be considered in the trying to identify the main actors of a supply chain: definition of the end user/customer/buyer and determining if the study focuses on suppliers' or customer's perspective.

When focusing on the suppliers' perspective the business to business relations between a supplier and its main customer/buyer are the most important, while when the focus is on customer's perspective the relations between a seller and the client/consumers are the most important.

The end user or main customer/buyer in the building and construction sector is in general the contractor. The actors involved in the housing construction sector can be broadly divided into those

directly and indirectly linked with the supply chain management functions. In the first group we may find: Contractor, constructor, subcontractors, suppliers of raw materials, products or equipment, raw material manufacturers, intermediate goods manufacturers, finished goods manufacturers, distributors and wholesalers, retailers and customers/consumers/buyers. In the second group there can be logistic service providers, financial institutions, government institutions (planners, regulators, policy, permit, etc.), building associations and private experts (consultants, researchers, etc).

Green Supply Chain Management (GSCM) and Sustainability

Stakeholder pressure from investors, shareholders, customers and non-profit organisations are pushing companies to include sustainability and green issues into their supply chain. They do so not only because of the inherent social and environmental risks and the governance challenges the supply chain poses, but also because of the many rewards supply chain sustainability can deliver such as resources conservation, optimization of processes, uncovering product innovations, saving costs, increasing productivity and promoting corporate values.

The UN Global Compact Initiative (2010), defines Supply Chain Sustainability as the management of environmental, social and economic impacts, and the encouragement of good governance practices, throughout the lifecycles of goods and services.

The process of including sustainability into supply chains is known as greening supply chains. Singh, (2010) tried to explain the main differences between a traditional and a green supply chain stating that while in a traditional supply chain, the flow of materials and information is linear moving from one end to the other and each supply chain partner has limited information regarding, for example, the environmental impacts and greenhouse gas emission of the other, the green supply chains consider the environmental effects of all processes within the supply chain from the extraction of raw materials to the final disposal of goods and all the partners within the supply chain are in one or another way committed to green principles.

A green supply chain in general includes the following elements: green procurement, green manufacturing, green distribution and green logistics.

Green procurement is defined as an environmental purchasing consisting of the involvement in activities that include the reduction, reuse and recycling of materials in the process of purchasing. It includes selecting suppliers that purchase materials or parts only from "Green Partners" who satisfy green partner environmental quality standards;

Green manufacturing is defined as the production processes which uses inputs with relatively low environmental impacts, which are highly efficient, and which generate little or no waste or pollution;

Green distribution consists of green packaging

Green logistics and Green logistic/transportation involves direct delivery to user site, uses alternative fuel vehicles, distributes products together, rather than in smaller batches, it changes to a modal shift (Singh, 2010).

One central element to promote the greening of the housing supply chains is the identification and exploration of green interventions that can or could occur in both the building delivery and management process and the material supply chains. UNEP has created a project called Greening the Building Supply Initiative to identify and explore these interventions. (UNEP, 2014). For the purposes of this initiative, green interventions are defined as regulatory and control mechanisms, economic or market-based instruments, fiscal instruments and incentives, and support, information and voluntary actions, taken by stakeholders in the supply chain, that lower the environmental

impact of a building, its materials or building-related activities over the life-cycle of the building, and/or have a wider or legacy environmental, social or economic impact beyond the building itself. The key building sectors elected to identify and explore the opportunity for green interventions are energy, carbon, materials, waste and water.

In this same project UNEP proposes to make a simplification of the building supply chain in order to systematically reveal and assess opportunities for green interventions within these chains. In this initiative the building supply chain is divided into the following two dimensions: 1. Assessment of the building delivery and management process: The building delivery and management process describes the way in which buildings are designed, delivered, occupied and maintained and 2. Assessment of the materials supply chains which included two elements (i) Overview of stakeholders and barriers within materials supply chains – description of the main, stakeholders, relationships and barriers associated with the materials supply chains. (ii) Prioritization of materials supply chains - a prioritization of materials groups supply chains to be studied based on the environmental impact of materials used in the construction process. In this study the following materials were prioritised: Aluminium, brick, cement, flat glass, mineral wool, plasterboard, polystyrene, polyurethane, steel (rebar and structural), and timber (structural).

According to Tseng et al (2009), Greening of the Supply Chain Management (GSCM) refers to the responsibility of industries and enterprises to ensure coordination for environmental, social and ethical compliance throughout all supply chains. He also define GSCM as the combination of environmental thinking encompassing product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer, and end-of-life management of the product.

GSCM can reduce environmental impact through improved energy efficiency measures and the reduction of waste and pollution along the supply chain. It focuses on how firms utilize their suppliers' processes, technology and capability, and integrating environmental concerns to enhance its competitive advantage.

In the process of conceptualization of a green supply chain the main focuses are: products, production processes, including materials sourcing, the immediate outcome of the supplier on green efforts, the means by which more green operations or products are achieved and the buyer requirements. To keep a good coordination and management among all these focal points it is important to have a good collaboration between the upstream (green suppliers) and the downstream (green costumers) parts of the supply chain.

The selection of suppliers is a key issue in managing a GSCM since they play an important role in its implementation. Sing et al. (2010) recommends that all conventional SCM criteria including performance, need to be incorporated together with environmental criteria to find the most suitable supplier. He proposed six GSCM dimensions that must be addressed during this selection process: a) green manufacturing and packaging, b) environmental participation, c) green marketing, d) green suppliers, f) green stock, and g) green eco-design.

In promoting the use of green materials, products or services in the building supply chains many actors are involved. The suppliers play maybe the most important role. The Greening the Building Supply Initiative project has identified the roles of the diverse actors involved in the building supply chain. These roles are summarized below.

Contractors in conventional contract select the suppliers, sometimes influenced by developer's procurement policies and define material quantities. Contractors also influence resource efficiency by site management activities such as waste and water management and the selection of energy sources.

Furthermore, developers impact the extent to which resources are used and environmental impacts are provoked or mitigated by defining the demands related to the building, influenced by public sector (public authorities) planning polices and building codes.

Designers and engineers, can contribute to improving resource efficiency and reducing environmental impacts by selecting methods of construction optimization and proposing materials and combinations of materials, which contribute to realizing construction parts with otherwise identical or sufficiently similar use characteristics and show a reduced resource consumption or lower environmental impacts

During the in use stage, facilities managers, who are responsibility for the ongoing management of a building and are acting on the behalf of the developer or owner, they can influence resource consumption and unwanted environmental impacts related to ongoing maintenance and replacement actions. Decisions about renovation or demolition/disassembly are also of key importance to the overall resource efficiency of a building and are often prompted by tenant (decisions).

Material (and equipment) suppliers can influence resource consumption and unwanted environmental impacts by selection, sourcing and haulage of input materials and precursors, selection and sourcing of energy, and the selection of technologies and processes, inter alia for efficiency improvements, releasing opportunities for virtuous circular economy loops within the whole building sector.

Green Market: Green Consumption and Green Purchase

There are many definitions of green markets and the concept has evolved since the eighties after the appearance of the Brundtland report also called: Our Common Future: The American Marketing Association (AMA) defines green markets as the marketing of products that are presumed to be environmentally safe. AMA divides this definition into three aspects: (retailing definition) as the marketing of products that are presumed to be environmentally safe; (social marketing definition) as the development and marketing of products designed to minimize negative effects on the physical environment or to improve its quality (social marketing definition) and (environments definition) as the efforts by organizations to produce, promote, package, and reclaim products in a manner that is sensitive or responsive to ecological concerns (Morel and Kwakye 2012). Chitra (2007) defines green markets as green marketing-mix elements and eco-friendly products that are designed and developed as being less harmful for the environment.

The concept of green marketing calls upon businesses to follow ethical and green practices while dealing with customers, suppliers, dealers, and employees. Companies have started marketing themselves as green companies, and more recently many public sector units and state government agencies are starting to pay more attention to green issues. Going green in not only an issue of rich countries as a recent survey conducted by the National Geographic Society (2010) to determine consumers' green attitude called "Consumer Greendex" showed. According to this research developing economies of India, Brazil and China presented the top consumers' green attitude scores while the industrialized countries ranked at the bottom.

Various studies cited by Morel and Kwakye (2012 supported the assertion that consumers today prefer environmentally safe products and have a positive disposition towards companies following such practices. While these findings showed a strong willingness of consumers to favour environmentally conscious products and companies as per various opinion polls taken in the US and EU have shown that this willingness to consume green products has not being translated in an increasing of green product demand. This later results pointed out that considerable barriers towards the diffusion of more green oriented consumption exist and that strong efforts need to be

made to match the existing high environmental awareness of consumers and their willing to buy green products.

Among the measures suggested by Morel and Kwakye (2012) to surmount these barriers are the use of green marketing tools such as eco-label, eco-brand and environmental advertisement. He states that these instruments are important to increase the confidence of the consumers on green products as well as influence consumers' behaviour towards green products.

Consumption and Green Purchase

Consumption in general and also green consumption is influenced by many aspects such as product, price promotions and place called Marketing –mix, quality, satisfaction, behaviour, life style and attitudes.

Marketing-Mix Concept

The concept refers to a set of actions, or tactics, that a company uses to promote its brand or product in the market. It is composed of four elements (the 4P): product, price, promotion and place.

Applying marketing-mix is very important for a company's success. Its application requires a lot of understanding, market research and consultation with several people, from users to trade to manufacturing and several others.

A short description of these four Ps and some links with green aspects is given below:

Product: Refers to the item actually being sold. The product must deliver a minimum level of performance; otherwise even the best work on the other elements of the marketing mix will not do any good. In the market, packing is an important aspect on marketing a product. As packaging uses a lot of materials it has the potential to cause many environmental impacts.

Price: Refers to the value that is put on a product. It depends on costs of production, segment targeted, ability of the market to pay, supply - demand and a host of other direct and indirect factors. Morel and Kwakye (2012) found that some consumers view the price of eco-friendly products as more expensive than the conventional ones and that this view has not to do with the healthy components of the products.

Promotion: Refers to all of the activities undertaken to make the product or service known to the user and trade. This can include advertising, word of mouth, press reports, incentives, commissions and awards to the trade.

Place: Refers to the point of sale. In every industry, catching the eye of the consumer and making it easy for her to buy it is the main aim of a good distribution or 'place' strategy.

The relationships between these four Ps with satisfaction, attitude and purchase behaviour have being the object of many researches. In the coming sections we will present a summary of the main concepts, theories and results of studies concerning these subjects.

Attitudes

With regard to consumer's attitude and green behaviour for example, Davidson et al. (1985) found that the consumers' attitude is associated with the knowledge and personal experience they possess but applied to green consumerism this result could not be confirmed. In this same study Mainieri et al. (1997) confirmed the results obtained by Davidson finding a low correlation between consumers' attitude and green behaviour. Spruyt et al. (2007) explains these results suggested that the prediction of an individual's behaviour is dependent on the attitude of the consumer. He stated

that in order to predict a specific behaviour, the measurement criteria of attitudes should be directed at a specific environmental issue like purchasing of green products.

The attitude is an important part in the study of consumer behaviour. Many studies have being dedicated to try to describe and understand the relationships between consumption and attitudes. The information used in this part was adapted from the study conducted by Morel and Kwakye (2012).

In this study Morel and Kwakye states that in a psychological sense attitude is defined as a "..tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour". He also presented the functional theory and the ABC model as two very important instruments used in studies involving attitude.

The function theory outlines that attitudes; "serve a function for the person" and they are; "determined by person's motives" Morel and Kwakye (2012). Four functions cited in this study are:

- *The utilitarian function:* This is related to the basic principles of reward and punishment. People develop positive or negative attitudes towards products or services when they bring them satisfaction or pain
- *The value-expressive function:* At the opposite of the utilitarian one, this function is related to what the product or service that consumers; "say about them". This function is linked with consumer's consumer lifestyle. For example a teenager will buy a sport brand shirt not because he likes the quality of the product, the features, and the comfort that provide him but just because this product shows that he is trendy.
- *The ego-defensive function*: These attitudes that consumers develop serve to protect them, for example, holding to attitudes that protect your self-image. Some consumers have an attitude towards eco-friendly products in order to help reduce global warming and be healthy.
- *The knowledge function*: These attitudes that consumers develop serve their need of a world which is formed of order and stability. This allows the individual to have a sense of control and helps to organize and structure our experience.

The ABC model of attitudes stresses the interrelationships between knowing, feeling and doing. Highly experienced researchers ~~have in~~ agree~~ment~~ that an attitude has three components; affect, behaviour and cognition. The effect category explained as the emotions and feelings of people towards an object, for instance, a product. Behaviour relates to the actions and intentions of attitude towards an object or product which can be favourable or unfavourable and cognition can be explained as the beliefs a consumer has for the attitude object which can be negative or positive. "The consumer's attitudes affect their thoughts and feelings and thus influence behaviour such as purchasing behaviours. The past experience of the green products for example, could result in a positive or negative attitude towards them which could influence the behaviour of the consumer whether to purchase the eco-friendly products or not.

Satisfaction

Satisfaction plays important role in the attitude of the consumers towards a product. In a marketing view according to Morel and Kwakye (2012) satisfaction can be linked to brand loyalty which is; "a pattern of repeat product purchases accompanied by an underlying positive attitude towards the brand". Satisfaction is also linked to the product quality and quality leads to performance and finally to customer satisfaction.

The satisfaction of the consumers with regard to the consumption of green products is very important for the companies once it shows that the company's corporate responsibility and the green commitment are being achieved. A survey composed of around 200 respondents in Taiwan

has showed that green product quality was positively linked to customer satisfaction and green customer loyalty (Chang and Fong, 2010).

Purchase Behavior/Intension

Purchase behaviour can be influenced by many factors such as environmental considerations, financial considerations, ethical considerations, awareness, knowledge, etc.

Many studies were developed to try to understand how these factors affect the consumption of green products: Dobson (2007) argues that behaviour change towards sustainable development that is driven by environmental citizenship considerations is more likely to last than behaviour driven by financial incentives. He states that attitudes work at a deeper level than behaviour, but that behaviour change is what most environmental policy is aimed at, especially the UK government's sustainable development strategy, detailing fiscal incentives (Young et al, 2010). In the same study Young found that the so called 'attitude–behaviour gap' or 'values–action gap' can explain why 30% of UK consumers report that they are very concerned about environmental issues but they struggle to translate this concern into green purchases.

Braimah and Tweneboah-Koduah (2011 in Mayank 2013, in a study conducted in Ghana showed that due to the low level of awareness on green marketing and products, and the price of these products were the main factors affecting the purchase decision of the local consumers. The study also found that among all consumers the young consumers were those more likely to be more influenced by green issues. Mayank (2013), found that consumers lack green knowledge and because of this low awareness, organizations are still not focusing towards the development of green products.

The results of these studies have showed that the green market sounds very attractive for the business sector but this appeal has not being always translated into more demand for green products. Because of this fact companies are being very careful in considering whether to include green aspects in their supply chains. They are aware that moving green means increasing their production and market costs at least at the conception, and that moving will not automatically assure a future increase of revenue. Going green also demands that companies be prepared to extensively communicate the presence and benefits of green products to the customers.

In green marketing studies the concept of purchase intensity is being very much used to identify what consumers think they will buy. This concept plays an important role in marketing strategies because they permit companies to evaluate how many products could be produced according to demand.

Defining Green Housing Materials, Products and Services

The construction, renovation, maintenance and operation of buildings accounts for very large quantities of materials which are extracted from nature, processed, used and ultimately discarded. The opportunities to reduce the environmental and health impacts of the housing sector involve important big decisions such as location, to small decisions such as paint and light bulbs. The products we use to clean, light, furnish, renovate, and build our homes must also be a part of the greening process. Reducing their environmental impacts requires thinking and learning about not just how we use products, but where they came from and where they are going. Important factors to be considered in this process are: energy used to make, transport, and use a product; the product's contents and the sources of its raw materials; emissions during manufacturing the product, and the level and type of toxins in the final product; and the product's durability (lifespan) and recyclability.

Defining what a green product, material or service is, has proved to be difficult and very challenging. No accepted definitions of green products or service exist until this moment.

According to Prasad Modak (2014), the Greenness of products is defined through various attributes. These could be environmentally focused in terms of materials used, energy consumed or pollution generated. These attributes are reflected in different stage of the life cycle - before usage, during usage or after usage. He also defines green products, materials or services as those having reduced environmental impact, over its life cycle.

For the USA Environmental Protection Agency (EPA) a product may be considered "greener" if scientific evidence demonstrates that human health or environmental impacts have been significantly reduced in comparison with other products that serve the same purpose. EPA also added that in defining a green product it is important to look at the product's life cycle; from product raw material extraction to manufacture until use and disposal, and its potential for adverse impacts, such as toxic exposures, air pollution, water pollutions, climate change, stratospheric ozone depletion, natural resources (e.g., energy, water, materials), waste disposal and ecosystem damages.

Mayank (2013) uses different definitions of green marketing, Mayank formulated a list of characteristics that green products generally should have: 1. Energy efficient (both in use and in production); 2. Water efficient (both in use and in production); 3. Low emitting (low on hazardous emissions); 4. Safe and/or healthy products; 5. Recyclable and/or with recycled content; 6. Durable (long-lasting); 7. Biodegradable; 8. Renewable; 9. Reused products; 10. Third party certified to public or transport standard (e.g., organic, certified wood); 1. Locally produced.

In the housing sector the expansion of the concepts of green buildings and green homes has accelerated the search for tools capable to determine how green a product, material or service is. Several tools and or guides exist which try to measure how green a building material, product or service is. Many approaches are used to measure how green a product is. One of these approaches found in many of these tools and guides is to check if the examined product, material or service contains the green characteristics (attributes) used by the tool or guide. Voluntary instruments such as green labels and green procurements also use this approach.

In the USA, these tools were developed and are being used by the National Institute of Standards and Technology Building for Economic and Environmental Sustainability (BEES) which measures the environmental performance of building products by using the environmental life-cycle assessment approach specified in ISO 14000 standards; AIA's Environmental Resource Guide which presents detailed life-cycle information about a number of building products and LEED Material Credits which determined material credit requirements in the LEED Green Building Rating System.

In Europe there exist many tools and guides that help consumers to identify a green product. One of the most famous is the one applied in UK called the Building Green's Online Product Guide (GreenSpec). This guide lists over 2,200 environmentally preferable products, with key insights on the green attributes of each product and the most critical green issues for each product category. The directory is divided into 5 areas with each area containing a set of standards and their respective definition. A summary of the directory main content is showed below:

1. Products Made with Salvaged, Recycled, or Agricultural Waste Content

    1a. Salvaged products

    1b. Products with post-consumer recycled content

    1c. Products with pre-consumer recycled content

    1d. Products made with agricultural waste material

2. Products That Conserve Natural Resources

    2a. Products that reduce material use

    2b. Products with exceptional durability or low maintenance requirements

    2c. Certified wood products

    2d. Rapidly renewable products

3. Products That Avoid Toxic or Other Emissions

    3a. Natural or minimally processed products

    3b. Alternatives to ozone-depleting substances

    3c. Alternatives to hazardous products

    3d. Products that reduce or eliminate pesticide treatments

    3e. Products that reduce storm water pollution

    3f. Products that reduce impacts from construction or demolition activities

    3g. Products that reduce pollution or waste from operations

4. Products That Save Energy or Water

    4a. Building components that reduce heating and cooling loads

    4b. Equipment that conserves energy and manages loads

    4c. Renewable energy and fuel cell equipment

    4d. Fixtures and equipment that conserve water

5. Products That Contribute to a Safe, Healthy Built Environment

    5a. Products that do not release significant pollutants into the building

    5b. Products that block the introduction, development, or spread of indoor contaminants

    5c. Products that remove indoor pollutants

    5d. Products that warn occupants of health hazards in the building

    5e. Products that improve light quality

    5f. Products that help noise control

    5g. Products that enhance community well-being

As one of the objectives of this research is to identify the existing green products in the sustainable housing supply chain in Nepal we have used the contents of some guides and tools and created a list of attributes that is going be used in this research as a check list to determine and identify a green product or service.

A green material, product or service for the purpose of this research is defined as the one containing one or more than one of the following attributes:

- They have been salvaged from existing or demolished buildings for reuse;
- They are made using natural and/ renewable resources or contains minimally processed products;
- They have low "embodied energy" (the energy required to produce and transport materials);

- They incorporate recycled content (post-consumer and/or post-industrial);
- They are obtained from local resources and manufacturers; For certified wood or bio-based products, they employ "Sustainable Harvesting" practices;
- They are durable (long-lasting) compared with the traditional products;
- They can be easily reused (either whole or through disassembly);
- They can be readily recycled (preferably in a closed-loop recycling system);
- They are biodegradable.
- They promote good indoor air quality (typically through reduced emissions of VOCs and/or formaldehyde);
- They do not contain highly toxic compounds, and their production does not result in highly toxic by-products;
- They are energy efficient (both in use and in production);
- They reduce heating and cooling loads
- They conserve energy and manages loads
- They are water efficient (both in use and in production)
- They are porous allowing storm water infiltration and or reduce storm water pollution
- They reduce pollution or waste from operations

4 Methodology

4.1 General approach

The research adopts a deductive approach using what is already done and known in the research topic and the necessary theories applied to the topic in order to guide the formulation of the objectives.

The unit of analysis are private companies involved with the construction and reform of commercial and residential houses in 3 cities of Nepal: Katmandu, Pokara and (to be determined).

Descriptive and explanatory types of research are going to be used in this study. These choices are motivated by the types of the two fold objectives of this research: 1 to understand the organization and the factors affecting the relationships of the supply chains of a selected number of construction companies, and to identify the green products and services used in these supply chains and their respective suppliers; and 2 to understand the perception of the actors of these supply chains on green/sustainability issues, and to explain the factors influencing the attitudes of these actors regard to the buying and using of green housing products and services.

The research uses a cross-section approach to collect data at a single point in time and qualitative and quantitative methods to collect this data. The choice to use qualitative and quantitative methods is justified by the types of the objectives of this research.

Qualitative methods will be used to help us to have a more in depth understand of the organization of some selected building construction supply chains and to explain the relationship of the actors within these supply chains. They will also allow us to understand the perception of the consumers (defined here as the actors of the studied supply chains) with regard to the concept of sustainable/green housing, and to identify and explain the factors influencing the attitudes of these consumers with regard to the buying and use of green housing products and services. This qualitative approach will allow us to collect, to analyze, to interpret and to explain empirical data by observing what stakeholders do and say.

Quantitative methods on the other hand will be used to collect data to try to quantify the elements, factors, attitudes, opinions and behaviours influencing relationships and the use /buying of green products or services.

A non-probability sampling approach is adopted in this research, this choice is motivated by the difficult to know (estimated) the research population of this study. This population consists of the total number of private companies and organizations involved in the construction of commercial and residential buildings including the companies dealing with green house products and services in the three chosen cities. Among the difficulties we have found to estimate the study population we can cite: no availability of a full list containing the names and addresses of all the companies involved in the construction sector in the cities to be studied, the fact that many of these companies are small and medium enterprises that very often operate in a an informal way make it very difficult to identify them, and finally very little information is known about the green house products and services being used or produced by the local companies and which companies produce them. These difficulties together with the short time available to collect the data and the high cost involved in applying a probabilistic approach which includes randomly selecting a big sample led us to opt for using a non-probabilistic sample approach.

4.2 Data collection and methods

A survey strategy will be used to collect the data in this research. This kind of strategy is often used in studies trying to quantify the elements, factors, attitudes, opinions, behaviours as well as find out correlations between these elements in large populations, (Morel and Kwakye 2012; Pinsonneault and Kraemer 1993).

Although this study tries to quantify some elements and find out relationships between these elements using correlations, it also tries to know and to understand the diversity of the interactions and relationships whereby qualitative information will be used to complete the quantitative results.

Taking into account the needs of this study, we have decided that a qualitative and quantitative survey will be the most appropriate research strategy for this study. This decision can be supported by the study of Harrie (2010) who introduce the concept of a qualitative survey. He argues that many qualitative studies that describe the diversity of certain cognitions or behaviour in a population by means of semi-structured interviews from a small sample of the population, members can be typified as a qualitative survey. He points out that both statistical and qualitative surveys may collect data by questioning people, which is the most common type of survey, but also by observing interactions or artefacts in any kind of situation.

Three types of research instruments will be used in this study: group discussion (referred to here as a workshop with local stakeholders), interviews and questionnaires.

The data collection process will start by organizing a workshop with 15 to 20 key players of the commercial and residential construction sector.

The decision to start the collection of the data by organizing a workshop was taken because very little information is known on how the construction sector is organized, how it works, what green products they use and who is producing and delivery these products and services.

More specifically this workshop will allows us to:

- Have more reliable qualitative and quantitative information on how the sector is organized: the main contractors/constructors, component distributors, supply chains, existent green products/services, SMEs involved with them, relationships between contractors and suppliers, regulatory, market and institutional problems.
- Adapt if necessary the research methodology.
- Pre-test the questionnaires and interviews by applying them to ten of these stakeholders.
- Identify the target construction companies or distributor of housing equipments/services to have their supply chains studied in Katmandu, Pokara and in (to be determined).

- To train the four local experts to apply the interviews and questionnaires

Defining consumers for this study

Consumer or clients for this study are defined as those actors of the supply chains that can buy or use green products and or services. They can be contractors, constructors, distributors, suppliers, producers, retailers, engineers, architects, customers and representatives of private associations such as the chamber of commerce, architecture and engineer associations and representatives of public organizations responsible for housing policies, regulations, certifications, etc.

Process of data collection

A snowball sampling approach will be used to collect data to study these chains. This approached is going to be used because our target population is not fully known as we do not know which companies are the suppliers beforehand.

The process will start by selecting a short number of constructors or distributor companies dealing with the construction sector and use these companies to study their supply chains. Questionnaires will be applied to identify (mapping) the actors (suppliers, distributors, retailers, customers), the types and factors affecting the relationships, the types and the suppliers of green products and services promoting energy, water and wastewater efficiency into these chains, as well as the perception of the actors with regard to the use and buying of green products. A few interviews will be carried out to get more in depth information of the key aspects of the supply chains.

For each of the green products identified in the company supply chains, new questionnaires will be applied to these suppliers. If new green products and services are identified within this analysed supply chain, new questionnaires will again be applied to describe these new chains. This snowball process will continue until no more green products will be identified.

Questionnaires and interviews

Semi closed questionnaires and interviews will be used in this research. Semi closed questionnaires will be used to collect quantitative data about the supply chains organization, actors, relationships and perception on green issues and green products. Semi structured interviews will be used to obtain more in depth information on key aspects of the supply chains and perception on green issues. The semi closed questionnaires will be applied using a paper face-to-face survey consisting of closed and semi closed questions.

The semi structured interviews will be applied directly to key actors accompanied with a list of answers that could be selected. This approach will not limit the way in which each question can be answered but the use of a list of answers that could be selected will help to standardise the answers across respondents. The standardisation shall enable a straightforward comparison which will in turn allow the researchers to focus on the essential aspects of this research.

Target people to be interviewed and to apply the questionnaires

In big companies the target people to be interviewed and to apply the questionnaire are the managers of the environmental department or the managers in charge of buying and or marketing products and materials within the company. If there is no manager, the owner or the person who knows most about the working of the company will be the chose person to apply the questionnaires or the interviews to.

Pilot test of questionnaires and interviews

A pilot test of the questionnaire is going to be effectuated in the workshop to evaluate the relevance and the understanding of the various questions. Before the pre-test is applied the

questionnaire/interview will be revised by two experts, one from UN-Habitat, Nepal and the other a local university expert in sustainable housing and market issues. Ten (10) stakeholder's participants of the workshop will be selected to take part in the pre-test.

Sample size and composition of sample

As a non-probability sample will be used, the sample size is a more or less subjective judgment taken by the researchers. For our study it will be relevant to be able to obtain a sample of around 200 respondents, 100 in Katmandu and 50 in each of the other cities.

Limitations

When we use of a non-probabilistic sampling approach, which implies a relatively small sample size, which does not guaranty a good representation of the studied population. This means that the results cannot be generalized but are more likely to be a representation of the situation of the cities at the moment the data was collected.

In the design proposed to study the organization of the supply chains and the perception of the consumers we have purposively selected key factors from the literature review to be used in this research. Although this selection was made to fulfil the objective of this research we are aware that other factors can also be important but have not been taken into account such as, for example, some local factors linked to the local cultural values that influence the organization and relationship within the supply chains, involvement of employment in the process of production of green products, types and methods of producing green products, etc.

Another limitation of the study concerns the consumer perception which does not represent the perception of the consumer of the general population but the consumer of a defined and specific group of persons of this population.

4. 3 Quality criteria

The quality criteria to be included in this study are: generalization, reliability and validity

Generalization

The choice to use a non-probability sampling approach in this study makes it difficult to generalize its results. The sample to be collected does not take into account the whole population (stakeholders) involved with sustainable housing in the three cities chosen for this research. We will try our best to structure and conduct the collection process in a way that can include a fair sample of different stakeholder functions, ages and gender in order to get a good sample representation.

Reliability

Reliability means the degree of consistency whereby the instrument measures what is supposed to be measured. In other words "whether or not you get the same answer by using an instrument to measure something more than once"

In this study internal reliability will be assured by applying Cronbach's alpha test to the scale variables. In this test the alpha parameter ranges from 0 to 1, in which 0 means completely unreliable and 1 means perfectly reliable. A score of more than 0.5 is an acceptable reliable value.

The reliability will also be assured by formulating the questions using the information obtained in the extensive literature review, where articles, theories and concepts linked to the topics were analyzed and by properly phrasing the questions so that they are not misinterpreted or ambiguous.

Validity

Validity refers to the extent to which an instrument measures what is planned to be measured. Data to be collected for this research will be valid using a triangulation of semi-structured interviews with closed questionnaires and the literature review. Lastly, validity will be assured by the application of the pre-test of the questionnaire and interviews to some competent and specialized experts on sustainable housing issues linked to this study.

4.4 Data analysis

Data from the interviews and questionnaires will be coded and analyzed using the Statistical Package for Social Sciences (SPSS 20). Outputs generated will include descriptive ones such as Frequencies, Means and Percentages, Graphs and Histograms. SPSS 20 will also be used to generate the inferential statistics like the Cronbach's alpha test applied on the scale variables to indicate their internal reliability.

Three types of statistic methods will be used to try to analysis the factors affecting the supply chain relationships and the actors attitudes regard to the buying and using green products: paired sample Test to determine if comparisons between pair of variables are relevant or not, ANOVA (analysis of variance) to determine whether two or more means are statistically different from each other and correlations to see if there are some relationships between the factors affecting the supply chains relationships.

As the research is also interested to know the key factor(s) affecting the relationship of the supply chain and the attitude of the actors regard to the purchase intention of green housing products a multiple regression will be used. This technique permits to see which factors have an influence on a dependent variable.

A confidence interval of 95% will be used in this research. Adopting this confidence interval for the paired test and the ANOVA analysis, test significance result above to (generally) 0.05 means that there is no difference and if it is inferior means that there is a difference..

For the correlations we will use the Pearson's coefficient to measure the degree of relationships. In a rule of thumb according to Morel and Kwakye (2012), there is a very strong relationship when the Pearson coefficient is between 0.8 and 1 (no relationship between 0.0 and 0.2, weak between 0.21 and 0.40 and moderate between 0.41 and 0.60) however this level of strength of correlation coefficient is not absolute.

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