The enabling environment for artisanal dimension stone in Nairobi, Kenya.

Volume I: Main report

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THE ENABLING ENVIRONMENT FOR ARTISANAL DIMENSION STONE IN NAIROBI, KENYA

VOLUME I: MAIN REPORT

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ABSTRACT

This study considered the enabling environment of artisanal dimension stone (i.e. blocks cut and shaped from natural rock using hand tools) for building in Nairobi, Kenya. It relied on the socio-technical system theory to capture the forces (variables) that influence the business/enabling environment of the building material. The socio-technical perspective was necessary because hitherto existing literature had only considered the archi-technical, patho-technical, geo-technical, archaeo-technical and eco-technical perspectives. The study sought to explore the organizational structure of the construction industry in Kenya and profile the internal structure and the external environment of artisanal dimension stone producing units so as to identify and ascertain the socio-technical forces (variables) influencing the production and use of the stone. The study further sought to analyse the interrelationships among the identified forces in order to suggest adjustments to the enabling environment.

The study applied PEST analysis techniques (including stakeholder and factor analyses) to characterise the enabling environment. The research took place in two main stages: exploratory and conclusive. The exploratory study involved the use of ethnographical methods (unstructured interviews and participant observation), analysis of secondary data and literature review so as to come up with theoretical propositions that further were tested conclusively through quantitative research using factor analysis. Data for factor analysis were obtained through structured interview conducted among relevant stakeholders of the building industry (i.e. stone producers, architects, quantity surveyors, contractors, and structural engineers) operating in Nairobi.

The outputs of the study include: a profile of the business of the construction industry in Nairobi (Chapter 5), a profile of the internal structure and the external environment of artisanal stone producing units (Chapter 6) and a factor analytic model of the enabling environment of artisanal dimension stone (Chapter 7). Factor analysis that forms the conclusive part of the study has demonstrated that the enabling environment is relatively hostile. Further it has established the three levels of analysis proposed by Bertalanffy i.e. the number of system elements, the typology (variability) of system elements, and the interrelations among system elements. The study has also made certain policy recommendations in response to the hostile nature of the enabling environment: including the formation of an association by the producing unit, the formation of a marketing cooperative by the producing units and the cessation of blasting as a method of cutting rock.

DEDICATION

This work is dedicated to Eiffel and Tertia

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DECLARATION

This thesis is the author's own original work. It has not been presented for the award of another degree or qualification of this or any other university or institution of learning.

However part of this work has been directly published (see also the listings under Appendix 22) as:

K'Akumu, O.A., Jones, B. and Blyth, A. (2010) The market environment for artisanal dimension stone in Nairobi, Kenya. *Habitat International*, 34(1): 96-104.

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LIST OF ABBREVIATIONS

AAK	Architectural Association of Kenya
ASH	Agency-Structure-Healey
ASM	Artisanal and Small Scale Mining
BOQ	Bill of Quantities
BORAQS	Board of Registration of Architects and Quantity Surveyors
CASM	Communities and Small Scale Mining
CBK	Central Bank of Kenya
CFA	Confirmatory Factor Analysis
CMA	Capital Markets Authority
EFA	Exploratory Factor Analysis
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ERB	Engineers Registration Board
FA	Factor Analysis
GST	General System Theory
IBM	Indigenous Building Materials
IDRC	International Development Research, Canada
IEK	Institution of Engineers of Kenya
ILO	International Labour Organization
IMF	International Monetary Fund
IRA	Insurance Regulatory Authority
ISE	Informal Sector Enterprise
ITDG	Intermediate Technology Development Group
KBS	Kenya Bureau of Standards
KMO	Kaiser-Meyer-Olkin
KSh	Kenya Shilling
MSE	Micro-and Small scale Enterprises
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NHC	National Housing Corporation

NSSF	National Social Security Fund
PCA	Principal Component Analysis
PEST	Political, Economic, Social, Technological
PESTLE	Political, Economic, Social, Technological, Legal, Ecological
QS	Quantity Surveyor
RBA	Retirement Benefit Authority
SLEPT	Social, Legal, Economic, Political, Technological
SME	Small and Medium Enterprises
SOP	Structure of Provision
SPECTACLES	Social, Political, Economic, Cultural, Technological, Aesthetics, Customer, Legal, Environmental, Sectoral
SPSS	Statistical Programme for Social Science
SSoP	Social Structure of Provision
SST	Social Study of Technology
STEEPLE	Social, Technological, Economic, Ecological, Political, Legal, Ethical
STS	Socio-Technical Systems
SWOT	Strength, Weakness, Opportunity, Threat
UK	United Kingdom
UNCHS	United Nations Centre for Human Settlements
UNIDO	United Nations International Development Organization
VAT	Value Added Tax

CHAPTER ONE

1. RESEARCH BACKGROUND AND CONTEXT

1.1. Introduction

This is a report for award of a PhD on the research topic concerning the enabling environment for the production and use of artisanal dimension stone in Nairobi, Kenya. The research is a follow up on a group of studies under the aegis of ITDG[1], which had noted an expansion in the use of artisanal materials in African cities including Nairobi (see Wells and Wall 2003 and Wells 2000). Artisanal dimension stone refers to building blocks that have been cut from natural rock using hand tools. The basis of this definition is discussed in the main body of this report.

Artisanal dimension stone has been used for constructing buildings in many cities and countries of the world to the extent that it is considered a traditional material in such cities and countries. Although it had been used in the construction of buildings in the pre-colonial cities of the coastal region in Kenya e.g. Mombasa, Malindi and Lamu such is not the case for Nairobi where dimension stone was introduced about a century ago through colonial intervention. Prior to this the traditional or artisanal materials used for the construction of buildings by the local communities in the Nairobi area such as the Maasai included twigs, mud, cow dung and cow hides (Rukwaro and Mukono 2001).

Upon establishing Nairobi as the Railway headquarters and the headquarters of the Colony, the European settlers quickly found out that their newfound settlement was endowed with natural rock suitable for use as building blocks. This resource whose geological identity has been given as Kerichwa Valley Tuffs or the Nairobi Stone (Williams 1967) was the main material with which the early colonial Nairobi was built. Some of the earliest buildings within the central business district constructed of the Nairobi Stone such as Kipande House and the Provincial Commissioner's Office have been declared historical monuments.

[1] ITDG stands for the Intermediate Technology Development Group, of Rugby UK—currently known as Practical Action

This study examines the current exploitation of natural rock deposits by artisans in their endeavour to produce dimension stone for use in the building industry in Nairobi. A sample of dimension stone produced by these artisans is shown in Plate 3 in Appendix 1. The study is based on the business environment associated with the use of artisanal dimension stone for constructing the walls of buildings in Nairobi.

The study applies the general system theory to capture the variables that compose the enabling environment for the artisanal dimension stone. The enabling environment is characterized by exchange relationships between the key players such as: suppliers of inputs for manufacturing the product; the manufacturer of the product; and, the buyers of the product. These exchange relationships are also governed by several forces that come into play in the business environment. The general system theory forms the methodological basis upon which this thesis traces these socio-technical relationships for a better understanding of the issues surrounding the use of artisanal dimension stone.

1.2. The Study Material: Artisanal Dimension Stone

A review of the literature base did not yield a definition for artisanal dimension stone; therefore a working definition for this study has been developed from existing construction terminology. In construction, stone refers to a rock that has been quarried or mined and worked for use in constructing the building fabric (Shadmon 1989 p. 11, Dimes 1999 p.1). The ordinary English dictionary definition of rock is the solid part of the earth's crust. The rocks from which stone can be derived are of three main types: igneous, sedimentary or metamorphic (see for example Hugus et al. 2005, Dernie 2003, Hegger et al. 2007). Quarrying in Nairobi is done on igneous rock of volcanic origins (Saggerson 1991).

The human race has relied on natural rock for the construction of buildings since the remote times. Historical evidence of use of stone in buildings is found in many ancient structures including caves hewn in stone. For example, Shadmon (1989) has observed that only one (the Hanging Gardens of Babylon) of the Seven Wonders of the World is not made of stone. Despite being associated with such archaic technological exploits, stone still remains a significant material for the construction of buildings. Currently, stone can be used in the construction of the

built environment in several ways as described by Hornbostel (1991) in his encyclopaedic text entitled, *Construction Materials: Types, Uses and Applications*. The types and uses include: rough stone, rubble stone, dimension stone, monumental stone, stone tiles, flagstone, crushed and broken stone and stone dust or powder as shown in Figure 1.1.

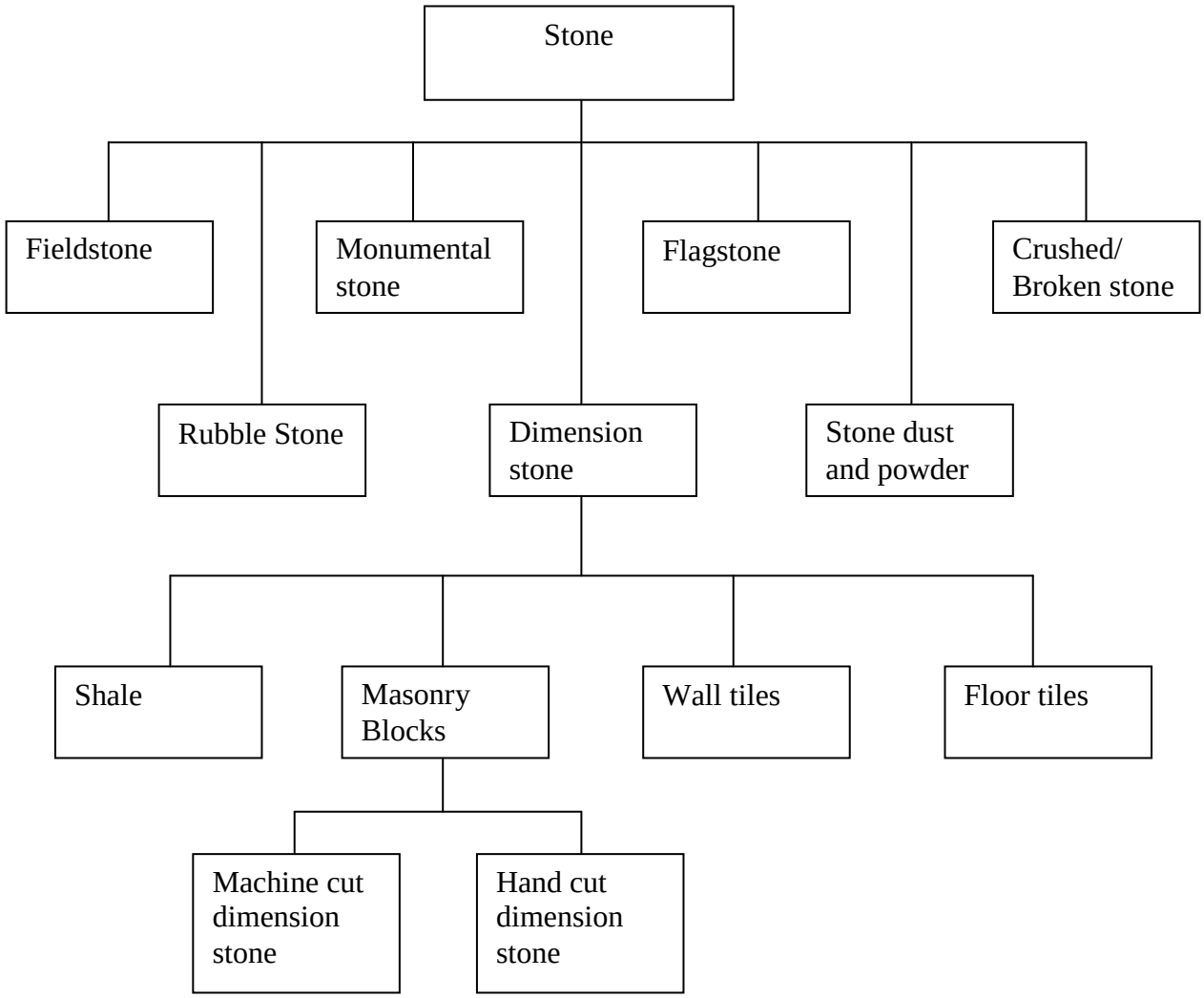


Figure 1.1: Types of stone used in building works

Source: Constructed by Researcher with information from Hornbostel (1991).

Hornbostel (1991) gives detailed descriptions of the various types of stone used in building construction as summarized in the table below.

Table 1.1: Types of stone and their uses in building construction

Stone Type/Use	Description
Fieldstone	Also known as rough building stone. Consists of rock faced masses of various sizes and shapes
Rubble stone	This refers to irregular stone fragments having at least one good face that are obtained from quarries. It can be cut and made into blocks and pieces for building walls, veneers, copings, sills etc
Dimension stone	Also referred to as cut stone or ashlar It may be obtained as finished products from stone mills done to a specific size, squared to dimensions each way and to specific thickness There are two types of finishes: • the surface is rough or the natural split of the stone • the surface is smooth, slightly textured or polished It can be used for exterior or interior surface veneers of buildings, prefabricated panels, preassembled systems, toilet partitions, flooring, copings, stair treads, sills, bearing walls etc Ashlar is now included under dimension stone; it refers to smaller, rectangular stone with a flat-faced surface, generally square or rectangular, having sawed or dressed beds and joints.
Monumental stone	This is either rough or finished stone that meets the same requirements as dimension stone and used for gravestone, monuments, and like structures
Flagstone	Refers to flat slabs of thin stone generally from 1 to 2 in. (25.4 to 50.8 mm) thick, either irregular or squared, with the surfaces smooth, slightly rough, or polished Flagstone is used in the exterior for paths, walks, and terraces and on the interior as stair treads, flooring, blackboards, coping, sills, countertops, etc
Crushed stone	Crushed or broken stone consist of chips, granules, or irregular shapes that have been graded and sized for construction work Crushed stone usually begins at ¼ in. (6.35 mm) and runs by various stages to 2½ in. (63.5 mm) size It differs from large-size gravel in being usually composed of only one kind of rock It is used as aggregate in concrete work and asphalt walks, roads, driveways paths, and other traveled areas, as surfacing material for asphalt shingles, siding, and built-up roofing; and in terrazzo and artificial stonework
Stone dust	Stone dust or powder is used for surfacing asphalt paving, as fill in paints, for resilient flooring etc

Source: Hornbostel (1991 pp 825-827)

The common ways in which stone can be used in wall construction (stone masonry) are shown in Figure 1.2.

Dimension stone refers to rock that has been cut and worked to a specific size or shape for use in building (Ashurst and Dimes 1977). There are different types of dimension stone that may be used in the building envelope including tiles for roofing, tiles or slab stone for floor finish, tiles (e.g. marble) for wall finish and blocks for stone masonry. The focus of this study is on stone masonry also known as ‘cut stone’ or ‘ashlar’ (Hornsbostel 1991). In this context, dimension stone takes the meaning attributed to it by Prentice (1990) as pieces of stone that have been cut into regular (three) dimensions and used for wall construction.

According to Shadmon (1989 p. 58) there are two categories of tools used in extracting and working (manufacturing) dimension stone—i.e. hand tools or machine tools. Hand tools, in this case, include: levers, jacks, picks, hammers and chisels for extraction; and hammers, chisels (including pneumatic), drills, saws, grinding stones and polishing powder for stone-working (Shadmon 1989). On the other hand, machine tools include: jack-saws, saws, wire-saws, chain-saws, mechanical chisels for extraction; and guillotines, saws, planers or fraisers, grinders and polishers for manufacturing (Shadmon 1989). Adopting the definition of artisanal materials by Wells and Wall (2003) as materials produced by individuals who use methods based on hand tools with simple division of labour and little capital equipment, artisanal dimension stone refers to materials obtained by the first category of tools; in other words—building stones of regular dimensions that have been extracted and worked using hand tools as opposed to machine tools.

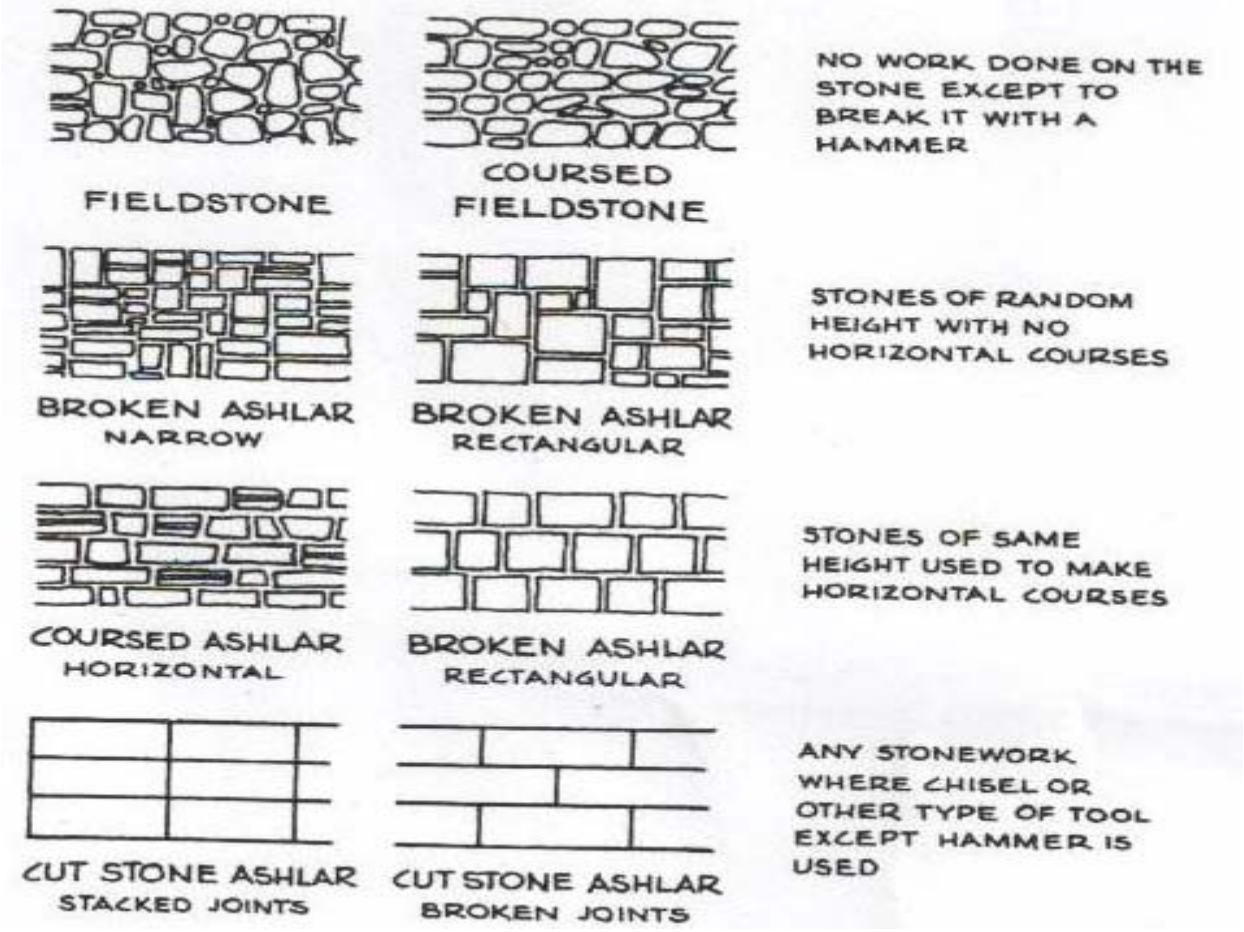


Figure 1.2: Common types of masonry stonework

Source: Hornbostel (1991 p. 828)

1.3. The Research Issue, Aim and Objectives

Dimension stone is commonly covered among other building materials in standard construction materials text books (see for example Ghose 1989, Everett 1994, Hornbostel 1991, Hegger 2007). Such books are not specifically written on dimension stone but usually dedicate a chapter on stone in general of which dimension stone is discussed as one of the type of stone used for building among others like artificial stone, rough stones, monumental stone, flagstone, crushed stone etc (see Hornbostel 1991). A handful of textbooks that solely are dedicated to giving technical instructions on how to win and use stone in building are also available (see for example, Clifton-Taylor and Ireson 1983, O'Neill 1965). The shortcoming of this instructive textbook literature is that it may have little to add to existing knowledge. In deed Shadmon (1989) had regretted the low regard the building industry has for stone 'that it has been dropped

from the syllabi of many architectural courses and the agendas of international meetings' yet stone was the most available material that had been in use since time immemorial. Therefore he had to write a book 'to put stone back on the map and show why it is an important building material'

In spite of the above position on stone literature, some debate on the use of stone in building has been going on. According to this study, the discourse of this debate is distinguishable into certain emerging perspectives i.e. restoration/preservation (patho-technical), geological (geo-technical), historical/archaeological (archaeo-technical) and environmental or ecological (eco-technical) perspectives. The architectural literature discussing or giving instructions on how to build with stone as mentioned above may be distinguished in this case as: *The archi-technical perspective*.

The patho-technical perspective: The literature on the restoration or preservation of stone is a pathological discourse that considers dimension stone in buildings that had been erected in the past. In this case the stone material is likely to deteriorate due to age or neglect hence the need for restoration or preservation. Restoration essentially gives the literature a focus on the existing or likely defects during the functional time of stonework, hence the term patho-technical that is used in this case in a sense similar to 'pathophysiology' in medicine. Examples of this literature base would include: the anthology on stone cleaning published as proceedings of The International Conference held in Edinburgh, UK, 14-16 April 1992 (Webster 1992) and anthology on understanding and managing stone decay published as Proceedings of the International Conference on Stone Weathering and Atmospheric Pollution Network (Přikryl and Viles –2002). This literature does not debate any current issues relating to processes in the production and use of stone in building.

The geo-technical perspective considers geological attributes of the dimension stone principally from the geological and engineering points of view. This area is rich in books and research articles such as Prentice (1990) discussing the geology of construction materials, Blyth and de Freitas (1974) that is a text of geology for engineers. Other works include Shadmon (1993) on the role of geological engineering on the environmental effects of dimension stone and Loorents

et al. (2000) on the natural fracture system in a dimension stone quarry in the Offerdal Nappe, Sweden. Their focus is on the formal quarrying processes or the scientific and technical procedures of the mining of stone for use in construction. The literature is therefore not applicable to informal mining situations although it debates current applications in the production of dimension stone.

The eco-technical perspective involves a study of the ecological/environmental issues caused by and the technological issues involved in the mining of stone. Examples abound in this case including Heldal and Neeb (2000) on dimension stone production in Norway, Walles et al. (2000) on the stone deposits of central and southern Ethiopia, Saliu (2008) on blasting and breaking technology in Supare, Nigeria, among others. It debates the current production and use of dimension stone but leaves out other pertinent issues like the marketing aspects.

The archaeo-technical perspective on the other hand considers the mining of stone in the historical past. The prefix archaeo is used in this case in a context similar to the use for example in 'archaeo-astronomy'. There are considerable monographs on this perspective especially from the Anglo-Saxon heritage including the works of Arkell (1947) describing the mining, cutting, transportation and use of stone for building Oxford in the pre-industrial past and Purcell (1947) on the same theme for Cambridge. Similarly, Bailey (1982) covered stone construction in rural England. Across the Atlantic, Gage and Gage (2005) have looked at the rock quarrying methods in pre-industrial New England. The relevance of this perspective to the situation in Nairobi is that it considers pre-industrial or artisanal mining of dimension stone although not as a current affair. The other perspectives rarely focus on artisanal dimension stone; except the eco-technical that emphasize the environmental damage caused by artisanal quarrying.

Artisanal dimension stone has been the subject of research in Kenya within the ITDG initiated studies as reported by Agevi and Ogero (1990), Wells (1996), Mjaria (1997), among others. The main drawback of these studies is that, as consultancy reports, they are not published for wider readership. Their contribution to academic debate on the subject matter is therefore limited. Fortunately, some academic papers have been published from one of these research endeavours as evidenced in Wells (2000) and Wells and Wall (2003)—also published as Wells and Wall

(2001). Wells (2000) is mainly concerned with the environmental impacts of artisanal stone mining in Nairobi having undertaken a research project on the environmental impact of artisanal stone quarrying in Kenya funded by the UK Department for International Development through the ITDG.

Although not part of its main focus, Wells and Wall (2003) noted an expansion in the use of artisanal dimension stone in Nairobi and speculated on causal factors. Both papers mainly focus on the eco-technical perspective mentioned above. Although the other environments are mentioned such as the legal and political they are not conceptualized as part of a comprehensive discussion of the organizational environment. This weakness in the literature on Nairobi follows the general tradition of literature on dimension stone worldwide in which discussions concentrate on technological and ecological to the exclusion of macro-social issues. Nevertheless, the most critical contribution Wells and Wall (2003) make to the contemporary debate on artisanal dimension stone is their recommendation for further research and an understanding of the phenomenon from a *socio-technical perspective* although they do not exactly use these words.

According to Wells and Wall (2003), the production and use of building materials like artisanal dimension stone which has been promoted by the 'informalisation' of the construction systems in developing African countries presents a great challenge to regulation and may entail the risk of unsafe or unsanitary structures, degenerated conditions of employment, and probable environmental degradation. To tackle the challenge and risks in the contemporary African world, Wells and Wall (2003) suggested a way forward which includes:

- The recognition of artisanal production by other stakeholders including governments and donors through formulation of effective policies to support and streamline the activities, and;
- The direction of attention of academics and professionals in the construction sector to research the area of artisanal material production and use for further development.

Therefore this study is a step toward addressing some of these concerns about the challenge and risks involved in the production and use of artisanal dimension stone.

The literature on dimension stone in general and artisanal dimension stone in particular is therefore of limited application to the social reality in Nairobi and hence calls for a fresh look at the issue in its contemporary and local context. In particular, the existing literature is fragmented and does not comprehensively capture the socio-technical issues that are pertinent to on-going quarrying activities. This research therefore employs a socio-technical study of the production and use of artisanal dimension stone in Nairobi. A socio-technical approach, in general, applies to any research involving a social study of technology. Social study of technology can take place under several paradigms including the 'technological determinism' school, the social shaping of technology (SST) paradigm (MacKenzie and Wajcman 1985 and 1999, Edge 1988, William and Edge 1996), and the socio-technical systems (STS) theory (Trist 1981, Trist and Emery 2005).

Proponents of SST including MacKenzie and Wajcman (1985, 1999) and William and Edge (1996) have criticized previous social studies of technology for perpetuating the myth of 'technological determinism' by conceptualising the relationship between society and technology as a one way affair in which technology was taken as an independent variable that affected social life but not the other way round. Therefore it is this bias in the previous social studies of technology that the SST paradigm was meant to resolve. The SST paradigm posits that society shapes technology first before technology can affect society (MacKenzie and Wajcman 1985). In general SST engenders the philosophy that social and technological systems are mutually determining systems that must be studied in a holistic approach for deeper insights into their change outcomes.

Some STS commentators including Rohracher (2001) and Oborski (2003) situate the STS theory within the project of SST—although the STS concept predates the SST project—primarily because the STS theory considers the social and technological systems as mutually dependent. The socio-technical concept in the context of this study was introduced to academic discourse by the Tavistock Institute of Human Relations of London in the early 1950s (Trist 1981). At that time, the socio-technical theorists were committed to analysing the outcome of change in coal mining from an autonomous to a more mechanized process. The concept was first applied to small work groups in the coal mining but with the advent of the General System Theory (GST) by Ludwig von Bertalanffy in 1949/50 (see Bertalanffy 1950 and 1968) the originators of the

socio-technical principle synthesised it with the GST leading to the founding of the socio-technical systems (STS) theory and consequently the open system theory of organization. Therefore the STS theory became applicable to whole organizations and consequently to society in general.

In terms of applications, the STS theory has spread to cover interdisciplinary areas such as systems engineering, operations research, computer engineering among others (Ropohl 1999). Within these current applications, the socio-technical system is defined simply as 'a collection of interacting components in which some of the components are people and some are technological' (Hall and Rapanotti 2005). However, the socio-technical logic of this study is informed by the theory that the choices made by entrepreneurs involved in the production of dimension stone, according to Rohracher (2001, p. 139), depend on 'technological considerations, organizational, political or economic factors and on actor strategies'. The technological considerations, in this context, include configurations of knowledge, equipment and procedures 'that make up the material, technical, non-human elements' of production (McLoughlin et al. 2000, p. 20) while the social systems, in contra-distinction would involve all the non-material or the human elements including the actors, their beliefs, attitudes, laws and values influencing their interactions. Social systems may occur in hierarchies of work unit systems, whole organizational systems, or macro-social systems (Trist 1981).

Existing reports of socio-technical studies are mainly involved with the first (sub-organizational) and the second (organizational) hierarchies. To provide new insights, this study adopts the macro-social hierarchy that includes systems in the communities of actors involved in the production and use of dimension stone in Nairobi, the systems in the construction industry and institutions operating at the overall level of Kenyan society. The socio-technical perspective in this case takes the context attributed to such studies by Geels (2005) and Verbong and Geels (2007) involving the analysis of: network of actors and social groups; formal, normative and cognitive rules that guide the activities of the actors and; material and technical elements, involved in the production of artisanal dimension stone.

Therefore the main question in this study is: What are the socio-technical elements behind the production and use of artisanal dimension stone and how do they interrelate? Consequently, the aim, goal, or main objective of the study is:

to investigate the interrelationships of the socio-technical forces (variables) influencing the production of artisanal dimension stone for use in building construction within the city of Nairobi.

To achieve the main aim of the research, a summary of the specific objectives are stated below:

1. To explore the organizational structure of the construction industry in Kenya and identify the prevailing systems of building procurement in Nairobi.

2. To profile the internal structure and the external environment of producer organizations associated with the use of artisanal dimension stone for building in Nairobi.

3. To identify and ascertain the socio-technical forces (variables) influencing the operations of the producer organizations within the business environment associated with the use of artisanal dimension stone in Nairobi.

4. To analyse the interrelationships of forces influencing the production and use of artisanal dimension stone for building construction in Nairobi

5. To suggest adjustments to the enabling environment for the production and use of artisanal dimension stone in Nairobi based on the influences identified.

Further details of how to achieve these objectives are explained in Chapter Four on Research Methodology involving a discussion of the research design/strategy, research methods and techniques of data analysis.

1.4. The Study Area: Nairobi, Kenya

In Nairobi, as a city in a developing economy context, artisanal materials may form a significant means of constructing the building fabric i.e. floor, walls and roof. The main materials that are used in these cases can be identified through the housing census reports as detailed in Figures 1.3, 1.4 and 1.5. According to Figure 1.3, the materials used for roof construction are: iron sheets, tile, concrete, asbestos, grass, makuti and tin. Of these, the only traditional/artisanal materials are grass and makuti used in the form of thatch. The Figure also indicates that 0.07 and 0.1 percent of households in Nairobi lived under grass and makuti roofing respectively.

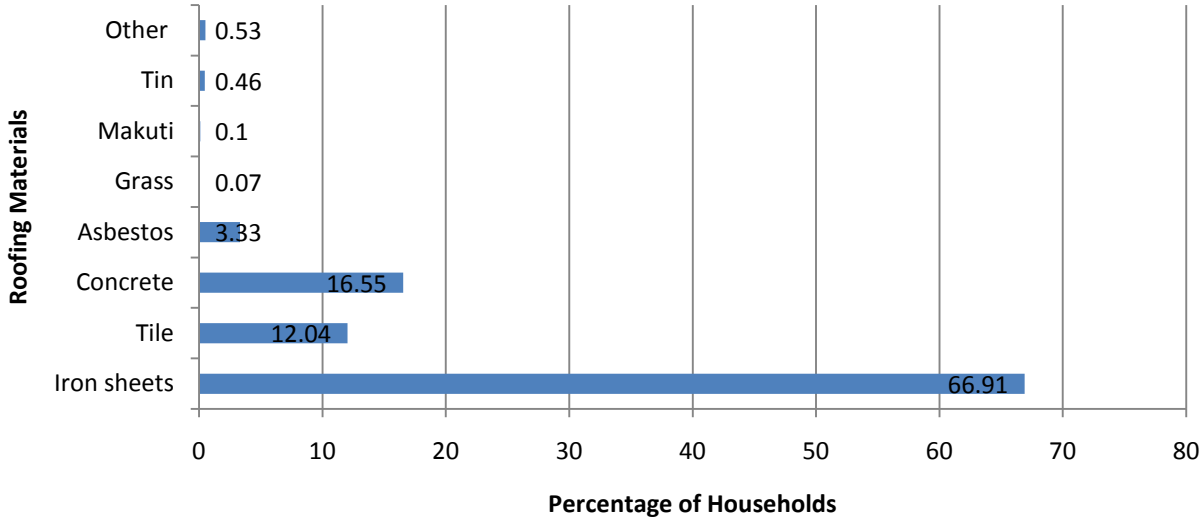


Figure 1.3: Number of households by main type of roof covering materials for the main dwelling unit

Source: Constructed with data from Republic of Kenya (2001 p.4-1)

It may be observed that Makuti, referring to palm leaf, is mainly used for roofing of residential buildings as a traditional material in the coastal region where it is available in abundance. In Nairobi, the material is used in commercial entertainment areas, such as clubs to effect uniqueness or traditional value in a modern urban landscape. As temporary materials, they are particularly used in areas under temporary occupation (use) since the building regulations do not allow the use of temporary materials in building construction. If the use of makuti was to be specified for conventional buildings then the plans of such buildings would not get development

approval. Grass is rarely used in any urban area in Kenya. Furthermore, apart from being a fire hazard in built up areas, it is virtually impossible to obtain in a place like Nairobi. Tin, although it is an industrially obtained material, its use as a roofing material is artisanal. Tin in this case refers to cans that have been flattened into sheets that are then used to cover the roof. The use is common in informal settlements.

Nevertheless, even if the use of grass, makuti and tin were considered and put together as artisanal materials for Nairobi, their application would still constitute less than 1 percent of dwellings in Nairobi. We can therefore safely conclude that the use of artisanal material for roof cover in Nairobi is negligible. The study would therefore not consider artisanal materials used on the roof of buildings in Nairobi.

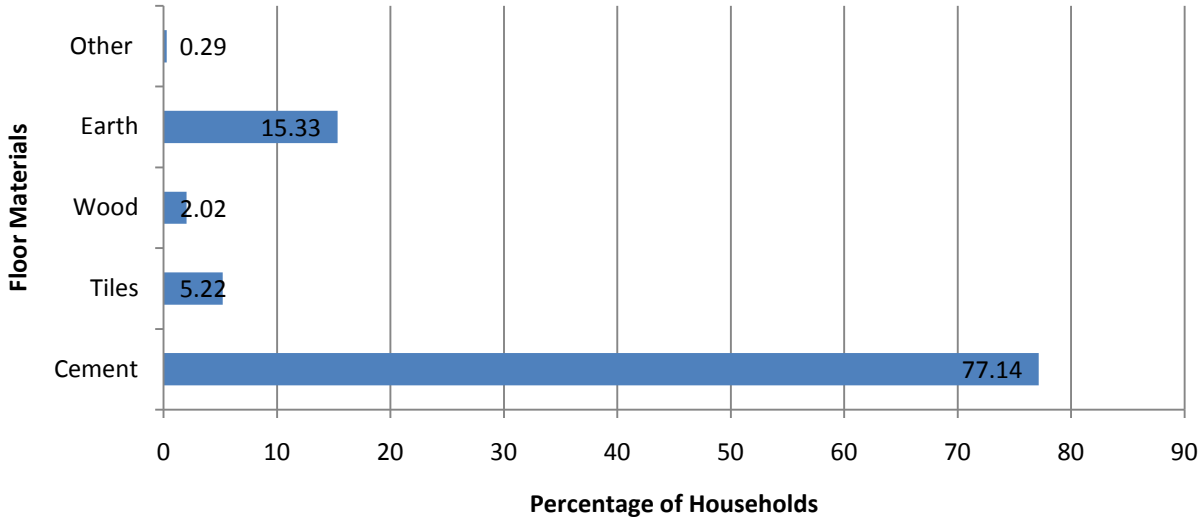


Figure 1.4: Number of households by main type of material for floor finish for the main dwelling unit

Source: Constructed with data from Republic of Kenya (2001 p.6-1)

For the materials for floor finishes, the census identifies: cement, tiles, wood, earth; Figure 1.4. Of these, earth is the only artisanal material but it is not permitted in the building regulations. It, therefore, cannot work for both the formal and informal sector. Wood floor finish is a highly industrialised material, the same for cement and tiles. Artisanal manufacture of these materials is

possible but there is no evidence of their production in Nairobi. Therefore the study excluded these materials.

For wall materials, the census identifies: stone, brick/block, mud/wood, mud/cement, wood only, iron sheets, grass/reeds, and tin, see Figure 1.5. Of these: stone, brick/block and wood only are the materials permitted by the building regulations. Wood is especially used in prefabricated construction that is a highly industrialised process. Informal use, however, also exists particularly concerning buildings with timber off-cut walls in informal settlements.

Stone, brick and block are conventional materials. They are permitted in the building regulations due to their permanence attribute. They are obtainable conventionally but artisanal production is also possible and acceptable. In practice, however, bricks and blocks are not produced by artisanal means in Nairobi.

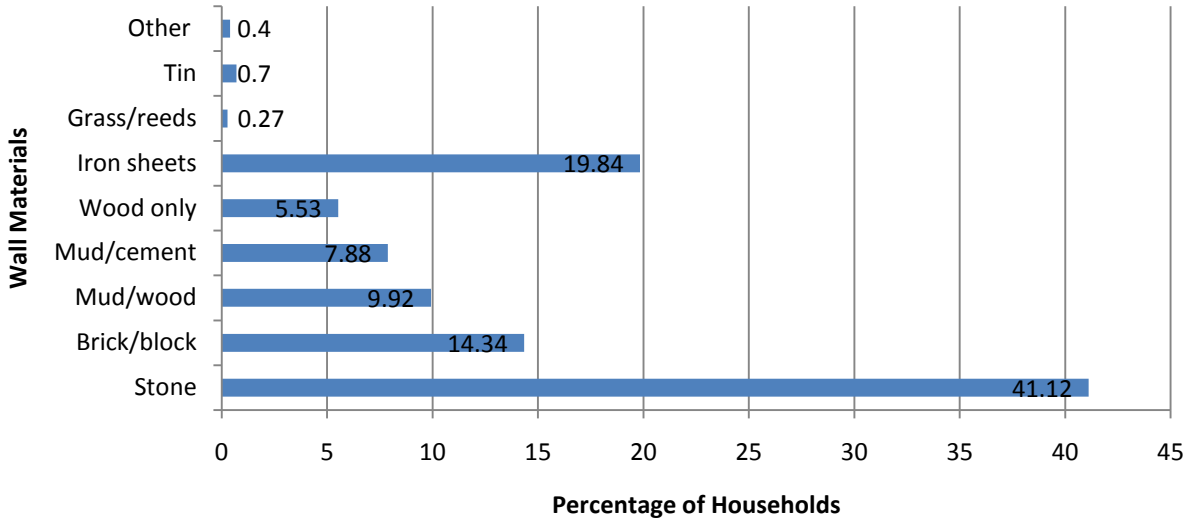


Figure 1.5: Number of households by main type of wall materials for the main dwelling unit
Source: Constructed with data from Republic of Kenya (2001 p.5-1)

This study is interested in materials that have the potential of serving both the formal and informal sectors of the economy and that can be produced by artisanal means. Stone qualifies for these specifications where use as a walling material is concerned. Stone is also appropriate for the

study because it is the main material for Nairobi housing encompassing 41.12 percent of the population. From this discussion on materials, we therefore find that dimension stone is the most suitable case study relating to the use of artisanal materials within the building industry of Nairobi.

Nairobi has been chosen because it is the largest urban centre in Kenya and therefore influential on what occurs in the rest of the country. The accuracy of national statistics have been questioned by Wells (2001) and K'Akumu (2006, 2007a/b) but, accepting them at face value due to lack of any contradictory evidence, they show that Nairobi is attracting more capital investment in buildings than the rest of urban Kenya combined, see Table 1 in Appendix 2. Likewise, the statistics show Nairobi as having the highest rate of household formation and hence a more pressing need for housing development, as demonstrated in Table 2, Appendix 2. Materials are the highest contributor to building construction unit costs (Kenya Building Research Centre 2006), hence a study involving material production, distribution and use is of greatest significance for the housing situation in Nairobi. Nevertheless, the factors generated and the processes used in this study may also apply in the general contexts of artisanal mining and the enabling environment.

1.5. The Study's Significance and Contribution to Knowledge

Artisanal exploitation of natural resources has come under intellectual scrutiny especially in the context of development research. The fishing and mineral resources have attracted greater attention in this respect leading to thematic areas of knowledge such as artisanal fishing/fisheries and artisanal mining. In the context of artisanal mining, one of the products that are used in the construction industry in Nairobi is the dimension stone. In this context artisanal dimension stone in Nairobi has been a subject of studies in the recent past by the ITDG, as already reported.

However, this work mainly exists as consultancy reports and their limited dissemination explain their small contribution to the academic debates in the use of artisanal dimension stone in Nairobi. Additionally because the ITDG studies are environmental oriented, they explain little about industrial organization based on empirical research. By overcoming these limitations of the

ITDG studies, this work will contribute an analysis of the forces within the enabling environment in which artisanal dimension stone is produced and used in Nairobi. So far the interrogation of the literature base provides no evidence that such a study has been undertaken for Nairobi or anywhere else in Africa which makes this research work a unique contribution to knowledge.

The research will also contribute the Nairobi experience to the body of knowledge in artisanal mining and the debate on the use of artisanal building materials. It will also contribute to the literature on enabling environments for artisanal production within the urban economies of developing countries. The analysis of the institutional interrelationships among the stakeholder organizations that includes both formal and informal organizations will provide opportunities for integrating artisanal activities into the formal sector of the economy thereby achieving an enabling environment for artisanal producers as premised at the beginning of this study.

The issues discussed in this study are transferable and comparable to issues affecting the informal sector in developing countries i.e. the production and consumption of informal goods and their roles in economic development and empowerment of the poor. The analytical process may be applied in many respects concerning the enabling environment of any economic activity/industry in the developing world. Its recognition of artisanal entities as organizations within the economic system challenges the present conceptualizations of knowledge that present organizations as formal or social such that what is not formal is not economic. Based on a microcosmic scale of artisanal producers in Nairobi, the research is questioning conventional development and economic terminological dichotomies such as formal/informal, organizations and non-organizations etc.

This study also follows the philosophy of critical social science in dealing with the social and economic problems of artisans producing dimension stone in Kenya. Sayer (1997 p. 474) has observed that ‘there is no point in social science if it does not at least offer the possibility of some kind of social improvement, even if it doesn’t go beyond enlightenment and reduction of illusion, to material change’. Bhaskar (1986) has therefore argued for an approach to social science that would ensure the emancipation of its target groups by enabling them to see how to replace

unwanted determinations by wanted and needed determinations. To this effect four stages of critical social science have been identified involving (Sayer 1997):

1. Problem identification; unmet needs, suffering, false beliefs
2. Identification of sources or causes of those unmet needs, suffering, false beliefs
3. Passing to a negative judgement of those sources of illusion and oppression
4. Favouring, other things held constant, actions that remove those sources.

This study will therefore embrace this philosophy of emancipatory social science in its examination of the phenomenon of artisanal production of construction materials in order to bring change to the life of the actors.

1.6. Definition of Concepts used in the Report

Artisanal Building Material: Building materials made exclusively by manual procedures as opposed to automated procedures

Artisanal Dimension Stone: Block of stone excavated and cut by hand and used in construction of walls of buildings.

Business Environment: A total set of institutions, networks and actors that affect the decisions and activities of an enterprise.

Confirmatory Factor Analysis: this is a class of factor analysis that requires that the researcher must have *a priori* knowledge or expectations regarding the number of factors, which variables reflect given factors and whether the factors are correlated (Thompson 2004). It explicitly and directly tests the fit of factors models.

Enabling Environment: The business environment of an enterprise evaluated in terms of being friendly or hostile.

Exploratory Factor Analysis: this is a class of factor analysis that does not require the researcher to have *a priori* knowledge or expectations regarding the number or the nature of underlying constructs or factors (Thompson 2004).

Factor Analysis: Refers to a number of statistical techniques that endeavour to discover and explain the internal relationships of a set of variates (Lawley and Maxwell 1971). In social science factor analysis is usually applied to correlations between variables (Kline 1994: 3).

General System Theory: A construct that holds that all systems whether organic, organizational, mechanical or electrical function by obtaining inputs from and giving outputs to the external environment.

Indigenous Building Material: Building materials that have been domesticated within the construction industry of a locale regardless as to whether they are traditional, conventional or hybrid.

Informal Sector Enterprise: An enterprise that exist outside of the realm of business regulation.

Jua Kali: Literally means 'hot sun' but refers to informal sector enterprise or product.

PEST: A generic term for the socio-technical environment of businesses, used here to include all its derivatives.

Pre-colonial City: A city that existed in Kenya prior to the establishment of colonial rule (circa 1889).

Socio-technical systems: Systems of whose parts are composed of human beings and whose other parts are composed of machines and tools

Traditional Building Material: Building materials that are historical used by the local people

1.7. Scope of the Study

The geographical scope of the study is Nairobi, the capital city of Kenya. However the research findings may apply to the rest of Kenya, Africa and the developing world. The material of study

is limited to artisanal dimension stone although the literature on artisanal materials and stone mining has informed the research process. The scope of the research is also confined to the building industry where players like architects, quantity surveyors, building contractors, structural engineers and artisanal material producers are concerned. These players formed the main stakeholder groups who provided primary data in the research process. In this context of the building industry, the study is only concerned with the production and supply chain of artisanal dimension stone. These include the processes in the quarry site and the processes that get the stone from the quarry site to the building site. Any *in situ* or *ex situ* building processes subsequent to the delivery of the stone to the building site are outside the scope of this study.

In terms of theoretical base, the study adopted the socio-technical perspective including the system theory as defined by Ludwig von Bertalanffy. The study does not test the socio-technical theories but only uses them as theoretic methodological guidelines in the research process. The socio-technical perspective sets the limits of the study to the PEST and its derivative environments as defined above. Since the study does not test the socio-technical theories, it employs exploratory factor analysis (EFA), which unlike the confirmatory factor analysis (CFA), is not hypothesis oriented, i.e. the researcher does not make *a priori* assumptions regarding variable interrelationships. Finally this is a cross-sectional survey whose temporal range of data includes the field and desk research done between 2007 and 2009.

1.8. Organization of the Report

The following is a brief outline of draft chapters of the dissertation that has come forth at the end of the schedule of research activities.

Chapter 1: Research Issue and Background. This chapter gives a general introduction to the study, introducing the research problem, the research objectives, and reasons for undertaking the research, its significance and contribution to knowledge.

Chapter 2: The Socio-Technical Systems Perspective. This chapter discusses the concept of socio-technical systems that form the theoretical background to the study. The socio-technical systems compose the business environment

Chapter 3: A Review of the Business Environment. This chapter discusses the literature available in relation to the identification of the gap of knowledge. This involves a discussion of the UNCHS policy initiatives of the 1980s on indigenous materials and the ITDG initiated studies on artisanal dimension stone in Nairobi. Conclusions are drawn from this discussion that gives the direction of focus for the current research under consideration.

Chapter 4: Research Methodology. This chapter details the research methodology that guided the study. It explains the epistemological stance and the ontological strategy of the research. Additionally it explains the methodical strategies including triangulation, data collection, data access and data analysis. Lastly it explains the research design that exists in two aspects: the exploratory and the conclusive research designs.

Chapter 5: The Business Environment of the Building Industry in Nairobi. This chapter will give an overview of the construction industry in Nairobi. The purpose is to report the outcome of Objective 1. It examines the building industry in order to identify the broader socio-technical systems that influence the enabling environment.

Chapter 6: The Business Environment of Artisanal Dimension Stone in Nairobi. This chapter gives the context of artisanal dimension stone in Nairobi. The purpose is to report the outcome of Objective 2. It deals with issues that are specific to the business environment of artisanal dimension stone.

Chapter 7: Factor Analysis of the Enabling Environment. This Chapter presents evidence from the conclusive field research. It also explains in details the analytical procedures and processes and lays out the results of analysis and reports the outcome of Objectives 3 and 4. The main analytical procedure applied in the study is Factor Analysis. Sections that follow the analysis constitute the discussion of the results as obtained from the analysis. This is in relation to Objectives 5 that involves a discussion of the outcomes of the previous objectives. This involves interpretation of the results and a discussion of their implications leading to *Chapter 8: Study Conclusions* that gives conclusions and recommendations

1.9. Summary

This Chapter has given the background and context of the research. The study focuses on production and supply of artisanal dimension for building purposes in Nairobi, Kenya. It focuses particularly on the socio-technical aspects of the production and supply processes of artisanal stone an area that has been ignored in the literature for Nairobi. The objectives of the study have been stated and are met in chapters 3, 5, 6 and 7. In the next chapter the study follows up on the socio-technical perspective that forms the basis of this research as already discusses under section 1.3 in this chapter.

CHAPTER TWO

2. THE SOCIO-TECHNICAL SYSTEMS PERSPECTIVE

2.1. Introduction

This chapter discusses the socio-technical systems theory introduced in Chapter One under the Research Aim and Objectives (section 1.3). The socio-technical systems form the basis of the analytical theory guiding this study.

The business environment for the artisanal organizations involved in the production of dimension stone in Nairobi can be considered for research through a handful of theoretical perspectives, which are competing and or complementary in nature. These include the theory of artisanal and small-scale mining (popularly abbreviated as ASM), Micro and Small Enterprises (MSE) theory and, organization theory.

ASM applies to the mining sector but since the production of artisanal dimension stone involves quarrying, which is an aspect of mining, some ASM issues therefore apply to this study. The problem of an exclusive ASM approach to this study is that it would be restrictive. Its scope is limited to the mining sector where the dominant issue in the literature concerns artisanal gold mining and its attendant problem of mercury pollution. A scope limited to the mining sector therefore may fail to capture adequately the market side of the mining product (dimension stone) i.e. the construction sector where this study is situated in terms of its professional orientation (the researcher is a built environment professional) and academic discipline (the research is based in the Department of Property and Construction). Thus this study does not adopt ASM as its main theoretical approach; nevertheless ASM literature is referred to where it appears relevant and complementarily useful.

MSE and its counterpart SME (Small and Medium-scale Enterprises) are a set of theoretical approaches that analyse the business environment of enterprises by first categorizing them according to size ranging from Micro to Small, or Small to Medium. The size categorization is mainly according to the number of employees. In their study of an MSE cluster in Nairobi, for

example, Opiyo and K'Akumu (2006, p.243) indicated that in Kenya Micro enterprises are classified as enterprises that employ 1-9 people while Small-scale enterprises employ 10-50 people. Going by the number of employees, the artisanal organizations are largely Micro enterprises while a few others may fall under Small-scale classification hence they can be identified as MSEs.

The main problem with the SME theory is its conceptualization of business units by numbers. The threshold numbers differ from country to country hence theory building is hampered by lack of a standardized operational definition. In this respect SME does not distinguish whether the businesses are sole proprietors, partnerships or companies; whether they are formal or informal et cetera. The informal sector in developing countries has received a lot of intellectual attention following the work of Hart (1973). In Kenya it is popularly known as *jua kali* (literally meaning hot sun) in reference to the business environment of artisans who work under the scorching heat of the tropical sun to earn a living (see for example King 2005, Bigsten et al. 2000, Barasa and Kaabwe 2001, McDade and Malecki 1996). The *jua kali* sector itself is not homogeneous but composed of several enterprise typologies involving hand tool manufacturers (artisans) in different sectors, street and market vendors, service artisans like mechanics and many others (King 1996). This study on artisanal dimension stone is particularly concerned with hand tool manufacturers (artisans) in the construction sector. As in the case of ASM, the literature on the business environment generated under the SME will be cited in this work where it is relevant but the work particularly is not based on SME theory for the reasons under discussion.

SME researchers in Kenya have pointed to difficulties in explaining enterprise behaviour owing to the wide variation in their characteristics. This is the case with the study by McCormick et al. (1997) where it is noted that pinpointing the reason for the stagnation of small enterprises in Nairobi was difficult because they were so varied. Some of the researchers are now turning to the systems theory in order to understand the peculiarities of the business environment in Africa and how it in turn affects enterprise behaviour as seen in the case of Pedersen and McCormick (1999) on African business systems in a globalising world.

Likewise, this study also has turned to the systems theory to analyse and understand the business environment of artisans producing dimension stone in Nairobi. The theory of choice for this study therefore is: organization theory. Unlike the ASM theory that may concentrate only on the production environment to the detriment of the marketing environment, the open systems aspect of organization theory is able to link all the variables in the production and market environments thereby encompassing the entirety of the business environment for the organizations under study as explained in the following sections.

2.2. Organization: Definition and Types

The term organization may refer to either a process or the result of organizing (French and Saward 1983, Collin 2004, Baum and Rowley 2005). In the general context of organization theory the process explains the how i.e. the way people and activities are organized while the result represents what is being organized i.e. an entity (Child 2005). It is the latter aspect that this study focuses on. As an entity, an organization will have its own specific character and identity. These characteristics differ across organizations making it possible for different classifications of organizations to exist in the real life.

Organizations may be classified according to their broad objectives e.g. private organizations, which have the objective of making profit. Public organizations on the other hand are not for profit. There are other types of organizations that are in between these two extremes such as: not-for-profit organizations, non-governmental organizations, quasi-public or quasi-private organizations et cetera. In this context, the organizations of concern for this study are private or for profit in nature (Campbell 1997).

Private organizations may further be classified according to size e.g. micro, small, medium and large business enterprises. As already discussed, the organizations this study is focusing on are mainly micro in nature while a few may be classified under small enterprises. Business enterprises may also be classified in terms of formal and informal depending on how they are constituted and how they conduct business. In this context the organizations this study is dealing with fall under the informal sector.

Formal business enterprises on the other hand may be classified according to ownership categories i.e. sole proprietorship, partnership, private limited company and public limited company (see further discussions in section 2.7). Informal organizations may be classified under sole proprietorship because like sole proprietors, they are not enacted in law and tend to be owned and operated by one person. Organizations engaged in production of goods may also be classified according to the technologies they employ. In this context, those employing machines are industrial while those applying handcraft technologies are artisanal. This study deals with the later organizations. The theory of organizations, in its latest development has been informed by the system theory; which is explicated below.

2.3. Origins of the system theory

The system approach is based on the principle of the general system theory that was developed from the ideas of Ludwig von Bertalanffy—the German-Canadian biologist. There are two principles of the system theory that bear direct relevance to this study i.e. the first one can be stated as follows: a system is defined on a mathematical basis as 'any whole consisting of a set of components and a set of their relations' (Mulej et al. 2004, p. 50). The second principle holds that a system is open i.e. it has relations with its environment. To demonstrate how an open system relates to its environment, Bertalanffy used a communication feedback scheme shown in Figure 2.1.

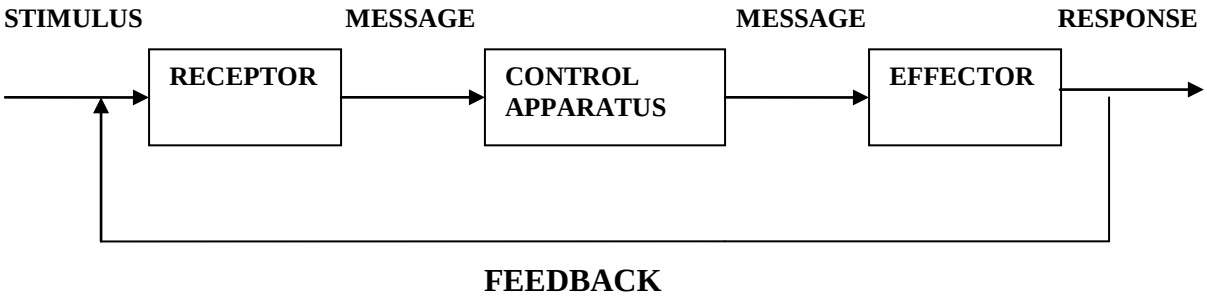


Figure 2.1 Communication feedback model

Source: Bertalanffy (1968, p.43)

In this scheme he demonstrated that an internal system consisted of a receptor that would get a stimulus from the external environment, relay the message to a control apparatus. The control apparatus would then forward the message to an effector whose purpose is to respond to the stimulus and the response is fed back to the environment. Bertalanffy (1968) pointed out that this feedback model applied to technological devices as well as any living organism. Bertalanffy (1968) proposed that this model could apply to the concept of organization too. He argued that organizations whether of society or biological organisms were characterised by notions of wholeness, growth, differentiation, hierarchical order, competition etc which can be defined within a mathematical model of a system and theories could be developed to deduce special cases from general assumptions. However, when proposing this scientific way for the study of organizations, Bertalanffy (1968) threw caution on its wholesale application.

He drew attention to the fact that there were 'many aspects of organizations which do not easily lend themselves to quantitative interpretation' (Bertalanffy 1968). Additionally, he noted that there were aspects of organizations that could not be measured easily and so we had to 'content ourselves with their explanation in principle as a qualitative argument'. The system theory is mainly applied in this work as a methodological device as explained further in section 3.6.

2.4. Systems Approach to the Study of Organization

The proponents of the systems theory rejected the universal principles advocated by the classical and human relations approaches on the grounds that an organization's operations depended on its own unique environmental circumstances (Woolf et al. 1985). The systems theory is very useful to this study owing to the basic assumption of interrelatedness that corresponds to the study's main concerns with interrelationship of forces/variables. Applied to the study of organizations, the systems theory assumes that an organization is interrelated with its environment such that a change in the environment will effect a change in the organization and vice versa. This fits well with the assumption of the study that changes in the institutional (enabling) environment would lead to changes in the performance of producer organizations.

The systems theory of organizations is based on two key concepts; one is what the sociologists have termed as embeddedness (after Granovetter 1985), also known as interdependency or contingency while the other is the notion of boundary (Collins 1998). Boundary refers to an imaginary line of separation between the organization being studied and its external environment where transactions or exchanges take place between the two sides (Collins 1998). The notion of contingency, on the other hand implies that the functions of the organization under study is contingent upon its external environment. Daft (1992: p.71) defines the organizational environment to include 'all elements that exist outside the boundary of the organization and have the potential to affect all or part of the organization'. However, given that the organization has its internal environment too (see Campbell 1997) what Daft describes is generally defined as the external environment which can be broken down for purposes of analysis, into: the task environment (also known as the micro environment) and the general environment (also known as the macro environment (see for example, among others, Daft 1992, Bartol and Martin 1994, Brooks 2003, Campbell 1997). The theory assumes a case of 'open systems' as described below.

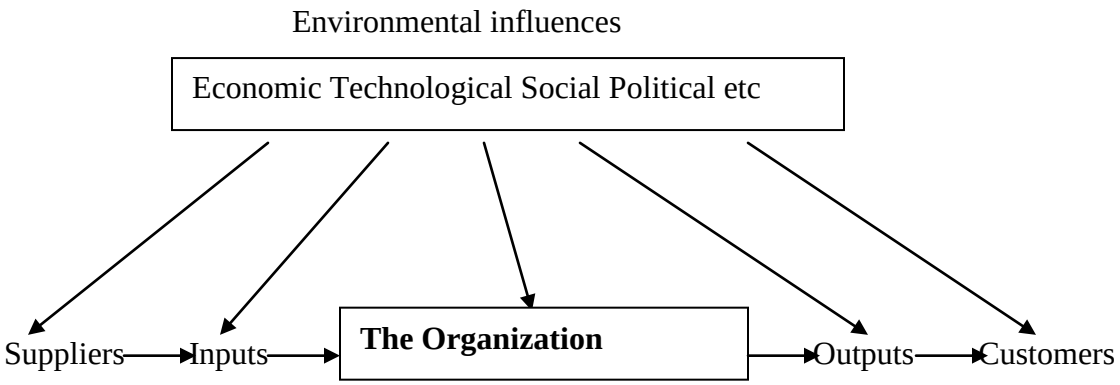


Figure 2.2: The organization and its environment
Source: Palmer and Hartley (2006, p.3)

Figure 2.2 illustrates an open systems model an organization that receives inputs from its external environment, processes the inputs and then gives it back to the environment as outputs. The arrows represent the transaction/exchange processes between the study organization and its external environment. As already mentioned, the study organization's external environment can be divided into two for ease of analysis—the micro and the macro environments which are

usually categorized into Political, Economic, Socio-cultural, Technological (PEST) environments, or its derivatives (see, among others, Campbell 1997, Brooks 2003, Buchanan and Huchzynski 2004, Capon 2000, Johnson et al. 2008, and Bartol and Martin 1994). Figure 2.4 is a graphical illustration of the elements of the micro and macro environments.

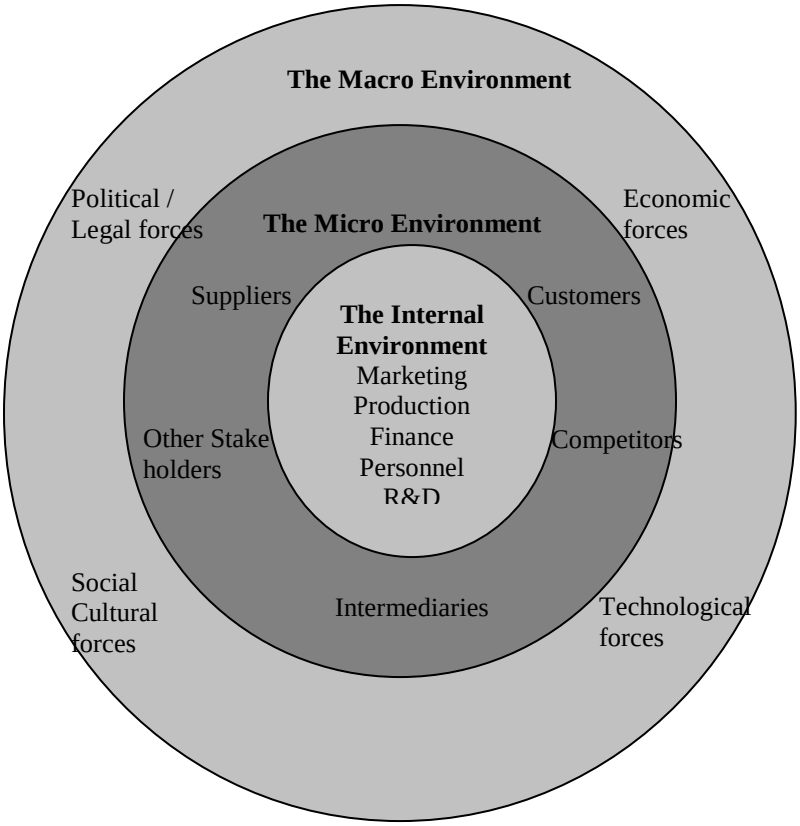


Figure 2.3: The principal elements of a business organization's environment
Source: Palmer and Hartley (2006, p.4)

The political environment would include issues such as the actions and policies of political authorities that influence the activities of the study organization (Campbell 1997). The political authorities may be of national or sub-national government origins. The economic environment on the other hand involve issues of type of the national economic system—whether command, mixed or market economy (Campbell 1997). The Kenyan economy, for example, has been re-organized towards the market typology through the Structural Adjustment Policies (SAPs) of the Bretton Woods institutions. The economic environment also involves issues of unemployment

levels and types and the regulations and practices involving financial and capital markets. Issues of industrial protection policies and fiscal policies regarding product subsidies and taxation are also relevant.

Connected to the political and the economic environments is the socio-cultural environment that involves the analysis of the demographic features such as population size, distribution, composition and changing trends (Campbell 1997). Relevant in this case, also, are the cultural attributes of the population including the opinions, beliefs, norms and preferences. The general awareness and interestedness by the population concerning environmental issues related to a product's processing and consumption will also influence the activities of the study organization.

The technological environment is related to the cultural history of a country (the national political set-up) and its economic system. Technology is of great significance to the economics of the study organization because it can reduce the overall costs of the organization by replacing manual tasks with automation (Campbell 1997). Likewise, it can enable increases in the study organization's productivity in terms of increased volume of output or increased product volume per unit cost. Technology can also increase the quality of the organization's product by removing the human error and introducing more consistent procedures (Campbell 1997). In terms of the processes, technology can speed up the processes so that the turnaround time is reduced for the organization's products and services (Campbell 1997). This study is directly concerned with the technological environment as it considers the artisanal aspects of stone extraction and cutting.

The legal environment can form part of the political environment but due to its complexity and importance it deserves a separate attention. To start with, the legal framework is what forms the basis upon which organizations come into being. Going by the definition of enactment as the basis of organization formation the influence of the legal environment cannot be emphasized. In the same token, the functions of organization must conform to the legal framework, otherwise it risks ceasing to be an organization. Apart from giving life to organizations, the legal framework also defines and enforces property rights that are a very crucial bit to the survival of organizations upon enactment. Additionally, the laws permit individuals to engage in lawful activities without fear of or actual molestation by others, restrict unlawful behaviour and constrain individuals to

comply with legally required activities or business (Campbell 1997). Most significantly, the law supports and streamlines the transactions/exchanges between the study organization and the stakeholder organizations within its external environment such as enforcement of private contracts, payment of taxes and fees et cetera. The system that ensures law and order is composed of the police and the judiciary. In this respect, when North (1990) defines organizations as players and institutions as rules of the game, the legal framework makes the bulk of the formal rules. The informal rules are also defined in contradistinction to the formal rules laid out in the legal framework. The transactions/exchanges that take place between the organization under study and its external environment are conducted according to the provisions of the law.

The ecological environment is concerned with issues to do with availability and use of natural resources and pollution of the ambient environment by the study organizations. Issues to do with environmental ethics like: employment practices and health and safety in workplaces are also important (Campbell 1997). Some writers also consider the spatial dimensions by differentiating between the local, national and international scopes of these factors (see for example Campbell 1997, Capon 2000). Given the localized scope of the subject organizations in this study, the national and international environment are not very significant hence it is not considered in detail here. How the systems approach has been applied practically in this study to analyze the enabling environment of producer organizations involved in the artisanal dimension stone in Nairobi is explained in Chapter Four.

2.5. The Concept of Formal Organization

The definition of organization given above is a generic one. However, in the world of theory organization is known to be a value laden concept where the definition of organization excludes entities that are not formal.

Following the work of Max Weber, *The Theory of Social and Economic Organization* first published in 1920 and translated into English in 1947, organization has been conceptualized as either formal or social (Weber 1947). For instance, within this theoretic construct Blau and Scott (1963) in their book on formal organizations conceptualized organizations as formal entities and any other entity that is not formal is social. In his later book on the subject matter, Blau (1983)

succinctly put it that 'social systems produced by formally enacted procedures rather than merely emergent forces are organizations'. In this sense organizations must be corporate bodies enacted into being through applicable law. Any entity that is not enacted is classified as emergent and therefore is not formal. Secondly, what is not formal is not an organization. In making this distinction Blau (1983 p.29) wrote that 'whenever groups of men associate with one another, social organization develops among them, but not every collectivity has a formal organization. The defining criteria of a formal organization—or an organization, for short—is the existence of procedures for mobilizing and coordinating the efforts of various, usually specialized, subgroups in the pursuit of joint objectives'.

Blunt (1983 p. 1), who made an attempt to contextualize the concept of organization in Africa, unfortunately, followed the same theoretic construct by noting that the term organization refers to formal entities but 'where social life exists without a formal framework […] it is considered more appropriate to use the term social organization'. To give further illustrations of this theoretic perspective, Dawson (1996: p. xxii) in her book on organizational analysis, defines organizations as 'collections of people joining together in some formal association in order to achieve group or individual objectives.'

Therefore we have organizations as formal entities on the one hand and social organizations as non-formal entities on the other. In the context of this research, the artisanal producers fall under emergent or social organizations. This social designation implies the organizations have no economic purposes. The study differs from this perspective for the reasons advanced in this section and proceeds on the assumption that artisanal producers operate as organizations for all practical purposes. The next step for the study is to assess the analytical options available for studying them as organizations.

Generally, there are three main approaches that can be used in the study of organizations i.e. classical, human relations and systems approaches (see for example Williamson 1981, O'Shaughnessy 1966). The classical approach considers an organization as a formal entity operating within certain defined principles such as division of labour, unity of command, unity of direction, scalar chain, centralization etc (Williamson 1981, Woolf et al. 1985). By defining

organization as formal entity, the classical theory of organization isolates the type of organizations that this study proposed to deal with hence the theory is largely not applicable to this work but helps to demonstrate the limitations of the theory of organization in capturing the organizational realities of the developing world. Secondly, its concentration on the internal management of organization makes it irrelevant for a study that is looking at the institutional environment.

The human relations approach as a reaction to the classical approach by theorists who saw organization not as mere social structures ruled by rationale but more importantly as structures created and constituted by human beings whose actions made them function or not. This approach mainly focuses on the internal management of personnel in individual organizations which this study is not concerned with; hence it is not relevant to the study at all. In contrast to the human relations approach, the systems approach is quite relevant to the study to the extent that it considers an organization as a web of interacting variables within an environment (Williamson 1981). The following section explains some details that make it relevant to this study.

2.6. Refuting the Concept of Formal Organization: The Western Perspective

The concept of formal organization has been refuted in other quarters, without specific reference to organizations in developing countries, in a body of literature that has assumed the name of post-modernist organization theory. The post-modern organization theory begins by identifying the mainstream organization theoretical perspectives—i.e. classical, human relations and systems schools of management thought—as the modern theory of organization. The post-modernist writings involve the refutation of these theories as not fitting the current organizational reality from the Western perspectives.

According to Clegg (1990), organization theory, especially as espoused by Max Webber, is a creation of modernity. It has already been noted that Max Weber influenced the theory of formal organization. Hancock and Tyler (2001) links the root of the modern tradition to the period of the European Enlightenment dating from the mid seventeenth century and bringing forth grand ideas

about the universality of human knowledge, culture, progress and history. The Enlightenment project, as it has come to be known (Hancock and Tyler 2001: p. 11), therefore put forward the contestable conception of the European thinking and tradition as the basis for universal human progress. This is the position that is currently being contested in the postmodernist debate that has also engulfed the theory of organization.

Hancock and Tyler (2001: p.55) present the postmodern concept of organization as 'one that eschews the formalistic imperatives of modernist organizations in favour of increasingly informal, flexible and culturally—driven means of organizing work'. The debate on postmodernist organizational structure does not help the case of the study organizations to the extent that it relies on the Enlightenment project's idea of progress. Progress in this context means the postmodernist organization marks a transcendental or successive change from the modern to the postmodern. The postmodernist literature itself can be confusing as it offers several denials that it marks a transcendental change but technologically this is affirmed when the postmodern organization is generally identified as having loosely related parts joined together by a system of computers. The postmodernist organization is therefore a technologically advanced organization and does not include pre-modern or artisanal technological positions.

Nevertheless by refuting the modernist concept of formal organization in the contemporary world, the postmodernist project opens the way for the recognition of other non-modernist organizations. It also opens the way for such organizations to be considered in the debates on the theorization of organizations. Therefore, the recognition of artisanal organizations and their subsequent placement in the body of organization theory are what this study contributes in this context.

2.7. Refuting the Concept of Formal Organization: The Developing Country Perspective

As already pointed out, the theory of organization considers an organization as a formal entity—any other entities are social organizations. It is notable that in the theory of organization the entities that are not formal are not referred to as 'informal'. Within this theoretical discourse, the term 'informal organization' is used to refer to non-formal processes within an organization as a

formal entity. The result of this is that all other economic activities by actors who do not fall under organizations, defined as formal, are classified under social organizations even when their motives are for profit making. This means that all the informal sector operators in developing countries are conceptualized as social organizations. In the theoretical discourse certain concepts are applied to describe the social groups or non-organizations. Blau (1983), for example uses the term 'emergent' to distinguish them from 'enacted' organizations.

If the study were to accept this definition, it would not be possible to analyse the artisanal producers of dimension stone in Nairobi using the organizational principles discussed above since the producers' operations would fall under non-organizations. Therefore the study is challenging this conceptualization of organizations and asserts that, where artisanal producers of dimension stone in Nairobi are concerned, the so called emergent social systems are not different from the so called organizations in terms of economic functions and productive objectives.

Further, the study argues that this conceptualization of organizations as informal constitutes a cultural basis for disabling the participants of the informal sector, including the artisanal producers. Therefore, to create an enabling environment for artisanal producer organizations, this cultural construct has to be demolished first of all. In order to demolish this theoretical construct and justify the applications of the analytical techniques on the organizations involved in the production of artisanal dimension stone in Nairobi, the study proceeds on the following bases.

The study relies on the general definition of organization as an entity without making distinction according to formal or social categories. In this way, it makes it possible to bring the artisanal producers within the concept organization for purposes of this research. Moreover, in the context of business, organization simply is the result of dividing work among people and coordinating their efforts—a need that arises when running a business gets beyond the capacity of one person to perform (O'Shaughnessy 1966).

Moreover, the restriction of the term 'informal organization' to processes other than entities by formal organization theorists like Blau is not entirely binding in the theory of organization. For example, Litterer (1973 p.17) used the term 'naturalistic' to refer to organizations that spring up

‘spontaneously from the needs of people who comprise them rather than from the wishes of an external authority’ in contradistinction to ‘planned’ or ordered organizations. According to Litterer (1973: p. 17), the naturalistic organizations ‘tend to be smaller, appearing as friendship cliques, families, informal organizations and so on’. Citing ‘informal organizations’ as an example of what he classifies as naturalistic organization, in this case, is recognition by Litterer that the term ‘informal organizations’ can be used to describe the informal sector operators in developing countries.

Some other writers have also queried the objectivity of mainstream organization theorists. Clegg and Hardy (1996), for example, pointed out that much of organizational research is biased toward large publicly quoted organizations—a bias that influence the organization theories researchers’ build. Aldrich and Ruef (2006) have attributed this bias in research to the fact that information is readily available on large corporations from the returns they have to file with the relevant regulatory bodies. For this reason, Aldrich and Ruef (2006: p.7) have observed that discussions of organizations in books and journals ‘often nourish an aura of unreality among scholars’ who portray organizations as large, powerful and long lasting corporations. However, Aldrich and Ruef (2006) found that corporations constitute a minority of all businesses while publicly quoted companies constituted a minority of all corporations in the US. In their research involving an evolutionary approach to the study of organizations in the US, Aldrich and Ruef (2006: p.7) observed that the majority of organizations were small and short-lived ‘coming and going on a much shorter timescale than the humans who create and run them’. Further, they noted that whereas large companies were economically dominant, most organizations were small in size but significant employers. Although Aldrich and Ruef (2006) refer to small corporate organizations, the points their study raised are also applicable to informal organizations that is the subject of the present study. These include issues of lack of readily available data and lack of research attention. Moreover, informal organizations are organizations in their own rights when organizations are categorized as incorporated or non-incorporated as shown in the diagram below.

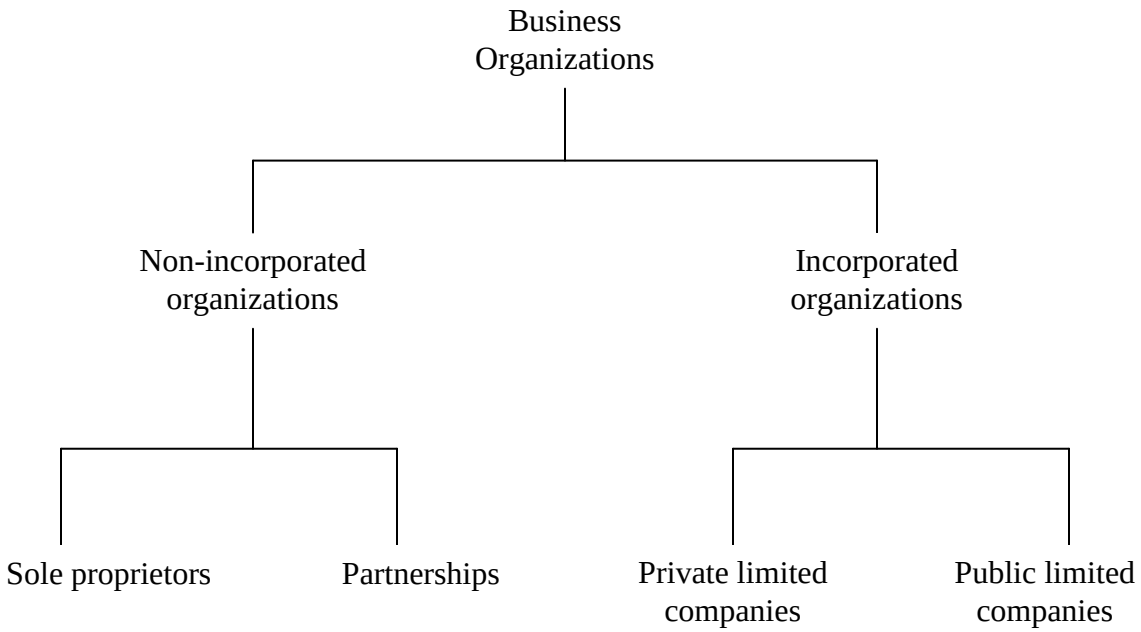


Figure 2.4: A taxonomy of private sector business organizations
Source: Campbell (1997: p.36)

According to Campbell (1997) not all businesses organizations have to be corporate as shown in Figure above. Non-incorporated organizations exist in terms of partnerships (that are recognized as legal entities) and sole proprietorships (that are not recognized as legal entities). There is no formal procedure for setting up a sole proprietor business and no requirement for sole proprietors to keep records except for tax purposes (Campbell 1997). Although the name implies one person carrying out business, this is not always the case. In the UK, for example, Campbell (1997) noted that sole proprietors employ as many as 100 staff. The start-up capital for a sole proprietor is usually limited to costs of buying tools or renting premises. The informal sector operators in the developing economies can be classified under sole proprietor organizations. For that matter, they can be studied using the framework of study as outlined above.

Refuting both the formal and informal organization within their current theoretical constructs is intended to justify the application of organizational analysis techniques to the study of informal organizations. After this justification, in Chapter Three, the research proceeds to explore the informal sector where these informal organizations operate in developing countries.

After discussing the mainstream organization theory, it is now appropriate to consider organization theories that are applicable in the built environment.

2.8. Organizational Theories of the Building Industry

Having considered the general organization theoretic approach for the study, it is now useful to evaluate some of the organizational theories that are specifically applicable in the building industry, where the products of the subject organizations fall, in order to evaluate the theories' relevance to the study at industry level and their likelihood to make a contribution to the debate on the enabling environment for the production and use of artisanal dimension stone.

These theories include what Ball et al (1998) termed the Agency-Structure Healey (ASH) Model in reference to the idea of structure and agency interrelationships and their effect on property development that was contributed in the writings of Patsy Healey (see Healey and Barret 1990 and Healey 1992). According to the ASH model, an analysis of the development process requires an explicit framework for the understanding of the relationship between structure and agency. Structure in this case is defined as 'what drives the development process and produces distinctive patterns in a particular period' while agency is defined as 'the way individual agents develop and pursue their strategies' (Healey and Barret 1990 p. 90). The structure is seen as the distinctive pattern established by the way agents operate in deploying, acknowledging, challenging and potentially transforming resources, rules and ideas as they frame and pursue their own strategies (Healey and Barret 1990).

In the model, resources are taken to mean the 'primary ingredients of the production process of a development, including land rights, labour, finance, information and expertise' (Healey 1992 p.35). Accordingly, the nature of resources available will define the economic structures guiding production and exchange relations in general and the built environment in particular. The rules on the other hand refer to rules of institutional organization and political regulation that govern the way material resources are used. Healey (1992) notes that such rules may be formalised in law and administrative procedure or exist as a custom practice. This conforms to the formal and informal sectors common with the production systems of developing countries and which forms

the main subject of this research. Healey (1992) observes further that the way rules are used and adapted by agents express a specific form of the mode of regulation within which property development occurs. Ideas on the other hand facilitate the deployment of both resources and rules by informing the interests and strategies of actors as the actors define projects, consider relationships and develop and interpret rules (Healey 1992).

The rules and ideas therefore make the framework within which individual agents make their choices. This framework in turn determines the various resources to which agents may have access, the rules that govern their behaviour, and the ideas which they draw upon in developing their strategies. The main drawback of the ASH Model is that it is designed for analysis of case study property development projects—to demonstrate its application, Healey (1992) relied on the case study of an urban regeneration project in Tyneside involving the conversion of former shipyards and galvanizing works of Hebburn Riverside to a 52 acre housing estate. Hence its methodological construct does not sit well with a study involving material production such as this one.

The other model considered alongside the ASH is the social system of provision (SSoP) proposed by Gruneberg and Ive (2000) as a model of explaining the institutional structure involved in the process of the development of the built environment. Gruneberg and Ive (2000) divide actors in the construction industry into two: the initiators of the construction process—the developers, and; the others—those who get involved in the construction process through direct or indirect contractual arrangement with the developers. The latter would include architects, engineers, contractors, users et cetera. Because the actors operate within a legal and planning framework, lawyers, town planners and policy makers also get involved.

According to Gruneberg and Ive (2000), therefore, the developer is the only primary actor while the rest are secondary actors in the property development process. However, according to the framework of Ball et al. (1998), the users are also important at the level of development initiation since they are the ones who originate the need for development that therefore leads the developer to take a decision to undertake a development.

In the SSoP Model, the actors can take any one or more of the roles of developer, designer, builder, owner or user. These roles can then be arranged into a matrix of roles and transactions (relations) between actors to generate different social systems of provision. Three social systems are possible, namely the contract, speculative and integrated systems as shown in Table 2.1.

Table 2.1: The roles of actors in the process of built environment provision

Transactors	**Roles**				
	Developer	**Designer**	**Builder**	**Owners**	**Users**
Speculative builders	S	S	S		
Contractors			C		
Architectural firms		C			
Engineering design firms		C			
Owner occupiers	C			C,S	C,S
Public authorities	C,I	I	I	C,I	C,I
Property companies	C			C	
Tenants					C,I

Note: S = speculative system; C = contract system; I = integrated system

Source: Gruneberg and Ive (2000 p.30)

In the contact system, the roles are fully shared among the actors. While in the integrated system, all the roles are taken up by one actor. This system is common with public authorities who may be employing their own architects, engineers and a works department. The system, however, is currently being deposed in the neoliberal era particularly in the developing countries. In the speculative system, on the other hand, the roles are partially integrated or partially shared out among the actors.

The SSoP, therefore, is characterized by the division of labour among the main actors in the construction process and their interrelationships. This division and interrelationships translates into certain business patterns in the procurement of the built environment that, therefore, can be identified as particular systems. It can be noted that it is a matrix of possible outcomes of role

sharing among actors in the building process. Like the ASH Model, that the authors indicated it improves on, it is project based hence may be case study oriented in application. Additionally, other than explaining the possible combinations of actors in the procurement process, it does not pay much attention to the institutional forces (the main focus of this study) that bring and/or bind these actors together into typical systems. Its general orientation to the formal economy, also, limits its application to a developing economy situation. Therefore, despite its strengths in explaining possible organizational arrangements for building procurement, it is not found appropriate for this study due to its project based nature and less focus on the institutional forces.

2.9. The SoP Model

Apart from the ASH and SSoP models, there is the structure of building provision commonly abbreviated as SoP. The SoP Model has its origins in the writings of the British economist Michael Ball published in the form of journal articles (Ball 1986a/b and 1998) and books, (see Ball et al 1998) Chapter 5 on Property Supply and Analysis. The model identifies the structure of provision (SoP) as an alternative theoretical framework that can explain the functioning of institutions and organizations in the property supply market. SoP is described as 'the contemporary network of relationships associated with providing particular types of building' (Ball et al. 1998 p.129). These relationships involve institutions and organizations and may be observable in market or non-market forms. The concept of provision in this case entails the whole range of property development including construction, ownership and use.

Ball et al. (1998) assert that the SoP is a property market oriented device that considers the rules, practices and relationships that lead to the development and use of specific property typologies (first point) and that it is only a methodological and conceptual device for incorporating institutions into analysis of the development process and not a stand-alone theoretical model (second point). For that matter, other theories are required to formulate and understand research questions being considered within its framework. These two points either makes SoP so restrictive in its approach (first point) or so flexible (second point).

On the point of flexibility, the authors indicate that an institutional focus will come into the SoP framework only where necessary or where the researcher considers it applicable; otherwise not all property development research have a bearing on institutions. On the point of restrictiveness or inflexibility, it is important to note that SoP is restricted to a construction product specific production process and hence cannot be applied to a generalized production system. Ball et al. (1998) for example point out that for the commercial property development in the UK, the number of structures of provision is limited to probably two: the provision of speculative and non-speculative accommodation.

The authors further assert that the SoP methodology 'argues that organizational relationships constitute one of the institutions of property development and use, and that they need to be incorporated into understandings of the operations of property markets' (Ball et al. 1998 p. 134). In this case, it becomes apparent from the authors' clarification that there are several other institutions of property development that may require consideration but SoP is only concerned with one; the 'organizational relationship'.

In the case of organizations in the building industry, Ball et al. (1998) have identified two main categories; those that are directly and those that are indirectly related to property development as shown in Table 2.2.

Table 2.2: Organizations in property development

Direct Relationship (Primary Actors)	**Indirect Relationship (Secondary Actors)**
Property Relations Lessees (renters) Owners *Functional Characteristics* Users Developers	*General* Landowners Planners (services and land use) Property agents Banks and Financial institutions Legal and Financial advisors *Construction* Architects Engineers (structural, mechanical, services etc) Surveyors (e.g. Quantity, building) Material producers Project managers Contractors Labour gangs

Source: Constructed with information from Ball et al. (1998 pp 109-111)

The organizations in this case refer to actors in the built environment. We can also refer to the first category as primary actors and the second category as secondary actors. The actors with direct relationship are the primary decision makers on the supply needs of the property market. They can then hire the second group for inputs of ideas, logistics and materials for fulfilling the supply needs of the property market. The first category actors can be classified under their relations with property, i.e. as renters and owners; or according to their functional roles, i.e. users and developers. Ball et al. (1998) put financiers under primary actors among users and developers; but financiers actually are agents of developers to the extent that they boost the developers' ability to afford the services of the second category actors. Table 2.2 therefore, unlike Ball et al. (1998), classifies them under secondary actors. In themselves financiers do not make the first decision on what has to be built, this is made by the developer depending on the needs expressed by the user. Quite correctly, financiers fit in the second category organizations under banks and financial institutions. Note also that under property relations grouping, Ball et al. (1998) put developers among renters and owners whereas the correct grouping should only be for renters and owners; being a developer is a function rather than a property relation. Nevertheless, as they have noted, an owner can as well be a developer (as in self-build housing) or an owner user (as in owner-occupier housing) in a mix-up of property relations and function. Owner-occupation can also occur in the commercial property sector where a non-property company builds and occupies its premises.

The organizations with indirect relationships include actors that would supply material and intellectual resources for property development following the needs of the developer/user. There are the general resource suppliers and the construction resources suppliers. The actors involved in construction, who are of interest to us here, include those who fulfill the roles of architects, engineers, material manufacturers and contractors.

A comparison can be made between the SoP and the ASH models as summarized in the table below.

Table 2.3: Comparison of ASH and SoP attributes

ASH	SoP
Project specific	Building type specific
Historical (applies to project that has been implemented)	Ahistorical, applicable across time
Open structure	Closure possible through type selections
Comprehensive in approach	Case-based
Relies on other theories	Relies on other theories
Attempts a grand theory	No attempt to construct a grand theory

The first thing to note about the two institutional theories is their units of analysis. The ASH Model is quite emphatic on its reliance on projects as case studies for its application. In her introduction to the empirical demonstration to the model Healey (1992 p.33) points out that the model is developed 'as an approach to the description of the development process which recognizes the variety of agencies, agency relations, activities and events involved in development projects'. She writes that a model like the ASH she is proposing: should be 'comprehensive in form, relevant to a complex mixed-use project in a city centre as well as a 5-dwelling housing scheme or a barn-conversion project'; should apply 'to a social housing scheme for the elderly as well as a private sector science park project'; and should be capable of 'addressing a self-build housing project on illegally-occupied land as well as a major new settlement or town subdivision project' To demonstrate its application she uses a regeneration project in Tyneside involving the conversion of former shipyards and galvanizing works of Hebburn riverside to a 52 acre housing estate. The SoP on the other hand is defined by type of property.

Ball et al. (1998) have observed that the ASH Model eventually falls under the institutional approaches that offer historical explanations to the phenomenon of property development. This is in contrast to the SoP approach that can apply across time. Ball et al. (1998) also find the ASH Model an endlessly open structure to the extent that in the end it is not possible to determine whether any outcome in the property market is due to the structure or to the agency effects. This is contrary to the SoP Model that can be closed depending on the research issues to be addressed.

One other attribute to note about the ASH Model is that it is rigid and attempts to be comprehensive. This is in contrast to the SoP Model that notes that there cannot be a universal explanation to the development process. Ball et al. (1998 p.131) also notes that 'only particular elements of an SoP may be relevant to a specific issue'. Therefore the SoP is applied according to need and this makes it applicable across many cases.

Similarities can also be drawn from the two models. Both of them are conceived as methodological theories that can be used as frameworks for the institutional analysis of the property development process. For that matter they have to be used in conjunction with other theories. But while the SoP is content at being a theoretical device for undertaking research in property development, the ASH Model on the other hand is also an attempt at a grand theory (Hooper 1992). This makes it difficult for application in empirical situations.

The greatest advantage the SoP has in this study is that it structurally conforms to the systems theory of organization that has been adopted as the main theoretical construct driving this study. The SoP, in a way, is the application of the systems theory of organization in the building industry and this gives it the advantage of compatibility and complementation for purposes of this study. However it is also important to note that, like the mainstream theory of organization that it depends on, the SoP is biased by limiting the concept of organizations to formal corporate bodies only. This makes it difficult to apply to the artisanal producer organizations that are the subject of this study. On the contrary sections 2.6 and 2.7 have refuted the limitation of the concept of organization to the formal sector.

2.10. Summary

This chapter has presented the theoretical basis for the study. Various theoretical possibilities have been considered including the ASM and the MSE theories. These first two theories have been judged inappropriate for the study. However the chapter has demonstrated that the socio-technical systems theory is the most appropriate theoretical basis for the study. In particular the systems approach to organization theory is useful in taking the research forward from this juncture. Organization theories specific to the building industry such as the ASH, SSoP and SoP models have also been evaluated but found to be inappropriate for the study. The socio-technical

systems on the other hand encompass the factors that compose the PEST environment or the business/enabling environment for artisanal dimension stone. The next chapter therefore reviews the literature on the business environment for artisanal dimension stone.

CHAPTER THREE

1. A REVIEW OF THE BUSINESS ENVIRONMENT

3.1. Introduction

This chapter develops from the previous one on the socio-technical systems theory and constitute the literature review sections of this study. The input-transformation-output model that defines the open systems theory of organization discussed in the preceding chapter (see Figure 2.2) also implies a description of the business environment for a study organization. Accordingly, Wetherly and Otter (2008) define business, broadly, as an activity that involves the transformation of inputs into outputs or the production of goods and services to meet customer need. Because the inputs for business activities come from the environment and their outputs go into the environment, the business environment can be defined to include the sources of and exchanges involving the inputs and the disbursements and exchanges involving the outputs of business entities. This idea is demonstrated further when it comes to the analysis of the business environment, see sections 3.2, 3.3, 3.4 and 3.5. Analysis of the business environment, therefore, involves the conceptualization of businesses as organizations (Wetherly and Otter 2008).

The chapter discusses the conventional techniques for analysis of the business environment then goes further to review literature on studies involving the business environment. Literature relevant to the artisanal production of dimension stone is considered. These include literature on the artisanal and small scale mining (ASM), small and medium enterprises (SME), the informal sector enterprises (ISE) and indigenous building materials (IBM) business environments.

3.2. Analysis of the Business Environment

It is notable that various techniques are available in standard business text books that can be used to analyse the business environment as found in (Beardshaw and Palfreman 1986, Ackroyd 2002, Kew and Stredwick 2008, Wetherly and Otter 2008, Baron 2006, Worthington and Britton 2006, among others). Apart from Baron (2006) who breaks down the business environment into the market and non-market environments for purposes of analysis, the rest of the authors adopt the open systems approach that considers the business environment as made up inputs and output environments. The open systems approach is discussed further in the subsequent sections of this

chapter. In the Baron's approach, the commercial transactions between the firm, on the one hand and its suppliers and customers on the other, constitute the market environment. Likewise, the nonmarket environment composed of social, political and legal influences that condition the commercial interactions between the firm and its suppliers and customers also involve voluntary or involuntary interactions between the firm and the public, quasi-public and private parties. This is not a radically different approach as the open systems theory is implicit in it; only that it is uncommon.

This study proposes to adopt the explicit open systems approach favoured by the majority of the authors considered above because it is able to bring directly together all the variables in the research. Analysis of the business environment involves various techniques and can take place in different stages depending on the final objective or level of analysis. Johnson, Scholes and Whittington (2004), in one of the earlier edition of their book on corporate strategy, had proposed a five-stage model for analysing the environment as reproduced below:

- Stage 1: Audit of environmental influences
- Stage 2: Assessment of nature of the environment
- Stage 3: Identification of key environmental factors
- Stage 4: Identification of competitive position
- Stage 5: Identification of principal opportunities and threats

This model is relevant to this study but only up to Stage 3. A major weakness to the techniques that have been developed to analyse the business environment is that they are intended for application by individual organizations especially in competitive situations. Stages 4 and 5 are perfect examples of such situations. Since this study collectively rather than individually considers the business environment of artisanal organizations involved in the production of artisanal dimension stone, the latter stages of the model therefore are irrelevant. Consequently this study adopts the model only up to stage 3.

The techniques, available from the text book literature, that are commonly used in the analysis of the business environment include: PEST analysis, Porter's Five Forces Analysis, SWOT analysis, scenario forecasting, trend extrapolation, expert opinion and stakeholder analysis (see, for

example, Wetherly and Otter 2008, Kew and Stredwick 2008, among others). These techniques are discussed in detail in the following sections.

3.2.1. The PEST Analysis

Kew and Stredwick (2008) have suggested that STEEPLE Analysis, a derivative of PEST Analysis, is suitable for application at Stage 1 of the five-stage model. In this report PEST Analysis is used as a generic term for all analyses deriving from it. As described above, the stage involves an audit of environmental influences. PEST, as shown in any text book on business environment, organization theory, or management theory, is an acronym representing Political/legal, Economic, Socio-cultural and Technological forces active in the business environment of a particular organization. This technique has mutated into several variants over time as different aspects of the business environment gain importance and become distinct and relevant to the analysis.

According to Kew and Stredwick (2008), PEST was widely used in the 1980s and the early 1990s; however, from the mid-1990s PESTLE came into being when the political/legal (represented by P) were split from each other (to form P and L) and another factor (environment/ecology) reflecting the growing importance of environmental issues and represented by an extra E was added to the analysis. Thereafter PESTLE evolved into STEEPLE from the early 2000s following the addition of another E (representing Ethics) on the account of the rising concern for corporate social responsibility and business ethics. Other variants include SLEPT (Social, Economic, Political, Technological) and SPECTACLES (Social, Political, Economic, Cultural, Technological, Aesthetic, Customers, Legal, Environmental, Sectoral)—further discussions of the derivatives/variants can be found in Wetherly and Otter (2008), and Sutherland and Canwell (2004), among others. The sequencing of the factors does not follow any order of importance; the arrangement is simply set for mnemonic effect.

The PEST Analysis or its derivatives is based on the open systems model of the business/organizational environment. In this case the organization's environment is divided into two: the micro/immediate/task environment (composed of customers, suppliers and regulators) and the macro/general environment (composed of the PEST factors)—see detailed discussion at

section 2.4. This model conceptualizes the business organization as an open system that interacts with its environment in two main ways i.e. firstly, by drawing resources from the environment (inputs), converting them into goods and services, then secondly, by returning the products (outputs) to the environment. This is diagrammatically represented in Figure 3.1.

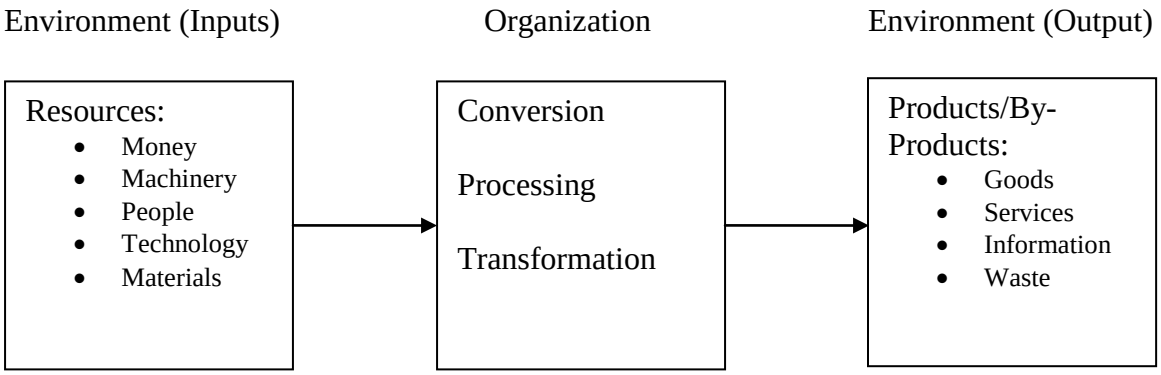


Figure 3.1 Interactions within the immediate environment of the organization
Source: Adapted from Kew and Stredwick (2008, p. 4)

According to this model adopted from Kew and Stredwick (2008), this interaction takes place in the immediate environment of the organization. To these two elements (inputs and outputs) can be added a third element i.e. regulation, which is the element that defines the nature of interactions that take place between the organization and its environment. The three elements together present the organization with opportunities and constraints and are themselves influenced by the factors of the general environment i.e. the PEST related factors (Kew and Stredwick 2008).

The study has adopted STEEPLE Analysis because it is based on the open systems approach that is used as a theoretical model for this study. As already stated, this model is appropriate because it brings together all the variables of concern for the research aims and objectives, see further discussions under section 3.3. The Ethics factor in STEEPLE in this case does not refer to corporate social responsibility, which is an issue associated with corporate organizations, but is intended to capture the corrupt practices and illegal business payments that artisanal

organizations have to engage in as a normal routine in their day to day transactions in their business environment.

According to Kew and Stredwick (2008), Stage 2 of the five-stage model of analysis builds on classifying the business environment as to whether it is placid, dynamic or turbulent in the case of conventional organizations. However, for artisanal organizations in the context of the enabling environment, the classification will depend on whether the business environment is hostile or friendly—for further discussions, see section 3.3. The study also adopts the guideline of Kew and Stredwick (2008) to the effect that the Stage 3 of the analysis that is intended to identify the key environmental factors involves:

- The identification of a smaller number of key environmental influences
- The identification of long term drivers of change

It is worth noting at this juncture that not all environmental influences are equally important in the analysis hence prioritization of issues is necessary (Kew and Stredwick 2008).

In recapitulation, it is important to note that the Stages 1-3 of the five-stage model of analysis conform to the study Objectives 3-5. One of the novel aspects of this study is that it adapts conventional business analysis techniques into academic research to study non-conventional business scenario. In standard practice this technique is applied to individual organizations but in this case it is adapted to analyse a multi-organizational context. As pointed out earlier on, Stages 4 and 5 do not fall under the scope of the study; nevertheless some of the techniques of analysis associated with them are discussed below with the intention of giving an indication of the extent to which they may not be relevant to the study.

3.2.2. Stakeholder Analysis and Mapping

The other technique applicable in the analysis of the business environment is the Stakeholder Analysis. According to (Wetherly and Otter 2008) stakeholder analysis is useful in understanding three key aspects of the business i.e. who the stakeholders are, the nature and level of their interest in the business and, their power to exert influence. Stakeholder analysis is necessary in this study for the purposes of Objective 2.

A stakeholder in an organization was defined by Freeman (1984) as any group or individuals who can affect or is affected by the achievement of the organization's objectives. Freeman (1984) also presented a history of the development of the stakeholder concept. On the other hand, one of the best definition of stakeholder analysis that can be found in the literature is by Varvasovszky and Brugha (2000 p. 338): 'Stakeholder analysis is an approach, a tool or set of tools for generating knowledge about actors—individuals and organizations—so as to understand their behaviour, intentions, interrelationships and interests; and for assessing the influence and resources they bring to bear on decision-making or implementation process'. Freeman (1984) proposed a three-step process of conducting stakeholder analysis as follow:

1. Understand from a rational perspective, who are the stakeholders in the organization and what are the perceived stakes
2. Understand the organizational processes used to either implicitly or explicitly manage the organization's relationships with its stakeholders, and whether these processes fit with the rational stakeholder map of the organization
3. Understand the set of transactions or bargains among the organization and its stakeholder map and the organizational processes for stakeholders.

The three steps described by Freeman concern stakeholder management for an organization. However in this study has no intention of stakeholder management therefore steps 2 and 3 are particularly not relevant. Nevertheless step 1 is essential for stakeholder identification that the study ought to perform for the units producing artisanal dimension stone, see Chapter 6. Concerning step 1, Freeman (1984) reiterated that the analyst should pose the following questions.

1. Who are those groups and individuals who can affect and are affected by the achievement of an organization's purpose?
2. How can we construct a stakeholder map of an organization?

Through Question 2, Freeman introduced the concept of 'stakeholder mapping' which he referred to as a rational exercise following Question 1. From this exercise Freeman constructed a sample/generic rational stakeholder map as shown in Figure 3.2.

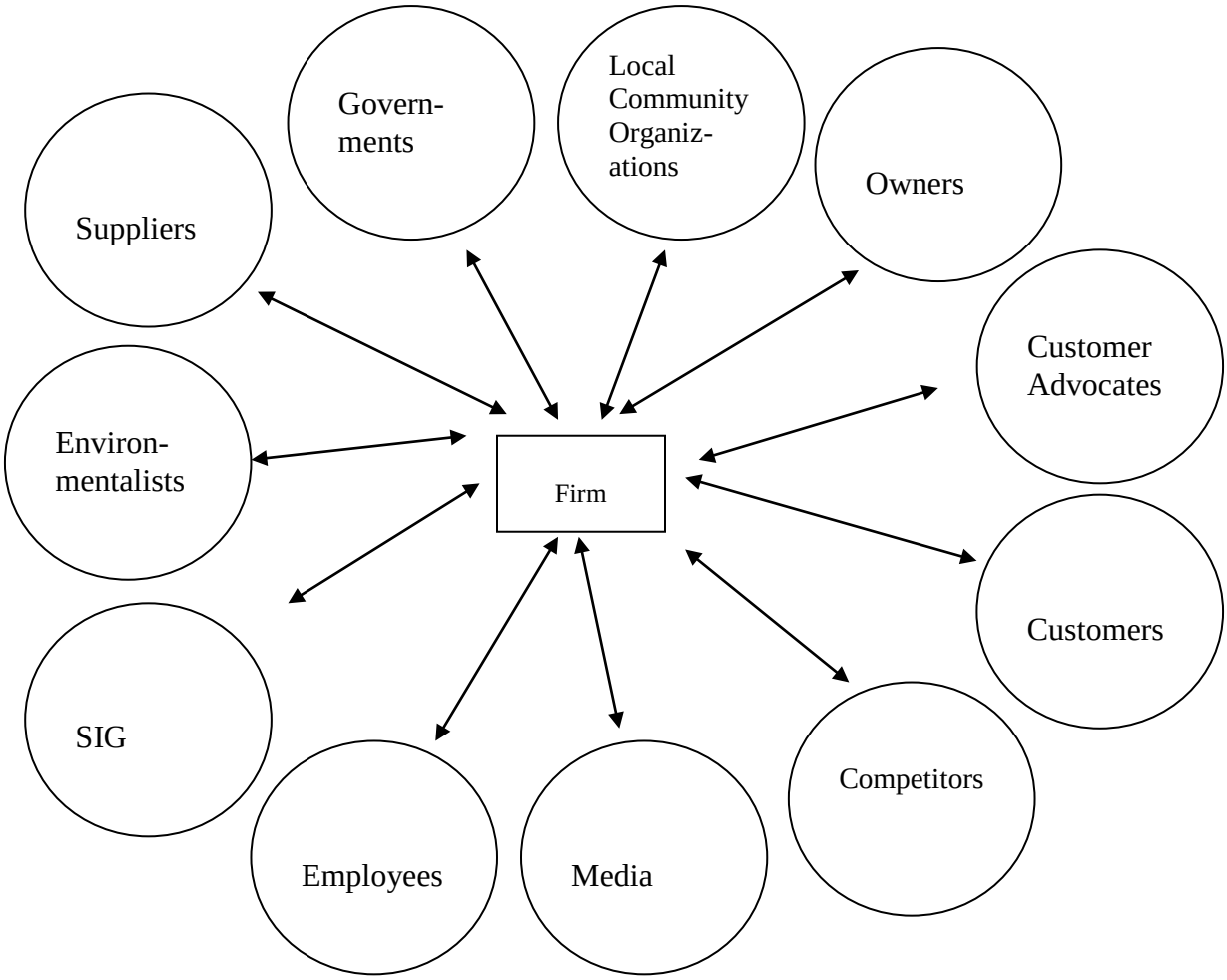


Figure 3.2: An example of a stakeholder map of the firm

Source: Freeman (1984 p.25)

In describing stakeholder relationships, other stakeholder analysts have tried to build PEST analysis into stakeholder analysis as in the example of Carroll and Buchholtz (2003) represented by Figure 3.3. However this fusion of PEST and stakeholder analyses describes the circumstances of modern Western organizations (Clulow 2005) and therefore may not capture the interest of this study i.e. the situation of micro enterprises in developing countries. Other analysts have suggested ways of analysing the stakeholder power configuration so as to determine the degree of influence they can exert regarding the achievement of an organization's goals. One of the techniques that is popular in use for this purpose is the Stakeholder Matrix Mapping.

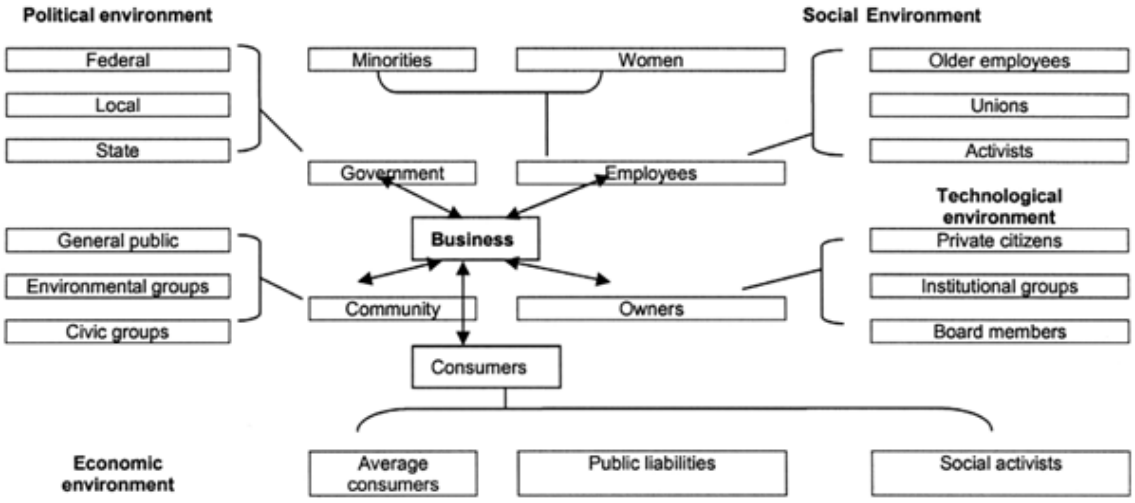


Figure 3.3: A mapping of stakeholders according to the PEST environments

Source: Carroll and Buchholtz (2003, p. 73)

3.2.3. The Stakeholder Matrix Mapping

This is an analytical technique that involves the categorization of a focal organization's stakeholders by their influence according to two variables by plotting them on a two-by-two matrix. One of the axis may represent the magnitude of power a stakeholder can hold sway while the other may represent another attribute like the degree of interest they have as shown in Figure 3.4 below. The matrix demonstrates that stakeholders are not equal and some may be more important for the achievement of the organization's objective than others.

The interest axis may be substituted for other issues, for example the strength of stakeholders' support or opposition to a particular issue that affects the achievement of the focal organization's objectives; also known as Problem-Frame Stakeholder Map (Anderson et al. 1999). In other cases the two-by-two matrix may be used to analyse a completely different set of variables as in the Policy Attractiveness versus Stakeholder Capability. In this case the interest axis is substituted for the Attractiveness of Policies, Plans, or Proposals while the Power axis is substituted for Stakeholders' Capacities to Implement Policies, Plans or Proposals (Bryson 1995, 2004).

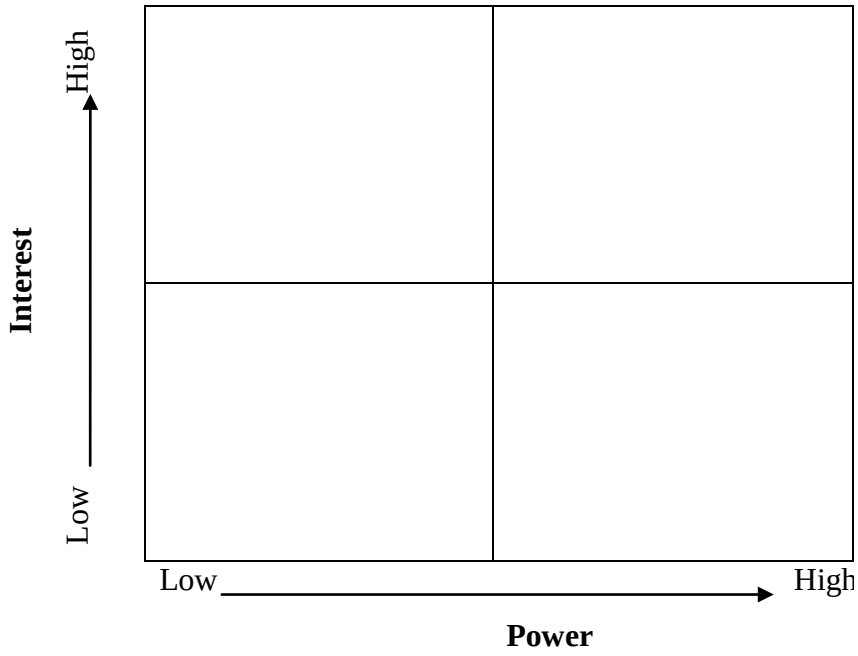


Figure 3.4: Stakeholder power versus interest matrix

Source: Bryson (2004), see also Eden and Ackermann (1998 p. 122)

3.2.4. Other Techniques for Analysing the Business Environment

Kew and Stredwick (2008) have suggested that for identifying the competitive position of an organization, a technique such as the five forces model developed by Michael Porter (see Porter 1980) can be applied. As already pointed out, this study is not concerned with the competitive environment of a single organization. Moreover the five forces model is appropriate for conventional/formal organizations in a competitive environment. According to the model, the competitive position of an organization in the business environment is determined by five forces, viz. the threat of entry of new firms, the power of buyers, the power of suppliers, the power of substitutes and the intensity of rivalry among existing firms.

The last stage of the five-stage model concerns the identification of the principal opportunities and threats. This stage, as the wording tells, obviously calls for the technique of SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis. The strengths and weaknesses concern the internal environment of the organization under analysis while opportunities and threats are to be looked for in the external environment of the organization under analysis. The

technique's division of the external environment of the subject organization into two analytical aspects only limits its scope of analysis compared to PEST Analysis or its derivatives.

Further details on how to perform SWOT Analysis for an organization's business environment can be found in Kew and Stredwick (2008), Wetherly and Otter (2008), Johnson et al. (2008) among others. However for the purposes of this research, it suffices to note that the study does not apply SWOT Analysis as an analytical tool on the account that such an analysis only suits the study of a single organization while this study involves a multi-organizational analysis.

Alternative Scenarios is another technique that is used in business environment analysis. It involves the forecasting of the various possible environmental scenarios the organization is likely to face in the future and then devising strategies for tackling or taking advantage of the scenario (Wetherly and Otter 2008). As in the case of SWOT Analysis and Porter's Five Forces, the scenario forecasting is meant for individual and large business organizations. It is also vague on the variables to be considered hence it is unsuitable for this study compared to the PEST Analysis or its variants.

Trend extrapolation is also another technique in the book that involves the organization relying on its past records to project the future trends of variables in its business environment (Wetherly and Otter 2008). This is meant for established business organizations with past records, which is not the case for artisanal organizations that keep no records of their business transactions.

Sometimes an organization may rely on experts to provide opinions on the state of their business environment (Wetherly and Otter 2008). This can be done through consultancy and one of the methods that can be used is the Delphi technique that involves collection of opinions from a cross-section of experts. In the case of this study, the subject matter is quite precisely about the production of artisanal dimension stone in Nairobi and expert opinion may not be adequate to meet its objectives. Although expert opinion, without the use of the Delphi technique, has been relied upon to a minor extent in Objective 1, it was not found appropriate for the whole study.

After this overview of the concept of the business environment and the techniques for analysing it in relation to the artisanal organizations in the production of dimension stone in Nairobi, it is now appropriate to consider in detail the chosen method of analysis in the section that follows.

3.3. Application of the PEST Analysis Model in the Study

The study adopts a model developed by Lusthaus et al. (1995) and Lusthaus et al. (2002) for assessing the institutional capacities of research organizations in developing countries working in partnership with the International Development Research of Canada (IDRC). Using the systems approach, the model by Lusthaus et al. (2002) is based on the general principles applied in the organizational analysis of the external environment commonly discussed in organization and corporate management theory; refer to the previous discussion at section 2.2. The PEST models organizations employ for business analysis vary in the categories of forces they wish to include from the external environment. The main drawback of these models is that corporate organizations employ them in competitive strategy formulation for scanning/modelling the business environment. Since organizations aim to achieve individual corporate goals within the business environment, their models are not intended to reform but rather to assist analysis.

The model by Lusthaus et al. (2002) is chosen for this study because, although specifically developed for analysis of research organizations, the literature base suggests that it is the only model that is specifically developed for the analysis of organizations in developing country situations. According to the literature on organization theory, Lusthaus et al. (2002) have identified the forces which create a framework for the external (business) environment and calls this the enabling environment for organizations in the developing world where reforming such environments in order to improve the productivity of private enterprise has been a major challenge in the recent past. Although Lusthaus et al. (2002) adopts the typical categories of the external environment—that is, Legal/administrative, Technology, Political, Economic, Social and cultural, Ecological and the Stakeholder environments, their model is more appropriate for this study because, having been developed for developing country situations, it is not confined to the corporate world and hence applies to informal organizations of developing economies including ISEs.

Lusthaus et al. (1995) point out that the influencing forces from these multiple environmental contexts can become major "facilitating or constricting" forces on an organization as it works to accomplish its objectives; thereby making the forces the variables of the enabling environment. These forces will therefore encompass the independent variables influencing the status of the enabling environment for producer organizations of artisanal dimension stone in this study. As suggested by Lusthaus et al. (1995), analysis of these variables will enable the study to answer two aspects of the main research:

1. What are the major forces affecting the organizations? This question is associated with Objective 3 that seeks to identify the forces and Objective 4 which seeks to analyse the interrelationships of these forces in influencing the production and use of artisanal dimension stone for building construction in Nairobi.
2. How "friendly or hostile" is the external environment? This question is associated with Objective 5 that seeks to evaluate the contribution of the influencing forces to the enabling environment for the production and use of artisanal dimension stone in Nairobi.

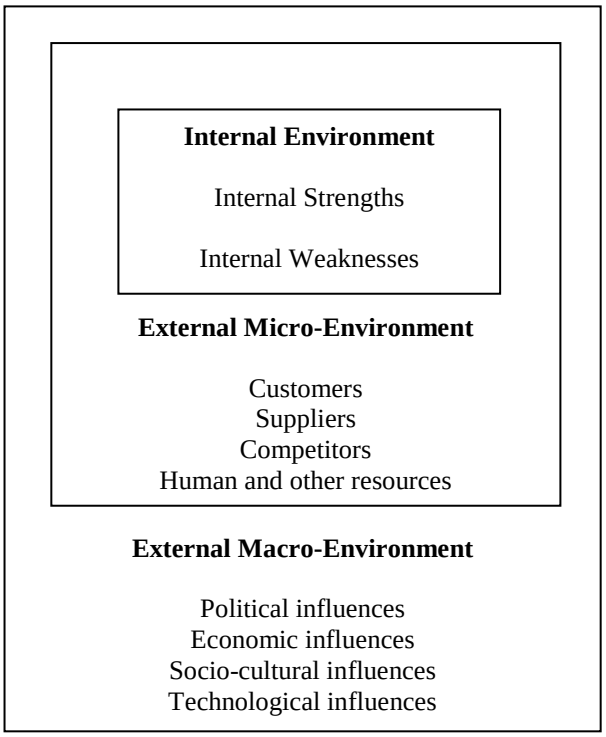


Figure 3.5: Analysis of organizational environments[2]

Source: Campbell (1997: p. xiv)

[2] Note that Campbell erroneously refer to the external macro-environment as 'external micro-environment'.

The problem with the model by Lusthaus et al. (2002) at this juncture was that it is too general. In deed the term environment is of such arbitrary usage in this case to the extent that it includes everything else outside of the study organization (Capon 2000, Dawson 1996). Therefore it was necessary to blend the model with the models by Campbell (1997) and Dawson (1996) of partitioning the external environment into micro and macro scales for ease of analysis. According to Campbell (1997), the environments of an organization can be split into three portions: the internal, the external micro and the external macro environments as shown in Figure 3.5 above.

Campbell's categorization allowed the study to separate the general environment from the external micro environment by placing the political, economic, socio-cultural (Campbell uses the term sociological) and technological influences in the outer box. This left three out of the seven environmental categories of Lusthaus et al. (2002) in the task (external micro) environment. These are the legal/administrative, the ecological and the stakeholder environments. For the purpose of this study, the stakeholder environment is the most important as it covers all the relevant environments. Campbell's listings in the micro environment (Figure 3.5, i.e. customers, suppliers, competitors) refer to stakeholders.

Following Campbell (1997: p. 23) stakeholders include 'any person or party that has an interest in the activities of an organization'—for example, shareholders/owners, management, employees, competitors, suppliers, customers, communities served by the study organization, near geographical neighbours, pressure groups and opinion formers and regulatory authorities. According to Campbell's definition quoted above, the list of stakeholders can be endless hence it is sometimes necessary to distinguish between the key ones and the rest.

Campbell's model gave a clear separation of the influences that sharpened the focus of the study but it could not lead the study to focus on specific variables. For this the study relied on Dawson's model shown in Figure 3.6 below.

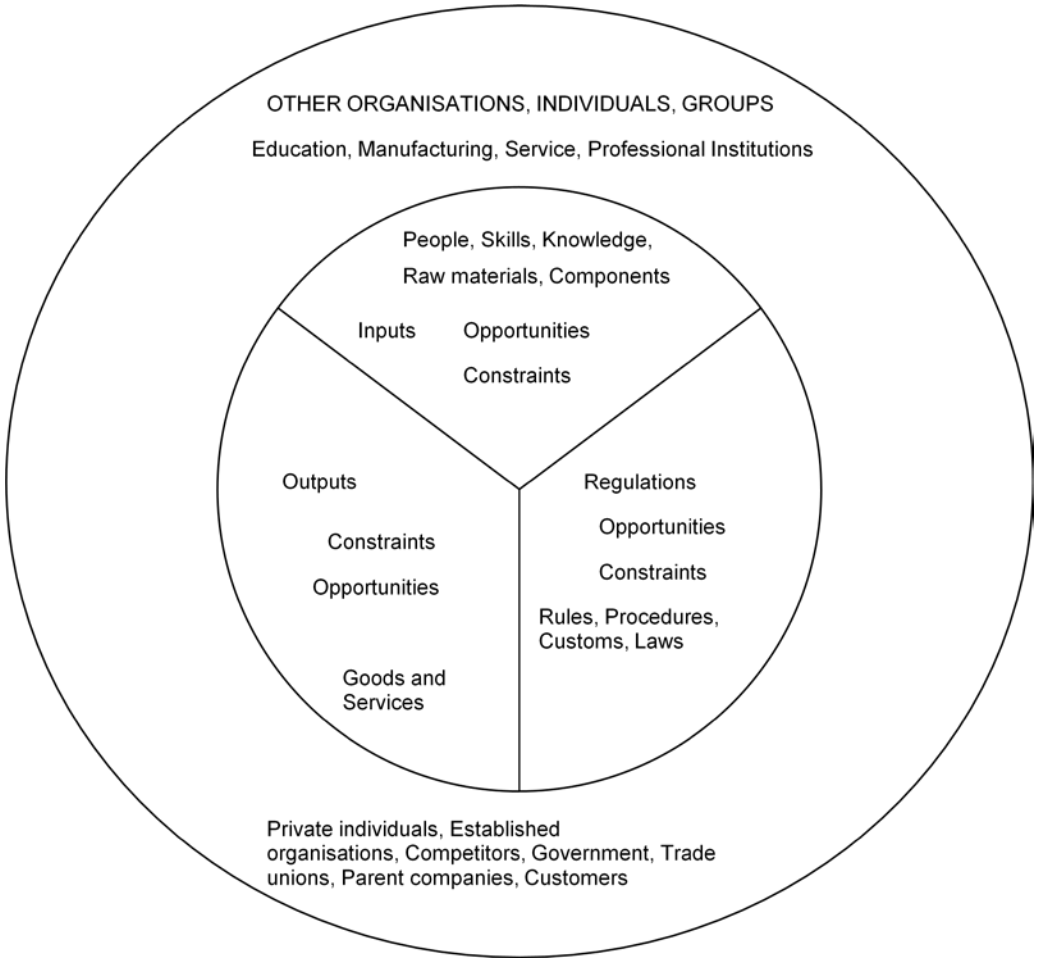


Figure 3.6: Analysis of organizational environment
Source: Adapted from Dawson (1996: p. 82)

Dawson's categorization of the interactions between the study organization and its environment into three broad kinds: interactions to secure the supply of its inputs, interactions to secure the disbursement of its outputs, and interactions which have the effect of regulating its operations and transactions is a useful follow up to the stakeholder environment. Inputs and outputs are the goods and services that are taken into and disbursed from the organization while regulation refers to the formal or informal rules, practices and networks conditioning the transactions between the study organization and its environment (Dawson 1996). According to Dawson (1996: p. 81): 'The inevitability of needing to secure inputs, to disburse outputs and of attempts to regulate, inextricably links the members of any focal organization with the members of its environment in

a form of love-hate relationship.' In this statement love refers to the opportunities the external environment provides while hate refers to the constraints and losses the external environment may impose.

To enable the producer organizations, there is need to increase the disbursement of their output and to this end, with the aid of the Dawson Model, six basic questions are posed in this research:

Inputs

1. What opportunities does the environment provide for inputs?
2. What constraints does the environment impose on inputs?

Outputs

3. What opportunities does the environment provide for outputs?
4. What constraints does the environment impose on outputs?

Regulations

5. What opportunities does the environment provide with regulation?
6. What constraints does the environment impose with regulation?

This may be followed by a second set of questions on how to overcome the constraints imposed and enhance the opportunities presented by the environment. These questions were used to develop the measurement instrument as discussed in section 4.8.1, see also section 6.7.

3.4. The Business Environment of Small Scale Enterprises

The organizations involved in the production artisanal dimension stone may be classified under micro and small enterprises. Therefore operations of the study organizations are contingent upon the business environment of micro and small enterprises hence it is necessary for this study to consider briefly the business environment of small scale enterprises. The distinction between micro, small and medium scale enterprises is rather confusing. The acronym MSE is commonly used to refer to micro and small enterprises while SME is commonly used to refer to small and medium enterprises. In Kenya research on small enterprises has focused on either configuration

as can be seen in the examples of Daniels and Mead (1998) Mead and Liedholm (1998) and Liedholm (2002) for MSE, and Jackson et al (2008) for SME. Nonetheless it is common to make distinctions regarding these enterprises using some quantifiable characteristic such as number of employees, sales volume, or worth of assets (Haksever 1996).

3.4.1. Defining the Small Scale Enterprise

Mawali and Yala (1995) who used the term 'small businesses and micro-enterprises' to refer to these kind of organizations observed that there is no lower limit to their size but the upper limit is often set by factors such as the size of the workforce, the value of fixed assets or net worth of value added. However a lot of confusion sets in with the attempt to fix the upper limit for small scale enterprises. Haksever (1996) for example, cites one classification scheme that defines a small business as a firm with fewer than 500 employees. This can further be divided into sub-categories of very small (1-19), small (20-99) and medium (100-499) while any company employing 500-plus people is considered as big business. Note that in this classification system the distinction is mainly between small and big but the very small category (1-19) may correspond to the micro in other classifications.

On the other hand, Barrow (1998) citing a quantitative classification based on employment size lists the following categories in the case of France and other countries.

- Less than 10 employees: *artisanal* and very small enterprises.
- 10 to 40 employees: small enterprises.
- 50 to 500 employees: medium-sized enterprises.
- Over 500 employees: large enterprises.

The artisanal enterprises that are the concern of this study fit well within the first category: artisanal and very small enterprises.

Likewise Liedholm (2002) suggested that MSE in Latin America and Africa could be defined to include enterprises with 1—50 workers; with micro enterprises falling under the smallest bracket of not more than 10 workers. A similar definition has been adopted for Kenya where MSE is used to refer to profit-oriented private firms with between 1—50 employees; this includes firms

employing between 10—50 people, usually referred to as small scale enterprises and firms employing between 1—9 employees referred to as the micro or *Jua Kali* enterprises (Opiyo and K'Akumu 2006). *Jua Kali* is the term of popular use in Kenya with reference to informal sector enterprise (King 1996). According to Safavian et al. (2001) one most common characteristic of micro enterprises in developing and transition economies is that they operate outside or on the fringe of the formal economic sector—having little interaction with the legal and regulatory environment.

The classification of small business according to numerical size would therefore vary according to countries under consideration. In most cases the smallness of an enterprise is defined in comparison to a large enterprise. For developing countries Pedersen (1996) noted that the market is small compared to developed countries hence the room for large scale production is much smaller compared to industrialised economies. For this reason, in terms of quantity, what is considered large in a developing country situation would be smaller in a developed country situation. Likewise what is considered small in a developed country may appear big in a developing country situation.

Owing to the confusion relating to the quantitative definition of small enterprises, Hakserver (1996) suggested that some qualitative approaches can be relied upon to define clearly what a small enterprise is. These include such characteristics as concerning its management which is said to be independent i.e. usually the manager is the owner. Secondly, for a small enterprise, capital is supplied and ownership is held by an individual or small group. The third feature concern the fact that the area of operation of a small firm is mainly local i.e. workers and owners tend to be in one home community, although the markets need not be. Lastly the business unit is small compared to the biggest units in its field. The organizations under study in this research conform to these characteristics and can therefore be certainly distinguished as small enterprises.

Fortunately the definitions seem to agree on one aspect concerning the definition of micro enterprises as comprising 1—10 workers. Specifically the business units that are the subject matter of this study can be identified as micro, artisanal or *jua kali* enterprises. Following the ITDG studies on enterprises involved in the production of artisanal dimension stone (see Wells

2000 and Wells and Wall 2003) it was established that these enterprises employed less than 10 people as shown in Table 3.2. According to Mawuli and Yala (1995) the micro enterprises commonly cited for developing countries include street vending; workshops for vehicle and mechanical repairs and for carpentry; repair shops for shoes, watches; retailing or trading stores; tailoring; artisan work; cottage industries and; local food vending. But most MSE surveys in developing countries exclude mining and quarrying activities, see for example Liedholm (2002 p.228). It is also important to note that the quarrying business units are organizations involving division of labour hence, as micro enterprises, their composition may not fall to the lower quartile of number of workers.

3.4.2. Obstacles in the Small Scale Business Environment

Generally the surveys indicate that small enterprises dominate the economies of developing countries. The reasons for this dominance include the fact that the bad state of the infrastructure leads to isolated markets with limited demand that can best be served by small scale localised production (Matambalya and Wolf 2001). This is true especially for rural areas where such productive enterprises absorb excess labour from season-dependent agricultural activities. Some observers also regard the increase in number of people in MSE activities as a sign of failure by the economy to provide employment opportunities hence MSE participants have been forced to resort to activities that only provide minimal livelihood support (Liedholm 2002). Small scale enterprises are also generally prevalent in developing countries in low barrier sectors where entry is easy. Nevertheless small scale industries do not find it easy to operate in developing countries owing to several obstacles that are found within their business environments.

For example in the East African SME Survey respondents were asked to rank the major obstacles in their business environments. Figure 3.7 represents the rankings for Kenya. From the figure it becomes apparent that regulations for business start-up, lack of business financing, unfavourable tax regulations, inadequate supply of infrastructure and market unreliability were the highest ranked obstacles for always being in the way of the SME entrepreneurs interviewed. With a score of over 40 percent, business financing ranked highest for always being an obstacle. Although not among the highest within this ranking, corruption is among the top ten out of the 17 obstacles

being ranked as well as inflation, crime, safety regulations and environmental regulations. Some of these factors may apply for the micro enterprises under study in this research.

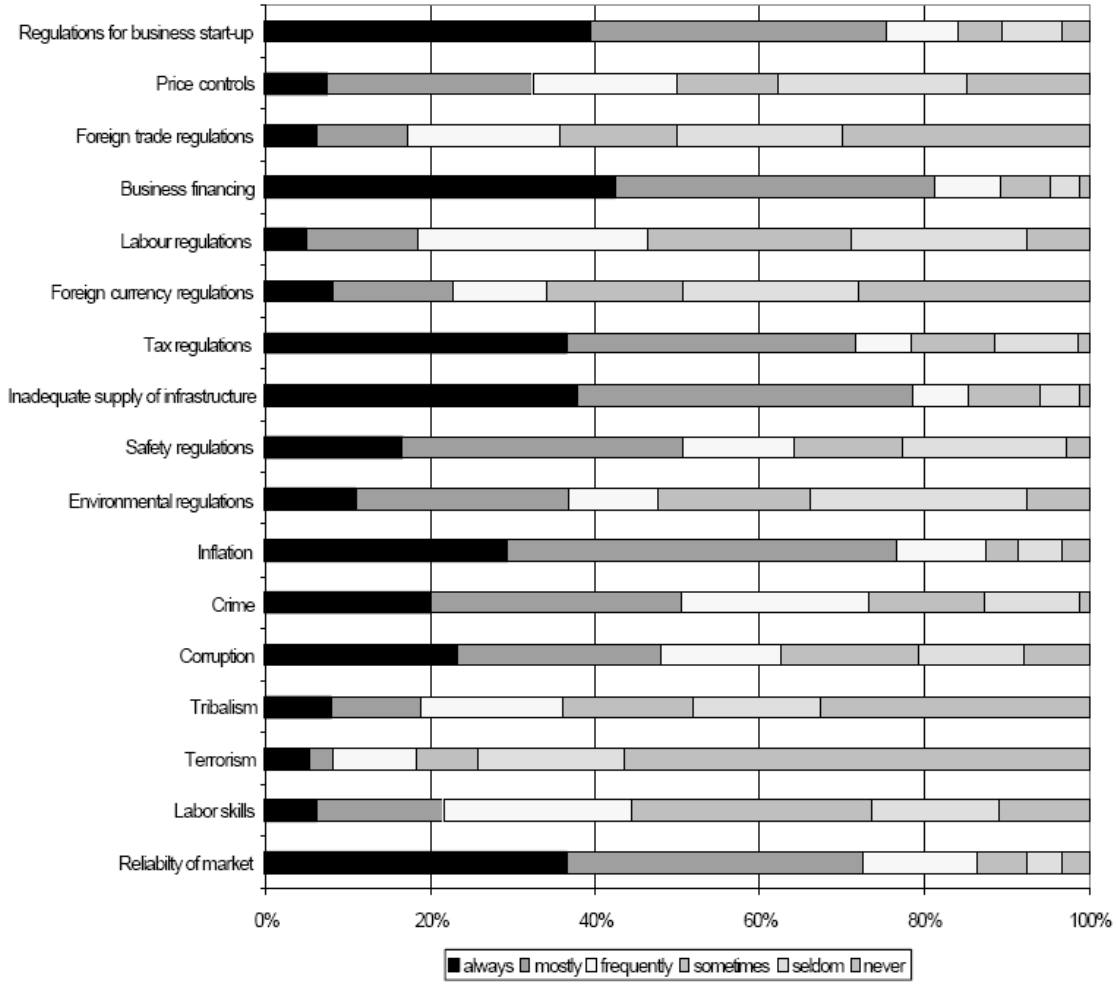


Figure 3.7. The ranking of obstacles for operators in the SME business environment for Kenya
Source: East African SME Survey.

The top ten factors identified for Kenya by the SME survey have been discussed in various research outputs concerning small scale enterprises. McPherson and Liedholm (1996) for example dealt with the issue of registration in Niger and Swaziland. This study however did not consider registration as an obstacle to SME business; rather it was concerned with the factors that determine registration. Macculloch (2001) on the other hand tackled the issue of government administrative burdens on SMEs in East Africa and considered registration as a burden to the

entrepreneurs concerned. Concerning business licensing and registration in Kenya, she found that:

'Micro and small operators are seen as being particularly vulnerable. *First*, it is the industries in which they engaged that are the most tightly regulated; for example, the manufacture of tools (requiring the use of scrap metal), baking, laundering, hairdressing and hawking. *Second*, they are subject to the constant harassment and intimidation of enforcement officers who repeatedly confiscate their property and means of livelihood' (Mucculloch 2001 p.11).

The officers concerned therefore use the regulation laws to harass and intimidate business persons to give bribes thereby in-breeding corruption into their business transactions. The harassment and intimidation also expose the informal operators to destruction of property and premises thereby discouraging them from investing more in their business (Macculloch 2001). Additionally, by preventing the development of informal business units, the regulatory and administrative barriers hinder the transition to formalization. However empirical studies of corruption in micro enterprises such as what Safavian et al. (2001) have done for Russia are hard to come by. As noted by these researchers, corruption being secretive and illegal in nature, present great challenge to data collection. Much of the literature on corruption is therefore theoretical, or relies only on parsimonious studies, or uses cross country comparisons based on the perceptions of foreigners living in the study countries (Safavian et al. 2001).

3.4.3. The Policy Environment for Micro Enterprises

The significant contributions small enterprises make towards employment creation, enhancement of economic growth and poverty reduction in Africa has been acknowledged (Rogerson 2001). Initially there was a tendency to label them negatively especially if they were not registered but the trend is changing. The promotion of micro enterprises is now seen as an important means of social and economic development in developing countries (Mawali and Yala 1995).

According to Mawali and Yala (1995) government stances towards micro enterprises may be grouped into three main categories: outright discrimination, active neutrality and, positive discrimination. They believe that outright discrimination against micro enterprises is rare; the

laws and regulations that restrain development of micro enterprises are usually intended to achieve some good goals such as town planning or public health. Active neutral policies that are neither intended to favour small nor large enterprises on the other hand are aimed at promoting a friendly business environment for all with the belief that the market will provide an effective forum in which any enterprise whether small or large may prosper. Positive discriminatory policies, according to Mawali and Yala (1995), may include tax incentives or subsidies and soft loans. However the positive policies can be stretched further to address the issues that have been identified for specific countries such as Kenya.

3.5. The Business Environment of ASM Enterprises

Artisanal and Small scale Mining, popularly abbreviated in the literature as ASM, has had unprecedented growth in developing economies in the past few decades (Shen and Gunson 2006). This growth may be attributed to the fact that increasing numbers of people are turning to ASM to seek alternative livelihoods a phenomenon that is facilitated by barriers to entry to the ASM sub-sector that are significantly lower than those in the large scale or formal sector (Pedro 2006). In a research that is not supported by hard facts, Banchirigah (2006) has suggested that the structural adjustment policies favoured by the IMF and the World Bank are responsible for the growth of the sub-sector in sub-Sahara Africa.

Due to the said growth and since the report by ILO (1999), ASM has received considerable intellectual attention in the fields of mineral production and rural development. The ASM literature is relevant to this study because the quarrying of dimension stone by artisanal techniques places the activity within the business environment of artisanal mining. The main interest of this research is on artisanal mining that Labonne (2002 p.71) defined as ‘an informal and less mechanised form of small-scale mining’.

Why has ASM generated enormous interest in the last few decades? According to Pedro (2006), ASM is a sub-sector of mining that is labour intensive and therefore has great potential to generate employment at local levels. For this reason it can foster local economic multipliers and contribute to local/rural development. ASM business is therefore important both for the local and national economy. It also has the potential to catalyse SME development (Pedro 2006).

Additionally ASM operations are driven by poverty (Hilson and Maponga 2004, Labonne 2003) to the extent that the working population are poor groups of people who are struggling to eke out a living by resorting to mining. ASM is recognized as a critical component of survival strategies for many of the world's poor (Danielson 2003). Therefore ASM has potential for poverty reduction programmes for concerned communities in developing countries (Zamora 2000).

3.5.1. The Characteristics of ASM Business

ASM is defined by the use of rudimentary processes to extract valuable minerals from primary and secondary ore bodies (Shen and Gunson 2006). Primary ore bodies are involved in situations of first time exploitation while secondary ore bodies are involved in re-exploitation of previously mined areas. The use of rudimentary technology, according to Pedro (2006) has led to sub-optimal exploitation of resources. The use of rudimentary equipment also generates poor earnings which prevent the operators from accruing funds for capital investment (Hilson and Maponga 2004).

In some case ASM activities are seasonal in nature i.e. miners work during the dry season and return to agriculture during the rainy seasons (Quironga 2002). The activities are also characterised by the lack of mining planning and lack of adherence to regulatory controls (Shen and Gunson 2006). In terms of legal attributes and size, the characteristics of ASM business units may vary considerably. The units may be legal or illegal, formal or informal and in terms of number of employees may encompass individual gold panners to medium scale operations employing large numbers of workers (Shen and Gunson 2006).

According to Shen and Gunson (2006), the activities of ASM in the world are biased toward the extraction of a wide range of metals, precious stones and industrial minerals and can account for a significant portion of the world's mineral and energy production. However this may not be the most correct position for this study. The study argues that it is the literature that has been biased toward activities involving the production of precious metals and stones such as gold and diamond, and toward energy minerals such as coal; whereas construction materials such as

dimension stone and aggregates have been ignored. Therefore, it is this gap in the literature that this study aims to fill.

Other characteristics of ASM units include the fact that they operate in isolation from the mainstream economy (Pedro 2006). Their operations are also characterised by market failures that hinder access to goods and services (Pedro 2006). The ASM enterprises are also characterized by problems such as limited capacity including knowledge (Sinding 2005), lack of assets and restricted entitlements e.g. insecurity of tenure on mining titles (Pedro 2006).

The operations of ASM work is also limited by lack of technical, business and management skills (Mutemeri and Petersen 2002). On the other hand ASM activities are hampered by limited access to mineral rights and deposits, investment capital and markets (Mutemeri and Petersen 2002). Lending to the ASM sector is perceived by the financial institutions to be risky while the process of finding the market is 'unsystematic and haphazard' (Mutemeri and Petersen 2002). Veiga and Hinton (2002) did a tabular summary of the characteristics of artisanal mining compared to conventional mining as shown in Table 3.1.

Table 3.1. Characteristics of conventional versus artisanal mining

Conventional mining	**Artisanal mining**
Relies on Geological science and drilling	Depends on feeling rather than scientific testing
Undertakes reserve characterisation	Undertaken for subsistence purposes
Relies on engineering techniques	Miners rely on curiosity and intuition to discover deposits
Undertakes planning and feasibility studies	Extraction is done for short term results
Uses sophisticated equipment	Uses rudimentary tools

Source: Adapted from Veiga and Hinton (2002 p. 16)

With the table, Veiga and Hinton (2002) illustrated that artisanal miners are driven by the need for survival or subsistence and they employ instinct and intuition to identify and extract deposits. The miners do not have resources to conduct geological exploration, drilling, reserve characterisation, ore tonnage determination and engineering studies (Veiga and Hinton 2002). The miners are not in possession of techniques needed to establish a minimum mineable reserve which would enable them to plan safe operation and closure procedures (Veiga and Hinton 2002).

According to Mutemeri and Petersen (2002) some of the negative characteristics of ASM observable in operations that are rudimentary, unsafe, environmentally unfriendly and process-inefficient derive from the lack of skills and limited access to technology.

In light of the above, the operations of ASM are therefore generally deemed to be unsustainable (Quironga 2002). According to Labonne (2002 p.71) 'unless they are properly organized, the practices of artisanal mining are economically haphazard and are increasingly destructive socially and environmentally'.

3.5.2. Emphasis on the Ills of ASM Business

Shen and Gunson (2006) observed that there was a tendency by scholars and especially by journalists to focus on the negative impacts of ASM activities. The positive aspects of ASM were generally under-reported. In the case of China, Shen and Gunson (2006) argued that such unbalanced reporting has led to policies that focus on the negative overlooking the positive thereby entailing to little considerations for the wider consequences of ASM activities. This makes the policies less comprehensive and maybe less effective. The ills of ASM as generally reported in the literature include the following.

Air pollution is one of the most cited consequences of mining activities. While in the formal and large scale mining outfits, appropriate measures may be taken to control the impacts of dust pollution, under ASM the likelihood of taking such measures is nigh hence silicosis, a lung disease that may arise from the fine dust released into the air through mining processes, may be a major occupational/environmental health hazard for artisanal miners (Shen and Gunson 2006). In Bolivia, Quironga (2002) observed that silicosis has reduced the life expectancy of artisanal miners to barely 48 years. Noise pollution is another ill associated with ASM activities (Shen and Gunson 2006).

Accidents are another occupational health hazard that artisanal miners face. According to Shen and Gunson (2006), accidents within artisanal processes are often under-reported due to the illegal or semi-legal nature of ASM operations. In its 1999 report on ASM, the ILO (1999)

estimated non-fatal accidents involving ASM operations to be 6 to 7 times greater than the formal/large scale sector.

In the literature, ASM is also associated with the degradation of agricultural land as explained by Shen and Gunson (2006 p. 428). This includes the destruction of arable and grazing land, increased erosion of top soils, landslides, the lowering of the water tables, soil contamination and the increased levels of sediment loads and flooding of nearby rivers.

Apart from the physical impacts, ASM is also associated with a host of impacts on the social landscape. These may include prostitution, substance abuse and gambling in remote rural centres characterized by booms in mineral finds (Shen and Ghose 2006). Sometimes the use of child labour is evident where the mines are owned or operated as family business as was observed for South Africa (Mutemeri and Petersen 2002) as was the case in Bolivia too (Quironga 2002). concerning gold mining in Migori District of rural Kenya, Mitullah et al. (2003) found out that boys dropped out of school to work in the gold mines while girls were lured out of school to marry young men who had temporarily become wealthy from gold mining.

The other ills of ASM are legal in nature. Shen and Gunson (2006) noted that although ASM and the formal sector are more often than not regulated by the same legislations for environment, labour, mineral rights, mineral exploration, mining permits etcetera, the formers compliance is generally low owing to low levels of education of the artisans, unavailability of capital for investments, and generally inadequate technological options at the disposal of miners.

3.5.3. Economic Advantages of ASM Business

The most positive aspect of ASM is evident in the role it can play in poverty reduction and in the promotion of local economic development in the mining locales (Shen and Gunson 2006). ASM is a contributor to employment opportunities in the rural areas where the activity predominantly takes place (Ghose 2003). In its 1999 report on ASM, the ILO (1999) estimated the number of artisanal miners worldwide at 11 to 13 million of whom about 30 percent were women.

Collectively, ASM adds to the aggregate national mineral output hence contributing to the gross national product (GDP). Compared to large scale or formal mining enterprise, ASM holds several advantages in the business environment (Ghose 2003). These include:

1. The minimum reserve requirement for the purpose of economic exploitation is small
2. The turnaround time for business implementation is short
3. The initial capital investment requirement is small
4. The skill and infrastructural requirements are small
5. The employment output is high

Using minimal capital and simple methods, ASM has proven to be a viable means of exploiting hard-to-work deposits for India (Ghose 2003). Additionally operations in ASM exhibit unique socio-technical characteristics; what (Ghose 2003 p. 169) referred to as 'techno-economic and socio-cultural characteristics'. Therefore, referring to the case of India, Ghose (2003) concluded that the rudimentary nature of operations in the sector calls for need to promote effective technology capable of promoting cleaner production. According to Ghose (2003), in spite of the recognizable advantages for India, the ASM operations are inherently unsafe and are responsible for a wide range of environmental damage.

3.5.4. Suggested Solutions to the ASM Challenge

Some scholars see ASM as an unnecessary socio-economic phenomenon whose short term benefits to local communities fall short of the long term costs incurred in terms of illness, injury, pollution, waste of natural resources and market distortions (see for example Andrews-Speed et al.). On the other hand, many scholars have drawn our attention to the great potential in ASM and have therefore argued for the creation of an enabling environment for ASM activities in order to realize its potential benefits.

In the case of China, for example, Shen and Gunson (2006) have argued that the potential contributions of ASM far outweigh its negative impacts but on the condition that the central government should do more to regulate, guide and encourage its development as an industry and create a sound business environment for its operators. To this end, they recommend the

establishment of an ‘appropriate system of laws and regulations and a suitable institutional structure for administration’ as prerequisite infrastructure for the effective management of small scale mining (Shen and Gunson 2006 p. 433). However the challenge is not on the central government alone. According to Shen and Gunson (2006), regional and international bodies must also join in and expand their efforts to bridge critical information, technological and financial gaps that are evident in ASM enterprise. The interests of the players at the local level are also important. Shen and Gunson (2006) have noted that an implementation of a policy for ASM can be effective only if the interests of most if not all relevant parties are adequately met.

Approaching the issue from a general point of view without being country specific, Pedro (2006) has made elaborate proposals for improving the performance of ASM as a mining sub-sector. In his critical article that argues the case for the mainstreaming of mineral wealth in growth and poverty reduction, Pedro (2006) suggest a multifaceted approach to the challenges of ASM that would among other things, address market failures in the provision of affordable or accessible technology and other services to ASM operators. A multifaceted strategy would also include strategies to facilitate knowledge acquisition for the artisans, formalization of the ASM operations and the development of diversified and alternative livelihoods to ASM (especially for rural based operations that may involve under employment of abundant labour force or over exploitation of available resources).

Pedro (2006) has also suggested the integration of ASM operations into local and regional economic development and land-use planning, the provision of training to small-scale miners in analytical skills and the provision of training for sound business management culture, capabilities and practices. These suggestions, he expects, would help the transformation of ASM from a transitory activity and also in the creation of opportunities for local participation in the provision of goods and services.

To discern the said opportunities, Pedro (2006) suggests the mining industry needs to be unbundled so as to be able to identify some critical entry points. These entry points include the following which directly apply in this study i.e. increasing of local upstream support (involving the supplier/input industries) to release the flow of resources to producer organizations and

thereby enhance their productivity. Equally important is the need to identify and enhance the downstream industries (the supply chain of the mining commodity) with emphasis on local beneficiaries and local value addition of goods (where local development is intended).

Another entry point would involve the need to increase social, human, knowledge and institutional capital which can also be transferred to and applied in other sectors. Relevant in this context, also, is the need to promote the development of sustainable livelihoods in mining communities. One last entry point highlighted by Pedro (2006) concern the creation of SMEs and a more balanced and diversified economy with greater multiplier effects and potential to create employment. According to Mutemeri and Petersen (2002) artisanal mining per se should not be encouraged but rather fostered into SME operations with improved technical know-how and business skills.

3.5.5. Challenges to Research on the ASM Business Environment

One of the main challenges to research, recognized by research practitioners in the ASM studies, is to do with difficulties in obtaining useful data. Lahiri-Dutt (2004) noted that the defining feature of informal mining is that it has little if any official records. This is because the mining activities are not organized and often escapes documentation owing to the question of legality attached to their identity. This makes informal mines a generally elusive, unquantifiable and uncertain section of the mineral economy (Lahiri-Dutt 2004).

Researchers have suggested some of the ways to deal with the paucity of information on ASM. Noting that knowledge about ASM is characterized by rhetoric due to lack of empirical data, Hilson (2005) for instance, has advocated that a census should be taken for ASM activities so as to determine the locations of artisanal mining and profile the characteristics of artisanal miners e.g. their educational and ethnic background and their industrial migratory patterns. Such data would also enhance the implementation of ASM projects and programmes involving sustainable livelihoods and technological improvements. Ghose and Roy (2007) on the other hand have suggested strategy of government implemented reporting scheme that would require artisans to report their activities and hence help in generating official data that can be used for policy

development for the sub-sector. Obstacles that hinder data collection in ASM communities, also, have been discussed by researchers as discussed below.

ASM output is highly variable per unit producer thereby making it difficult to estimate mean production or average incomes (Heemskerk 2005). Secondly, the incomes of individual artisans in this field also fluctuate with time and also according to geographical location which makes it difficult to draw general conclusions about their income levels (Heemskerk 2005). Where data is being collected at household level, it becomes difficult to quantify ASM income as it cannot be isolated from other income generating activities of the household. According to Heemskerk (2005) mining revenues may support other activities while income from other sources may be invested in mining equipment. However, this research is not collecting data at household level.

The main challenge on data collection, however, concerns poor field record keeping. The people involved in ASM organizations usually are not formally trained in mining and may have received little formal education; and as a result few ASM operators keep (adequate) records of their earnings and investments (Heemskerk 2005). Additionally, operators in ASM are known to fear government interference in their operations hence most of them work outside of the formal economy. Therefore, according to Heemskerk and Olivieira (2004), as informal and (semi) illegal miners, they are likely to hide their earnings and their operational locations due to the fear that they may be chased away, or their work sites and material may be confiscated, or that they may be assessed for taxes.

From the above reasons, it becomes apparent that obtaining accurate numeric data concerning ASM is not easy. Heemskerk (2005) suggested that qualitative methods such as focus group discussions and key informant interviews may be relied upon although these may also face challenges as explained in the paragraphs that follow.

The other challenge concerns the distrust that miners in ASM have for outsiders. This distrust arises from their lack of confidence in the intentions of the government and researchers. Miners in ASM, therefore, may not reveal that they employ clandestine labour, sell their production outside legal channels and violate national labour, environmental and other regulations

(Heemskerk 2005). Data collection in ASM practices is also inhibited by cultural barriers. The social and economic relations in ASM are determined by local cultural beliefs and practices that may or may not be understood by researchers who, more often than not, come from different cultural backgrounds (Heemskerk 2005).

Lastly, apart from the difficulties they face in obtaining data, the researchers involved in ASM practices also face occupational hazards i.e. they work in dangerous situations that pose direct threats to their lives. ASM locations may be characterised by violent crime, drugs, the illicit use of fire arms and related illegal activities that make it dangerous to visit and collect data on certain mining sites, especially where gold and diamonds are concerned (Heemskerk 2005). Therefore researchers who rely on personal interviews and participant observations often face precarious conditions especially in conflict zones such as Sierra Leone or the Democratic Republic of Congo (Heemskerk 2005).

3.5.6. Artisanal Stone Quarrying

Quarrying is a form of mining distinguished by the fact that the product is for the construction or architectural purposes, rather than for other human uses (Lahiri-Dutt 2004). As already noted, literature on mining of construction materials is hard to come by. However this review chanced on a case study of informal hard stone quarrying in the Rajmahal Region in India by Lahiri-Dutt (2004). In this case study, Lahiri-Dutt (2004) observed some aspects of illegality in relation to the issue of landownership. The study noted that many of the quarries operated on what is called ‘non-transferable tribal land’ in India that was availed to quarrying through corrupt practices. The study also noted that the quarries were owned by non-locals but worked by indigenous labour while transportation was carried out mostly by private trucks.

Further the study noted that stone mining in these areas was a rudimentary extractive industry with nearly all labour tasks performed manually with the largest cost component being wages. The labour intensive-character of the mining has made the activity an easy form of investment with a high rate of return. Unfortunately the workers did not benefit from the labour intensive aspects of the industry. Respiratory diseases including tuberculosis were found to be common

causes of death among the workers. The workers were also found not to be tied to any particular quarry work owing to the seasonal nature of the work.

The study made several conclusions about stone quarrying in this case including the fact that incomes earned from mining activities were found to be meagre but labourers had no choice other than take up such employment in the absence of alternative productive occupations. The salient features of these informal mines were noted to be the low levels of mechanization (labour-intensiveness), considerable environmental degradation, low safety standards, poorly trained miners and a large influx of immigrant workers, low pay scales, low productivity levels, and chronic lack of capital. The mines were also found to operate without concessionary rights with little consideration for environmental impacts and ignorance of existing mineral reserves. The story of stone quarrying therefore reads the same as of artisanal mining in general.

3.6. The Business Environment of Indigenous Building Materials

Artisanal materials in a developing country situation also can be understood within the context of indigenous materials that the United Nations championed in the 1980s. This literature is mainly policy oriented and does not involve any academic considerations. Within this literature base, it is noted that in many developing countries, a substantial amount of the building materials that are used for the production of basic shelter and related infrastructure in rural as well as urban areas are produced by small scale units, often using indigenous resources which are cheap and abundant (UNCHS, 1984c). The production of building materials based on such small-scale units may sometimes meet all the needs of small scale private developers in the localities of rural trading centres and peri-urban areas, not only for shelter but also for structures that are used as workshops, commercial food bars, market stalls, kiosks, private clinics, restaurants, day nurseries et cetera (UNCHS, 1984c).

In some instances, small-scale production of lime and aggregates and the extraction of sand or laterite, for example, have contributed immensely to the construction of civil engineering projects (UNCHS, 1984c). In so doing, these small scale units satisfy a market which the large scale modern sector activities and materials fail to do (UNCHS 1984c). Most of these small-scale

building materials production units operate in rural and urban areas often without registration and their activities are not enumerated in government records as is characteristically the case of the informal sector. This will present a strong challenge for this study as secondary data will not be adequately available to help in the research endeavour.

There are several limitations facing small-scale building materials production units in the informal sector, but their demonstrated ability and potential contributions to local and national economic development are more significant (UNCHS, 1984c). If appropriate policies are adopted, building materials produced in the informal sector could be useful in the production of the bulk of the low cost shelter. In addition to this, they could be used in non-residential and civil engineering construction. In so doing, they could have significant impact on the task of developing indigenous building materials based on the principles of self-sufficiency and import substitution (UNCHS, 1984c).

The United Nations had championed the promotion of indigenous materials sector following the Habitat: United Nations Conference on Human Settlements, held at Vancouver in 1976 (UNCHS, 1985b). The matter was particularly taken over by the then UNCHS Habitat programme of the United Nations that was active on the issue in the eighties. For instance, in March 1985, UNCHS Habitat and UNIDO jointly organized the First Consultation on the Building Materials Industry for the purpose of fostering collaboration between industrialized and developing countries with the aim of leading to improvements in the building materials sector in developing countries (UNCHS, 1985b).

According to UNCHS (1985b) the main reason building materials deserved attention after the 1976 Vancouver conference is that they are the main input in the construction of houses, schools, roads, water supply facilities, dams, and the whole lot of items necessary for human settlements. Building materials could be seen as the cause of inadequate construction output, high construction costs, abandonment of construction projects and sometimes inadequate building maintenance in developing countries (UNCHS, 1985b). This was partly attributed to the fact that in most cases the basic building materials were obtained from predominantly imported sources using scarce foreign exchange so that costs were prohibitive and supply was limited. It was

thought that the trend of rising costs and falling supply of materials can be reversed if the system of production is based on locally available resources. It was observed then, that indigenous building materials exist but are unpopular because of their low quality or are simply insufficient. In most countries, efforts were being made to promote the use of indigenous building materials which led to improved traditional materials or the development of relatively innovative materials (UNCHS, 1985b).

According to UNCHS (1982) the importance of the indigenous construction sector as a contributor to social and economic development should be recognised by: giving particular emphasis to the role and contribution of the sector and formulation of policies for the integrated promotion and development of the indigenous construction sector, placing particular emphasis on the potential of the informal sector. In its document, the UNCHS (1982) also suggested that the above could be achieved by: giving special attention to the needs of the informal sector and co-ordinating all of its facets; examining the nature and scope of the informal sector as a matter of priority in order to formulate ways and means of ensuring its promotion and growth; selecting target groups and reflecting their different characteristics and circumstances in a plan of action incorporating appropriate measures and programmes aimed at meeting the needs of different groups; programming activities at the city and district levels in the first instances with a view to contributing to the subsequent formulation of a national plan of action and; preparing long range social, economic and physical planning proposals with the role of the indigenous construction sector in mind.

UNCHS (1984a) noted that certain problems in the construction sector in the developing countries made difficult the development of an indigenous construction industry. The main problem was singled out to be the fact that the basic inputs required for a supply of construction output were often inadequately developed, even though indigenous resources may have existed in abundance. There tended to be a high dependence on imported resources often paid for by scarce foreign exchange. In another report UNCHS (1984c) indicated that UNIDO adopted the self-sufficiency in building materials production as part of the goal of generating 25 percent of world manufacturing output from developing countries by 2000 as set out by the Lima Declaration and Plan of Action in 1975.

In the seventies and eighties, the majority of developing countries had followed a policy of import substitution as an industrialization strategy. Such a strategy was also pursued for the building materials industries in the formal sector of developing countries (UNCHS, 1984c). This frequently meant the establishment of local industries to produce materials identical to those previously imported in a process known as 'import reproduction'. The local reproduction of previously imported building materials and components generally meant that raw material inputs used in the production process had to continue to be imported, except where there were suitable local resources. Notably, even when these resources existed, they were not always developed (UNCHS, 1984c).

The import reproduction process also involved the importation of machinery and equipment that were characteristically capital intensive and required large quantities of imported fuel, spare parts and technical assistance for operations and servicing. In some cases, only the finishing touches of the production process were carried out locally such as rolling or bending of bars from imported steel or the mixing of paint from imported chemicals (UNCHS, 1984c).

UNCHS (1984c) concluded that the production of modern building materials in the formal sector of developing countries generally amounted to little more than the substitution of one kind of imported material for another, using imported inputs and technology, with the minimum use of local labour and/or development of locally available raw materials. Secondly, the building materials production plants that depended on imported inputs tended to operate at considerably less than optimal capacity and therefore affected the prices of products and in turn severely limited the prospects of market expansion.

It is for these reasons that UNCHS (1984c) recommended the need for wide-scale production and adoption of low-cost building materials, in developing countries, using minimal amounts of capital. This meant production of building materials for which the raw materials and other inputs were locally available. Artisanal dimension stone is one such material that should be encouraged but its production may be hampered by market and institutional environments which this study is addressing.

3.7. The Business Environment of Artisanal Dimension Stone in Nairobi

Artisanal dimension stone has been the subject of research in Kenya within the ITDG initiated studies as cited in Wells (2000); including Agevi and Ogero (1990), Wells (1996), Mjaria (1997), Savery (1997), among others. The main drawback of these studies is that, as consultancy reports, they are not published for wider readership. Their contribution to academic debate on the subject matter is therefore limited. Fortunately, some academic papers have been published from one of these research endeavours as evidenced in Wells (2000) and Wells and Wall (2001, 2003). In the discussion that follows, beginning with Wells (2000), the two publications are reviewed in terms of their contribution to the understanding of the business environment of artisanal dimension stone in Nairobi.

Wells (2000) is mainly concerned with the environmental impacts of artisanal stone mining in Nairobi having undertaken a research project on the environmental impact of artisanal stone quarrying in Kenya funded by the UK Department for International Development through the ITDG. Published in the *Small Enterprises Development* journal, the paper aptly situates quarrying of artisanal dimension stone in Nairobi in the context of small enterprises that are noted to contribute to employment creation and provision of basic goods at low cost (Wells 2000).

It gives a description of artisanal stone quarrying as activities involving 'the presence of a large number of enterprises, each operating on a small scale and employing low levels of technology and large quantities of labour' which involves extraction, cutting and shaping of stone by hand and with the use of 'very simple tools, most of which are produced and repaired by the local informal sector' (Wells 2000: p. 29). The paper claims that there is a rise in the use of dimension stone, a phenomenon it attributes to the liberalization of cement (an input in the production of concrete block) prices that made it more expensive to build in concrete blocks than in dimension stone. The paper makes this claim on the basis of no empirical data and claims further that the increase in the demand for dimension stone has lead to the establishment of large numbers of quarrying enterprises.

In terms of the organizational context of the artisanal stone production, the paper notes that in the stakeholder environment, the key role in the activity is played by the 'concession holder', a term used to refer to the entrepreneur who spends an initial sum of about US$ 750-2000 to invest in quarrying operations by hiring land, paying for licences and 'inducements' (the author's term for illegal fees paid to government officials and informal law enforcers), and paying for wages during the initial set-up stages before the quarry starts generating its own income. The paper also identified transporters as important actors in this venture. Because it costs more money to invest in a truck than to invest in a quarrying enterprise, most concession holders do not own trucks leaving this aspect of the business to a special group—the transporters. Other stakeholders, like employees, land owners, customers and government officials are not discussed—an omission that makes its profile of the stakeholder environment incomplete.

Table 3.2: Summary of the technical characteristics of artisanal quarrying enterprises

Attribute	**Technical Details**
Capital Requirements	US$750—US$2000
• Purchase of tools	• 5—10%
• License and 'inducements'	• 10%
• Working capital	• remainder
Quarry Dimensions	
• Standard size	• 50X100 feet
• Typical quarried depth	• 20—30 feet
• Number of employees	• 10—15 men
• Gross Productivity	• 400—500 feet of stone per day
• Average productivity	• 200 feet per man per day
Main tasks	• Removal of overburden • Drilling holes for blasting • Preparation of explosives and blasting • Splitting and rough shaping of stone • Clearing waste and piling of stone
Dimension stone products	• 9"X9" • 6"X9" • 4"X9"

Source: Wells (2000, pp 30-31), see also Wells and Wall (2003, p 331).

In spite of the above drawback, the paper also gives good descriptions of the organizational structures involved in artisanal stone production as summarized in Table 3.2. Typically, the concessions would measure about 50' by 100' that are exploited to a depth of 20'—30'. The paper reports that between 10—15 men would work in each concession to produce 400-500 feet run of dimension stone per day. The working men are engaged for different tasks that are performed and paid for as summarized in Table 3.3. According to the paper the stones are cut and squared to 9"X9", 6"X9" and 4"X9" typical width and breadth dimensions. It is important to note that some of the details may not add up. For example, of the US$750—US$2000 it is not clear how much would be for paying for the concession. Secondly, at a glance, if gross productivity is 400—500 feet of stone per day for one quarry employing 10—15 men, the average production per man per day may not be 200 feet. Nevertheless the detail provided is important in beginning to understand the business environment of artisanal dimension stone in Nairobi.

Table 3.3 Performance and payment summary for stone quarrying tasks

Task	**No. of Men**	**Performance**	**Mode of Payment**
Removal of overburden	2	Two men work together with hand shovel and wheel barrow	Paid per square metre; the rate depends on depth of overburden
Drilling of holes for blasting	2	Working together, two men drill the hole manually using a 25-30 ft metal pole with steel chisel as the drilling tip	Paid per foot of hole drilled
Preparation of explosives and blasting	1	A licensed blaster is sometimes hired	Not mentioned
Splitting and rough shaping of stone	4	Each working with an assistant two artisans break and roughly shape the stone using a hammer and chisels	Paid per running foot of stone produced Average production is around 200 ft per man per day
Clearing waste and piling of stones	Not given	Done by casual workers	Paid per day

Source: Wells (2000, pp 30—31) and Wells and Wall (2003, p 331).

Although the paper makes some points about the business environment for the production of artisanal dimension stone in Nairobi, its main focus is on the ecological environment. As the title 'Environmental concerns and responses in small-scale quarries in Nairobi' suggests, the paper addresses some key environmental issues about artisanal stone quarrying which it then offers solutions to. The key environmental concerns are basically two interrelated issues: one is to do with the process and the other with the outcome of artisanal quarrying of dimension stone. The process issue concerns the wastage of stone arising from the use of blasting to break rock into workable pieces. It is noted that blasting shatters the rock leading to wastages that various estimates put between 40—85 percent. The second issue which is to do with the outcome of quarrying relates to landscape degradation. The paper notes that the two issues are interrelated because 'if waste is high, quarrying is more extensive than need be and so environmental degradation is spread over a wider area than is necessary' (Wells 2000, p 32).

The paper offered solutions to the two issues including the use of appropriate quarrying techniques such as breaking rock with wedges i.e. benching other than blasting. The paper also suggests that the wastage is enhanced by the balance of property rights in which the quarry operator is not the owner of the land being quarried and hence tends to extract the greatest possible advantage without caring about the value and state of the land after quarrying. The rest of the paper discusses the operational possibilities for suggested appropriate quarrying techniques that may lead to efficiency gains in artisanal dimension stone production.

In conclusion, the paper is relevant in this study to the extent that, although the author does not apply the theory of organizations, it considers the production activities as business enterprises and attempts to portray them in a business environment perspective. However its orientation is to the ecological environment with issues of efficient utilization of resources and environmental landscape degradation as its main concerns. Apart from dueling on the environmental concerns, the paper also contributes to some basic issues concerning the organization of artisanal stone production such as the stakeholders involved and the internal structure of the production units.

The ecological concerns presented in the paper involving lack of rehabilitation of quarries and wasteful mining techniques are not anything new. In fact the paper relies on the earlier work by

Savery (1997) to make its points. However the major contribution of the paper is the proposals it advances as solution to the ecological problems of artisanal dimension stone mining. The paper recommends discontinuation of the mining of stone by blasting method and suggests instead the 'benching' method be used so as to increase productivity per unit area of quarrying. The paper also takes issue with what it terms 'the institutional arrangements' or the system of transactions between the landowners and entrepreneurs that it blames for not promoting environment friendly stone mining practices.

Although not robust in empirical evidence, the paper contributes greatly to the literature on stone quarrying for building in Nairobi by discussing the works of past researchers like Agevi and Ogero (1990), Wells (1996), Mjaria (1997), Savery (1997), among others. By so doing, it brings into academic debate pertinent issues that had been researched and shelved as consultancy reports. This notwithstanding, one major drawback of the paper, in this case, is the fact that it is only strong on the eco-technical aspects and largely leaves out the market environment involving the sale, distribution and use of artisanal dimension stone.

The paper in the foregoing discussion preludes the second one under consideration. The latter, Wells and Wall (2001, 2003), is based on the same research material and considers artisanal materials in East African cities—sawn timber in Dar es Salam and dimension stone in Nairobi. Its section on 'The expansion of artisanal stone quarrying in Kenya' repeats the basic information given in the former. What it does differently from the former is that it situates production of artisanal materials in the informal sector context or what the co-author has termed 'the informal construction industry' (Wells 2001, 2007). According to the paper, the production of artisanal dimension stone is greatly influenced by factors related to the liberalization and eventual informalization of the building industry. Liberalization of the economy brought about the decontrol of cement prices leading to sharp increase in cement prices. The increase in cement prices on the other hand led to the rise in the cost of the main competing walling material i.e. concrete blocks of which cement is a significant component, to rise thereby ceding part of its market to dimension stone.

Secondly, the paper contends that economic liberalization also saw to the shifting of building activities from the public to the private sector especially to the informal developers who more often than not build incrementally and therefore purchase materials like stone in small quantities. Artisanal producers of stone are in a better position to serve small and regular orders rather than large and intermittent orders from public or large scale private developers. The private developers in the informal sector also tend to be less particular about the standard of finish than the public or large scale developers in the formal sector who tend to adhere to the rigour of standards. They therefore tend to favour artisanal dimension stone over machine cut dimension stone or factory produced concrete blocks.

Despite the facilitating factors discussed above, artisanal stone as a product remains hampered and may not penetrate the formal sector market owing to the inherent inability of artisans to produce large quantities of stone at short notice due to the artisanal techniques of production that are generally labour intensive and slow. Secondly, artisanal producers generally operate at subsistence level hence capital limitation prevents them from stockpiling stone for large scale orders.

Both papers have one empirical weakness in that no explanation is given of how the information they discuss was collected. For example neither of the papers gives information on how many quarries were visited, and where they are located. Some quarry areas like Njiru, Ngong or Kiserian are mentioned by passing in the discussion but there is no systematic reporting of what was done and why. This therefore calls into question the representativeness of the information presented and some of it may need to be confirmed on the ground through an empirical survey.

Both papers mainly focus on aspects of the ecological and the technological environments. Although the other environments are mentioned such as the legal and political they do not form part of the discussion. This weakness in the literature on Nairobi follows the general tradition of literature on dimension stone worldwide in which discussions concentrate on technological and ecological to the exclusion of other issues. Examples abound in this case including Heldal and Neeb (2000) on dimension stone production in Norway, Walles et al. (2000) on the stone deposits of central and southern Ethiopia, Saliu (2008) on blasting and breaking technology in Supare,

Nigeria, among others. To address this weakness in the literature, therefore, this study takes a holistic view by relying on the organizational environments of artisanal stone production and use in Nairobi to capture all pertinent issues including stakeholders, political, economic, socio-cultural, legal and ecological.

3.8. Summary and Way Forward

The review has explored the informal sector literature under which artisanal production falls. The most relevant literature in this case concerns the informal construction industry that involves among other things the manufacture of building materials—otherwise known as artisanal materials. Nevertheless artisanal production covers many other areas such as mining and fishing. While a lot of research has been going on in these areas, the review has shown that the area of artisanal production of construction materials remains under researched and this partly forms the motivation for this study. Additionally, whereas the artisanal production of dimension stone can be classified under artisanal mining, the literature on the latter mainly concentrates on the mining of precious minerals like gold to the exclusion of construction materials.

The subject of artisanal production of construction materials also fits in the literature of indigenous construction materials. This literature arose from the efforts by the UNCHS to promote indigenous materials in the 1980s. The most notable aspect of this literature for this study is that, apart from being mainly policy based, it advances no academic debate or perspective. However, some of the reasons it advances to support the promotion of indigenous materials are relevant in this study. In this case, the study material also passes as an indigenous material thereby its study would inform debates on the promotion of indigenous materials.

Finally, the review has considered the literature on artisanal production of dimension stone in Nairobi. Much of this literature was not intended for academic purpose and exists in terms of reports of consultancy based studies initiated by the ITDG on the subject matter. For this reason, they are not readily available to inform academic debate. However some of the academic publications that have come out of this body of research, the review has noted, fall into the general pattern of considering mainly the technological and ecological issues. Of particular

interest in this case is the fact that these studies never consider the use aspects. The use of artisanal dimension stone as a building material is affected by the legal constraints and general practices of the building industry. As these constraints determine the level of use, in consequence, they dictate the level of demand for dimension stone and hence the rate of production by artisans in response to demand. This study therefore proposes a more holistic approach that considers all the relevant organizational environments in order to address the issue of the enabling environment. The application of this approach is explained further in the next chapter on research methodology.

CHAPTER FOUR

4. RESEARCH METHODOLOGY

4.1. Introduction

This chapter explains the methods that were applied in this study including their procedures and their bases or rationale. The methods are based on a conceptual framework that has been derived from the preceding Chapters Two and Three that reviewed the existing literature and established the theoretical grounding for the research. Secondly the methods are based on the epistemological stance of the study—identified as scientific realism. Further, in this chapter, the ontological strategy of the study is explained as another basis for the methods used.

After discussing the conceptual framework, the epistemological and ontological bases, the chapter embarks on the research design. Two main research designs are used: exploratory and conclusive design. Exploratory research design was necessary, as stated by Malhotra (2009), for purposes of providing insights into and comprehension of the research problem by the investigator. Conclusive research on the other hand was deemed fit for enabling the investigator to confirm the issues raised by exploratory research.

Exploratory research mainly relied on ethnography while conclusive research mainly relied on factor analysis. The following sections of this chapter give details of the procedures and their bases as already indicated. The sections include:

i) The conceptual framework for the Study
ii) The Epistemological stance of the study
iii) The Ontological Strategy of the study
iv) The Research Strategy
v) The General Research Design
vi) The Exploratory Research Design
vii) The Conclusive Research Design

4.2. The conceptual framework for the Study

The discussions from the theoretical background and the literature review can be summarised into a conceptual framework for the study as shown in Figure 4. 1. Since the conceptual framework links the theoretical aspects of the study with its methodological aspects, it is impossible to discuss a conceptual framework without including the methodological issues into it. In this case issues to do with methodology are only referred to in brief but the full details are discussed in the next sections.

As shown in the second topmost box to the left hand side of Figure 4.1, the theme of this research is the business environment. According to most writers on this subject matter the environment is defined as all the phenomena that surrounds a business organization and hence determine how it works (see, for example, Beardshaw and Palfreman 1986, Ackroyd 2002, Kew and Stredwick 2008, Wetherly and Otter 2008, Baron 2006, Worthington and Britton 2006, Palmer and Hartley 2009, Palmer and Hartley 1999, Blair and Hitchcock 2001 among others). In this context, business organizations are seen as systems that operate within an environment that is composed of several variables that influences its functions. The business environment is therefore grounded in the general system theory (see Bertalanffy 1950, 1968), however, because business systems actively interact with their environments, organization theory is specifically based on the open systems approach (Palmer and Hartley 2009).

This study is therefore guided by the open systems theory of organization. The open systems theory is appropriate for this study compared to other organization theories such as the classical and human relations approaches owing to its flexibility. The study criticizes the position of the latter approaches for perpetuating the concept of formal organization, which otherwise, would not be applicable to the study of informal organizations. To the contrary, the ‘contingency’ theorists have argued that by interacting with its environment in the open system, an organization develops its own unique characteristics thereby making organizational attributes contingent upon the environment. Since environmental situations differ organizations would accordingly differ owing to ‘environmental uniqueness’ hence organizational analysis cannot be based on predefined attributes as the classical and human relations approaches had proposed. The contingency

argument therefore qualify artisanal organizations, which in principle fall under informal organizations, to be studied as any other organization within its unique environment.

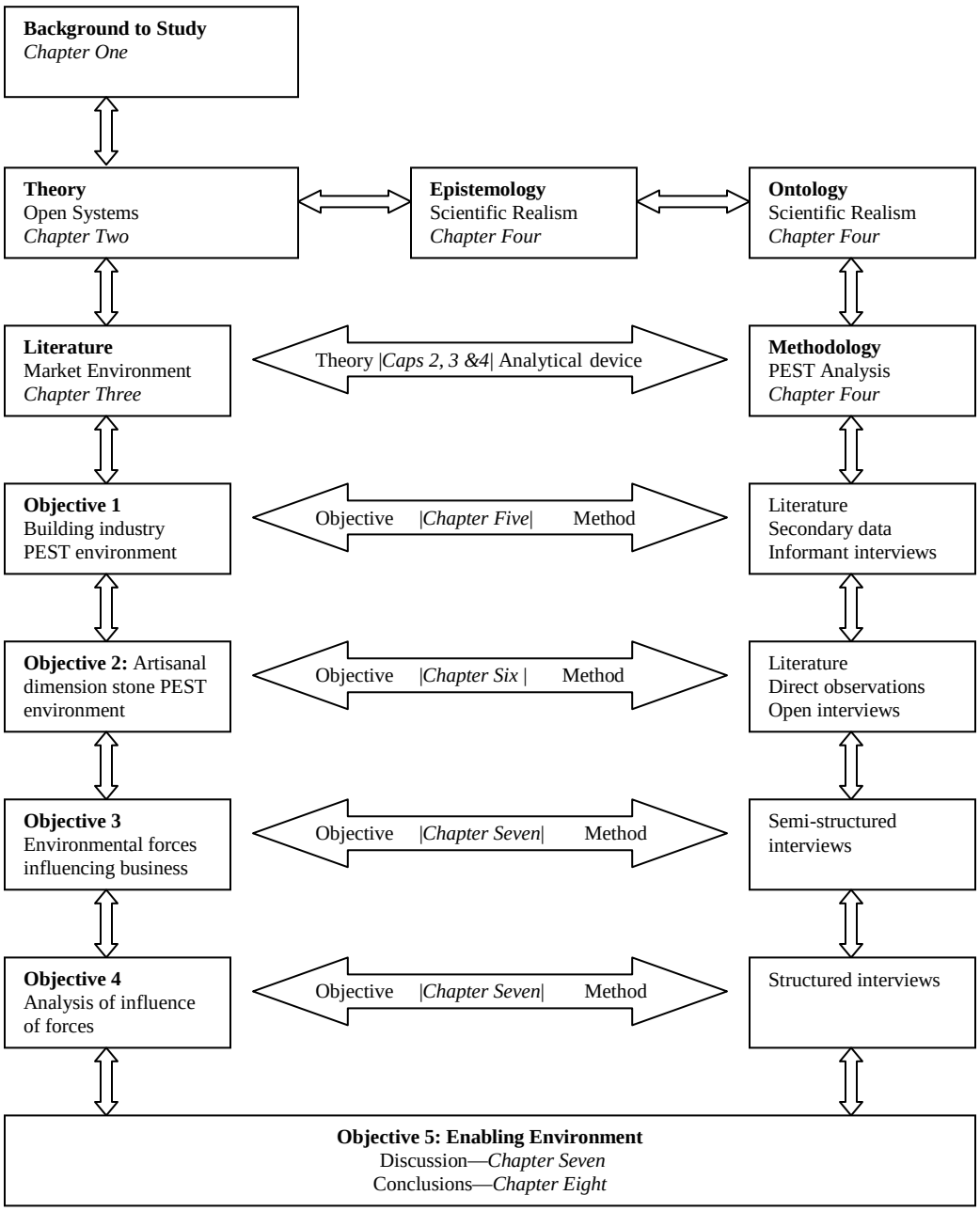


Figure 4.1: The conceptual model for the study of the business environment of artisanal dimension stone production for Nairobi.

The study has adopted scientific realism as the epistemological stance and ontological strategy for its methodological development. Within the open system theory, the study generally applies the PEST technique to analyse these artisanal organizations. Specific methods of data collection including literature review, open interviews, field observation, structured interview and questionnaire survey are used at different stages of the work. Sequenced objective by objective applications of these methods are explained below.

Objective 1 involves the description of the business environment of the construction industry in Kenya and Nairobi. It aims to describe the organizational environment of the industry in order to provide background and context to the study. As explained under Methodology, information needed to realize this objective were collected through literature review and open interviews with key informants from the building industry in Kenya. The results of data collection and analysis for this objective form Chapter Five of the thesis.

Objective 2 then seeks to describe the business environment of artisanal organizations in the production of dimension stone for Nairobi. The main aim of this objective is to describe the organizational environments (inputs and outputs) and transformation processes and also to generate a list of stakeholders (organizations) involved in the business environment of artisanal dimension stone for Nairobi. Information required for the realization of this objective was collected through literature review, field observations and open-ended interviews. The results of data collection and analysis for this objective are contained in Chapter Six of the thesis.

The list of stakeholders drawn at Objective 2 is intended for purposes of Objective 3 that seeks to identify the forces influencing the business environment of artisanal dimension stone for Nairobi. To identify the forces, a data collection technique involving the structured interviews was used to collect information from a cross-section of the stakeholders identified above regarding the collective input environment, output environment and regulatory environment of artisanal organizations. The results of this exercise will form the basis for Chapter Seven of the thesis.

The information generated from the outcome of Objective 3 will be developed into a structured interview schedule to be used to survey the organizations involved in the artisanal production of

dimension stone. The aim of this objective is to convert the qualitative data obtained at Objective 3 into quantitative data that is amenable to scientific manipulation through statistical techniques and also to triangulate the outcome by using a different method and different source and sets of data. The ultimate aim of this objective is to measure the magnitude and interrelationships of these forces through multivariate analysis so as to identify the key forces in the environment because not all forces deserve the attention of the researcher or the policy maker. The results of these exercises would be displayed in Chapter Seven of the thesis.

Objective 5 involves a discussion of the results of the research tasks in the study. It ties up the literature review with evidence from primary data in a discussion that essential identifies and describes the enabling environment for artisanal dimension stone in Nairobi under Chapter Seven of the thesis. This leads to conclusions under Chapter Eight where the report on the study ends.

4.3. The Epistemological stance of the study

As discussed in the preceding chapter, this study is founded on the general system theory which was a methodological device developed within the discipline of natural science. The main argument in this theory, restated here for purposes of clarity, is that natural systems share the same attributes as social systems hence both categories can be studied using the same methods (Bertalanffy 1950, 1968, Boulding 1956, Laszlo and Laszlo 1997). This theory's ambitious intention of unifying the methodologies of the social and the natural sciences is therefore apparent and conforms to the naturalist paradigm of the social sciences. In this regard, this research takes a naturalist epistemological stance (sometimes represented as positivist stance in social science research as opposed to the humanist or interpretivist (sometimes represented as constructionist, relativist or post-positivist) stance.

The application of naturalist or scientific methodologies to social phenomena of course has certain limitations. Concerning this research as an organizational study a pure naturalist perspective faces more difficulties. The first difficulty concerns the system theory itself which organization theorist have contextualized into the open systems theory of organization. The contingency theorist particularly have shown that each organization is unique to itself (Worthington and Britton 2006) which implies that uniform methodology may not capture some

unique aspects of the study organization. Lastly, as social structures, organizations bring together different sets of stakeholders whose opinions may differ concerning the organizational variables under study e.g. employers may not have the same view as employees over the issue of work conditions or adequacy of remunerations. For these reasons, complementary methods rooted in competing paradigm other than naturalist epistemology is necessary. Therefore a multi-strategy research design was found to be appropriate for this study.

In the social sciences, where the naturalist or scientific paradigm is associated with quantitative methods while the interpretivist paradigm is associated with qualitative methods, paradigm conflicts are rampant. Similarly, the field of organizational research is also characterized with paradigm wars (Moldoveanu and Baum 2005). Generally, debates in research methodology literature strongly point to differences between qualitative and quantitative methods (Brannen 1992, Cupchick 2001). Nevertheless, some writers take the compromise position that the two approaches can be used in pragmatic and complementary ways (see for example Bryman 1992, Hammersley 1992, Becker and Bryman 2004). This research project follows the latter school of thought owing to the inherent advantages that combining research perspectives may offer to different elements of the study. Consequently the study adopts the mixed method strategy (Brannen 1992), also referred to as hybridization (after Flick 2006) or multi-strategy research (Becker and Bryman 2004); involving the use of both qualitative and quantitative approaches.

A multi-strategy research design can combine qualitative and quantitative perspectives in various ways or proportions (i.e. whereby qualitative study supports quantitative study or quantitative study supports qualitative study or both approaches used in equal proportions) as pointed out in Bryman (2004, Ch. 22), Becker and Bryman (2004, Ch. 3), and Brannen (1992, Ch 1). Of these three aspects of multi-strategy design, the one applicable to this research involves qualitative study supporting quantitative study. This strategy is reflected in the sequencing of the objectives of the study as explained below.

Objective 1 of the study involves the mapping of the greater (national or sectoral) organizational environment within which the study population operate. This is done by the use of open interview with key informants (a qualitative methodological device) for collection of primary data.

Objective 2 narrows the focus of the mapping exercise to the specific organizational environment of the study population using open interviews (a qualitative methodological device) for primary data collection. Objective 3 intends to identify the environmental forces influencing the business environment of the study population using structured interviews (a qualitative methodological device) to collect primary data. In Objective 4, which is the key objective for this research, a questionnaire device is used to convert the qualitative data generated at Objective 3 into quantitative format for the main purpose of the research. Objectives 1-3 therefore play a supportive function in building up qualitative data necessary for the achievement of the key objective of the research that is quantitative in nature.

The combination of inter-paradigm methods to overcome the difficulties associated with naturalist or scientific paradigm modifies the epistemological orientation of this study to what is generally identified in the social sciences as scientific realism (Bhaskar 1975). In organizational studies discourse, the term Campbellian Realism is used to describe this epistemological position (see for example Azevedo 2005, McKelvey 2005) after the social science methodologist Donald Campbell. This epistemological perspective derives its realism attributes from the realist ontology that holds that there are:

1. Real entities in the world out there
2. That exist independently of our perception, experience, or knowledge of them, and
3. That they have properties and relationships that are independent of the concepts or language we use to describe them (Baum 2005).

Scientific realism, in this context is considered both an epistemological stand and an ontological strategy.

4.4. The Ontological Strategy of the study

Khlentzos (2004) defines realism as 'the thesis that the objects, properties and relations the world contains exist independently of our thoughts about them or our perceptions of them'. The importance of realism in social science is that it serves as a strategy for ensuring objectivity in the outcomes of the research inquiry. As Khlentzos (2004) tells us, the realist argument is that unless we acknowledge that the world (composed of objects, together with the properties of these objects and the interrelationships they enter into) exists independent of our ability to discover it

does, then ‘none of our beliefs about the world could be objectively true since true beliefs tell us how things are and beliefs are objective when true or false independently of what anyone might think’. But the interpretation of realism has been an issue of serious and sometimes controversial scholarly debate.

The contention among various social science research paradigms for legitimacy and intellectual and paradigmatic hegemony is well summarized by Guba and Lincoln (1994). According to Patomäki and Wight (2000 p. 218): ‘the commitment to realism is a condition of possibility for science and one that all parties adhere to; for positivists, sense-experience is real; for postpositivist, discourses or intersubjectivity is real. Hence the question becomes not whether one should be a realist, but of what kind?’ It is in this context that Guba and Lincoln (1994) constructed Table 4.1 as summary of various ontologies of realism.

Table 4.1: Basic beliefs (Metaphysics) of Alternative Inquiry Paradigms

Item	**Positivism**	**Postpositivism**	**Critical Theory**	**Costructivism**
Ontology	Naïve realism—‘real’ reality but apprehendible	Critical realism—‘real’ reality but only imperfectly and probabilistically apprehendible	Historical realism—virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallized over time	Relativism—local and specific constructed realities
Epistemology	Dualist/objectivist; findings true	Modified dualist/objectivist; critical tradition/community; findings probably true	Transactional/ subjectivist; value mediated findings	Transactional/ subjectivist; created findings
Methodology	Experimental/ manipulative; verification of hypotheses; chiefly quantitative methods	Modified experimental/manipulative; critical multiplism; falsification of hypotheses; may include qualitative methods	Dialogic/dialectical	Hermeneutical/ dialectical

Sourece: Guba and Lincoln (1994) p. 109

It is notable that the table does not specify constructivism as an aspect of realism. Although constructivism, as ontology, strives to depict reality, it is not a universal or objective reality;

hence it is classified under relativism other than realism. Indeed it is not precisely correct to say that all social science is realist as Patomäki and Wight (2000) put it. Apart from constructivism the rest of the ontologies are depicted as realist: positivism as 'naïve realism'; postpositivism as critical realism and critical theory as historical realism. Constructivism therefore is not exactly realist despite many analyses that have sought to portray it as such as we shall see shortly.

On the extreme end to positivism Guba and Lincoln (1994) places constructivism. This is a slightly different positioning from Patomäki and Wight (2000) who place deconstructionism at the extreme end and hail constructivism as a middle ground position. This can be tolerable in this case, if we consider deconstructionism as a subset of constructivism (on the extreme end in this case) since before anything can be deconstructed, it must have been constructed in the first case. But as observed by Patomäki and Wight (2000), paradigm boundaries are not definite. This is also the reason why many authors find it difficult to distinguish constructivism from realism as ontologies of the social science.

It is also important to note that in Guba and Lincoln's construction, postpositivism is given as a specific ontology while in the Patomäki and Wight's case it refers to all those ontologies that rose up against the perceived weaknesses of positivism as a scientific paradigm. It is good enough that in the Guba and Lincoln's case it is intended to refer to critical realism only. The Guba and Lincoln's spectrum was found to be inadequate by Heron and Reason (1997) who suggested the addition to it of the participatory research paradigm. This position has been accepted by the former authors and subsequently integrated into a revised version, see Guba and Lincoln (2005 p.195). Therefore it means that the Guba and Lincoln's taxonomy of the social science ontology is complete and can be relied upon in this study to identify its own ontological strategy.

Coming back to constructivism, what is it and how does it differ from realism? The often cited contention of constructivists is that they believe that reality is the product of mental or social construction. In the words of Faux, 'the meaning is ours to make, it is not "out there" to be discovered' and 'The aim of constructionism is not to discover the truth as revealed but the truth as constructed and imbued with meaning' (Cisneros-Puebla, 2007 no p. nos). This makes

constructivism diametrically opposed to realism. But there are two typologies of constructivism as identified by Hess (1997 p.35):

i) The moderate constructivism that goes by the belief that 'scientific theories are realistic maps or explanations of a real world and at the same time vehicles that encode culture-bound linguistic categories and cultural values'.

ii) Radical constructivism that goes by the belief that 'scientists do not discover the world but impose a structure on it or in some sense make the world'.

Moderate constructivism is therefore compatible with realism and to this extent Patomäki and Wight (2000) are right to include constructivism within the spectrum of realism. But radical constructivism is the direct opposite of realism.

This study falls under what is identified in Table 3.1 as 'postpositivism' paradigm or the critical realism ontology that is also referred to by other authors as scientific realism. It is an ontological strategy that combines quantitative and qualitative methods as shown in the table.

4.5. The Research Strategy

In order to obtain primary data for the study the researcher adopted several strategies including field research techniques, data access strategies, primary data collection techniques, triangulation and the adoption of factor analysis techniques for ultimate data analysis.

4.5.1. Field Research

Field research is used in this study to refer to a number of techniques aimed at producing direct observations of people's own written or spoken words and behaviour (Smith 1981). As noted by Smith (1981), it enabled the researcher to see people in the context of their lives and to study the meanings and consequences of their social reality. There are three main types of field research methods, namely participant observation, informant interviewing, and enumerations and samples (Smith 1981). The last typology can be broken down into open-interviews, closed-interviews and questionnaire all of which are applied in this study with necessary modifications.

According to Smith (1981) there are three broad categories of information that a field researcher would be looking for: incidents and histories, distributions and frequencies, and generally known

rules and statuses. Incidents and histories refer to a single or series of events or cases in a specified period of time including the meanings or significance that a participant in research attributes to it/them (Smith 1981). Distributions and frequencies, in this case, refer to the number of members or the number of times members have to do something (Smith 1981). The generally known rules and statuses refer to the informant's accounts of what statuses exist and who occupies them (Smith 1981) and in the context of this study includes things like defining the building industry and breaking it into its sub-components. Table 4.2 is a matrix of the type of information required in a field study and the types of field research methods that can be used to obtain them. This table was used to make choices on what methods to use in the field research for this study.

Table 4.2 Types of information by method of obtaining information

	Methods of Obtaining Information		
Information Types	Enumerations and Samples	Participant Observation	Interviewing Informants
Frequency distributions	*Prototype and best form*	Usually inadequate and inefficient	Often, but not always, inadequate; if adequate it is efficient
Incidents, histories	Not adequate by itself; not efficient	*Prototype and best form*	Adequate with precautions, and efficient
Institutionalized norms and statuses	Adequate but inefficient	Adequate, but inefficient, except for universal norms	*Most efficient and hence best form*

Source: Smith (1981, p. 78)

The table was used, in conjunction with the stated objectives of the research, to pick the most suitable methods for each category of information required. Objective 1 requires information about institutions, institutional norms and the status of the construction industry in Nairobi Kenya. Hence the best method of obtaining this type of information, according to the table, is interviewing informants; hence this method was chosen for field research to supplement information available from literature. Objective 2, on the other hand, in part required information on incidents and histories of artisanal activities hence observation was chosen as part of the methods for the purposes of this objective. Objectives 3 and 4 required some frequency distributions hence the best methods chosen for these were enumerations and samples (interviews) as guided by the table. The next sections outline these methods in more details.

4.5.2. Informant interviews

Informant interviews involve the interviewing of respondents only about other people (not about themselves) or only about events of the past (Smith 1981). Key informant in terms of organizational research refers to a person in a senior position who can speak on behalf of his/her organization (Bryman 1989). Key informants in this case refer to individuals who hold position and respect (Ran et al. 2004) who were interviewed in this study due to their positions of knowledge to provide information about the business environment of the building industry in Nairobi. The key informant technique was initially used by cultural anthropologists in ethnographic studies (Marshall 1996) however Tremblay (1957) demonstrated that the technique was applicable to non-ethnographic research.

The study followed the five-point guideline given by Tremblay (1989) for choosing an ideal key informant. This depended on:

- the informant's role in society—the informant's formal role should expose him/her to the topical information being sought
- knowledge—in addition to having gained access to the information required the informant is expected to have gained meaningful knowledge of the information
- willingness—the informant should be willing to communicate his/her knowledge and to cooperate with the researcher as fully as possible for the information to be reliable

- communicability—the informant must be able to communicate his/her knowledge to the interviewer in an intelligible manner
- impartiality—a key informant should be objective and unbiased regarding the topical issue

In the statistical sense, however, a selection of key informants is in no way considered to be representative members of a sample unit (John and Reve 1982).

The key informant interview technique proved to be a useful way of gaining information that cannot be found through other survey means. One disadvantage of the key informant approach in this case is that the knowledge source was a single sourcing exercise but triangulation was done by cross checking between informants. It offered a broad perspective over issues that do not require enumeration such as the institutional set up of the building industry.

4.5.3. Enumerations and Samples

Enumerations and samples in this case involved the use of various types of interviews. An interview is defined in this case with reference to Burns (2000) as a face-to-face verbal interchange in which the researcher elicited information and or opinions of research participants regarding the topical issues of the study. The interview types could be classified according whether they are serving the qualitative or quantitative perspectives of the research. The qualitative research interviews are a set of interviews whose purpose is to 'gather descriptions of the real life world of the interviewee with respect to interpretation of the meaning of the described phenomenon' and are unstructured or semi-structured (King 2004). The goal of the interview in this case is to consider the research topic from the perspective of the interviewee and to understand how and why the interviewee came to have this perspective. To achieve this goal, the interviews should have a low degree of structure imposed by the interviewee and a focus on 'specific situations and action sequences in the world of the interviewee' (King 2004). These attributes were therefore instrumental in designing the interview schedules for this study.

It is vital to note at this juncture that there are differences in the philosophical assumptions underlying the use of this type of interview methodology. According to King (2004) there are widely varying claims about the nature of the material gathered through qualitative interviews,

and the uses to which it can be legitimately put. For this reason the epistemological position of the qualitative research interviews is relevant. As mentioned earlier, this study adopted the realist approach, which assumes that the accounts participants produce in interviews bear a direct relationship to their 'real' experiences in the world beyond the interview situation. To the extreme end of this is the radical constructionist epistemology that sees the accounts of participants as text produced in the specific setting of the interview to be analysed in terms of the discursive strategies employed and resources drawn upon by the interviewee (King 2004). In this case, there would be no attempt to make claims about the participants' personal experiences.

In an organization research conducted from a realist epistemological position such as this one, the interviewees' accounts are treated as providing insight into their psychological and organizational lives outside of the interview situation. This would therefore imply concerns with the accuracy of accounts necessitating the need to triangulate interview findings with those obtained through other methods. However, as noted by King (2004), realist interviews need to be rather more structured in order to make it possible for different participants' accounts and different types of data to be analysed uniformly and compared. For this reason the study adopted an interview strategy that moves sequentially from unstructured to structured interviews as the research progresses from its exploratory to the main stage. Structured or close-ended interviews are used to collect quantitative data for the study.

The weaknesses of interviews are recognized by this study. Generally interviews are not suitable for reconstructing the past because they are open to memory bias hence the use of direct observations as explained above. Memory is known to decay as time elapses after the event in question, with lesser occurrence of the event in question, if the event is considered of little importance to the respondent among others (Smith 1981). To overcome these problems, archival data (including official statistics) have been used where appropriate for the purpose of Objective 1. Interviews are also subject to viewpoint biases hence the need for triangulation of data. Interviews deprive the researcher of real context in which the research participants' reported perceptions occur since with this technique the participants do not appear in their real world as is the case with participant observation (Burns 2000). The following sections consider further details of the type of field interviews that were used in this study.

4.5.4. Techniques of Primary Data Collection

Participant observation: Table 4.2 mentions participant observation which Smith (1981, p. 77) defined as 'observing and participating in the events, interviewing participants during events, and maintaining stable relationships in the group'. In this study, the researcher got into the real context of study (production of artisanal dimension stone) with the purpose of gaining firsthand knowledge of the phenomenon through observation of actors as they go about their normal activities (see for example Bryman 1989).

According to Bryman (1989), there are three degrees to which participation can take place in a participant observation set-up: covert participation, full participation and indirect participation. A covert participant, also referred to as 'complete participant' by Burns (2000), refers to a situation where the researcher gains entry into an organization as one of the member and observes the other members without they getting to know that they are being observed as opposed to a full participants, or 'participant-as-observer' (Burns 2000), situation where the other members get to know of the researcher's intentions/true identity. However, due to the unpredictable situation of activities in artisanal quarrying of dimension stone in the study areas, the researcher was not able to participate in the two ways explained above. Instead the researcher could only get involved in indirect participant observation or as what Burns (2000) termed 'observer-as-participant' without having to pretend to be one of the artisans. For this reason, in order to achieve Objective 2 of the study, the researcher made direct observations without appearing in the activities as part of the artisanal organizations. Participant observations were used in conjunction with unstructured interviews as part of the ethnographic methods employed in the exploratory stage of the research.

In this case what was observed and recorded included the processes involved in the cutting and shaping of dimension stone, the equipment used, the people involved and the environmental impacts of stone extraction and how what they did related to the business environment factors. This technique was found more suitable for documenting the environmental impacts which are the telltales of quarrying activities in the past. Smith (1981) noted the recall of past behaviour and

events through questionnaires and interviews is often highly unreliable hence information from direct observation often has higher quality than recalled information.

Another advantage participant observation afforded the study was to allow the researcher to study at first hand the behaviour of actors involved in the production of artisanal stone rather than through second hand accounts that survey instruments capture through participants' report of their behaviour or elucidation of their attitudes (see Bryman 1989). Owing to the fact that the researcher did not have any prior knowledge of the natural conditions of the study areas, no observation schedule was prepared. Therefore observations were made in unstructured manner that allowed the researcher to include all issues that had not been anticipated at the outset but were relevant to the study.

The disadvantages of participant observation in the study included the fact that the researcher had to minimise his intrusion into the natural flow of activities so as not to contaminate the sample frame that would be used for further survey in the study. One drawback of direct observation, however, was that the information obtained was not amenable to further analysis in this study.

Unstructured interviews: Unstructured interviews (also known as open-ended or in-depth interviews) form part of enumerations and samples of the field methods described above and shown in Table 4.2. An interview question is open-ended when it is posed in a way that gives the participant whose views are being elicited the freedom to respond in a relatively unrestricted manner (Smith 1981, Bryman 1989). Open-ended interviews were used together with direct observations at the exploratory stage of the research in order to establish the internal structure and the stakeholder environment of producer organizations involved in artisanal dimension stone.

The rationale of interviews in this case was that the people who understand the reality of producing artisanal dimension stone are the artisans themselves or their associates (see Burns 2000). These interviews took the form of conversation between the researcher and the artisans or their associates focusing on the latter's perceptions of themselves, their environment and their experiences regarding the production and sale of artisanal dimension stone. Unstructured interviews were suitable at this stage of exploratory research to facilitate access to events and

activities that could not be directly observed because they had occurred in the past or occurred in the absence of the researcher during the period of observation. Unstructured interviews also allowed more detailed study of the issues than would be possible with other interview techniques. Due to its conversational nature, the technique involved a practical advantage by proving flexible in the field where sometimes it was possible to discuss with the artisans even as they worked in their small groups. Unstructured interview is useful because the researcher does not influence the thoughts of the interviewee but as noted by Brewerton and Millward (2001), it renders the comparability and analysis of data difficult.

The other disadvantage of unstructured interviews is that it can be time consuming exercise where the researcher spends long hours with interviewees and runs the risk of straying from the core research issues. The open-ended questions have more disadvantages including the fact that they demand more motivation on the part of the respondent who, in this case, the aid of preset structured responses (Smith 1981). It also exposed the researcher to vagaries of the respondent's interpretation of reality, which raises a problem of validity (Burns 2000). One logistical disadvantage of unstructured interviews was to programme in advance how many sessions to conduct or when to conduct them since appointments could not be made in advance. It was not even clear how long one interview would take because it depended on how much an interviewee was willing to divulge. Its other disadvantage is that people rarely use the same words to express the same idea hence there is no uniformity in response which leads to the problem of analysis (Smith 1981).

Semi-structured interviews: Interviews can be open-ended as described above or closed-ended on the other extreme. Unlike open-ended questions, close-ended questions restrict choice of response to a preset structure thereby limiting the respondent's choice to given categories or alternatives (Smith 1981). Semi-structured interviews, which the study uses for purposes of Objective 3 to identify the variables that influence the business environment of artisanal organizations producing dimension stone, fall in between these extremes of interview variants.

A semi-structured interview technique was appropriate in this case because the variables required, although unknown to the researcher in the real context, could be defined beforehand

using a theoretical model as explained in section 4.15. In this case an interview guide was developed to give focus to the crucial issues of the study (as explained by Burns 2000). This permitted greater flexibility than was possible with structured interviews and at the same time improved the validity of respondents' perception of reality than would have been possible with unstructured interviews. Another advantage is that the interview guide allows for the participants' rather than the researchers' perspective to be captured (Burns 2000). Another advantage of the interview is that it would allow the participants to use their own language to describe their own reality but at the same time conform to the concepts of the study. Compared to structured interviews, in which participants are used as guinea pigs in the research and which can sometimes raise ethical issues for research, semi-structured interviews grant the participants the chance of participating on equal status to the researcher (Burns 2000). Lastly, the guide also made it possible to code the data for computerised analysis.

Semi-structured interviews are useful in this case for generating the factors in terms of opportunities and constraints on inputs and outputs but semi-structured interviews can be unreliable in the field of organization research due to their openness to biases (Brewerton and Millward 2001). Therefore, the results from the interviews will be triangulated by developing them into a structured schedule to be administered to the artisanal organizations in the production of dimension stone as discussed below.

Structured interviews: As indicated above, a structured interview involves the restriction of the respondent's answers to predetermined options. Structured interviews follow a standardised interview guide for surveys whose objectives involve quantitative analysis (Burns 2000). It presumes that the researcher knows all possible outcomes of the answers to the questions (Brewerton and Millward 2001: p.70). In this case every quarry operator will receive the same questions in the same specified order so that statistical manipulation would be possible. Structured interviews will be used to collect data for the purposes of Objective 4.

In this case specific questions would receive specific answers so that a conversational approach becomes impossible. All the questions will be close-ended so that the respondent is forced to select their answer from a limited set of responses that have been determined by the researcher.

No room of flexibility would be allowed for the researcher/interviewer or the respondents when choosing the responses that would be pre-coded to make it easy for creation of computer database and the subsequent statistical analysis.

A structured interview is similar to a questionnaire survey except that in the latter the questions are self-answered by the respondents while in the former the respondents answer the questions through an interviewer's prompt. According to Brewerton and Millward (2001: p.70), a structured interview 'effectively acts as an other-(as opposed to self-) administered questionnaire'. A questionnaire survey would present the best option for data collection in this study due to less time (speedy) and financial resources (economical) on the side of the researcher (Naoum 2007). Usually it is very easy to conduct a questionnaire survey through mail back post, telephone or by web-based means. However the respondents targeted at this stage of the research are artisans who work in open pits with no shelter come rain or shine, have no fixed address, may have trouble reading and answering questions in the English language, are not used to paper work and keeping of records. Due to these characteristics a questionnaire survey was not possible; hence structured interviews were identified as a sounder option.

Despite the advantages it holds over the questionnaire, an interview survey has some challenges as will be demonstrated in this study. The first point is that a structured interview leaves the researcher with no scope to find out the beliefs, feelings or perceptions of the respondent that do not fit into the pre-ordained response options (Burns 2000). To overcome this challenge, the researcher first identified all the possible key stakeholders at Objectives 1 and 2, and then consulted widely with the key stakeholders at Objective 3 so as to establish all the options of the most significant responses.

Additionally, the detachment and impersonal approach presumed for the interviewer in the structured interview session can eliminate trust and rapport building between the interviewer and the respondent. The researcher will overcome this by first holding general and friendly conversation with the respondent before embarking into interview enumeration. Due care will be taken to ensure that the conversation does not materially relate to the subject of the interview to prevent contamination of data.

4.5.5. Access to Data and Data Sources

Secondary data sources have been discussed; therefore, this section would concentrate on primary data sourcing. For purposes of the exploratory study, the researcher used Tremblay's framework, as discussed under the sub-section on Key Informant Interviews, for choosing key informants for purposes of Objective 1 of the study. The key informant interviewees included the chairman of the Joint Building Council[3] (to cover the formal procurement system) and a university professor recognized for his research in informal settlements (to cover the informal system). To confirm the views of these experts, one formally qualified and practicing quantity surveyor and one building technologist operating within the informal system, both with experience spanning over ten years, were interviewed respectively as alternative sources of opinion to triangulate the information obtained.

For the purposes of Objective 2, a case study strategy was adopted for data collection. Yin (2003) considered case study as a framework for application as a comprehensive research strategy to guide its design logic and methods of data collection and analysis. In this study, however, the case study is not used as a comprehensive strategy as pointed out by Yin (2003)—it was used at a limited scale during the exploratory stage of the research. In this study's context, there are three main clusters/areas of quarrying of artisanal dimension stone for Nairobi i.e. Kahawa, Ngong and Njiru. During the exploratory stage of the research, one area (Kahawa) was chosen as case study for understanding the preliminary issues of the study and to fulfil Objective 2 of the research. The information obtained in the Kahawa case study was assumed to be representative of the rest of the clusters yet subject to verification through interviews and questionnaires data to be collected from the other areas as the research progressed by way of triangulation.

For the purpose of the exploratory objective of the study, the researcher visited the quarries within these sub-clusters to conduct interviews and make field observations. Since the interviews were exploratory in nature, no preplanning was done. The researcher interviewed anybody on site who was willing to answer questions about the organizational environment of artisanal producers.

[3] Joint Building Council is the umbrella body for all building professionals and contractors in Kenya

It was recognised that this early fieldwork could contaminate the samples for the main stage of the research and therefore the visits to the quarries were discrete to lower their impact.

The field visits coincided with a government ban on quarrying in the Zimmerman sub-cluster where artisans operate on public land. Since there were no artisans on site interviews were possible. This, however, did not present any challenge to the research since some of the artisans interviewed in the active quarries had been operating on the public land before the ban. On the other hand observations were made on the environmental impacts following cessation of quarrying activities. From interviews with artisans who, hitherto, were working in the Zimmerman sub-cluster, the study established that quarrying activities ground to a stop after a row pitting two rival agency groups became violent. This was an important lesson for the study at this juncture. The ASM literature has shown that artisanal activities in this area are prone to government bans and the Zimmerman experience proved a point of confirmation for this research.

Due to the limitation on data sources and selection of respondents the data collected may not be representative and were not intended for generalization in the study. The data were only intended for intermediary purpose to feedback to Objective 3.

For the main stage of the study, the researcher has obtained a Research Permit from and according to the rules of the Government of Kenya, (see Appendix 3). This research permit will give the researcher confidence to approach data sources and informants for information. For official permit allows the researcher to obtain primary or secondary information from formal sources without being treated with suspicion. People in formal offices are always reluctant to divulge information to non-legalised investigations. The permit is especially necessary for obtaining information from government offices. It is also useful to the researcher in avoiding harassment by the law-enforcement officers while carrying out field investigations among artisans in the study areas.

4.5.6. Triangulation as Research Strategy

Triangulation is another strategy used in the research in order to make its findings robust and reliable. Triangulation is generally applied in research on the basis that the credibility of findings will be greater when more than one source of data is relied upon. According to Smith (1981) triangulation can be applied in a study in many ways including: triangulation of data, triangulation of investigator, triangulation of theory and triangulation of methods. Triangulation of data may take place in different ways as suggested by Smith (1981):

- in time which is applicable in a longitudinal study but not in this study which is cross-sectional in design
- in space or different geographical areas—this study covers different quarrying clusters (Kahawa, Ngong and Njiru) hence triangulation of data in space is applied
- by level: e.g. aggregate persons, interaction of persons or collectivities of persons—this study is dealing with different stakeholder groups whose views are therefore triangulated to see whether they share the same opinions about artisanal dimension stone or not.

One other aspect of data triangulation that was not mentioned by Smith (1981) but that has been adopted in this study is triangulation of sources.

Investigator triangulation on the other hand involves the use of multiple observers of the same subject so as to compare their observation results. However this study involves only a single observer (the researcher) hence this type of triangulation was not deemed applicable in this study as was the case with theory triangulation too. Theory triangulation involves the application of multiple theoretical perspectives on the same phenomenon. Since this study relies on a single theoretical perspective (the system theory of organization) theory triangulation was not applicable. Methodological triangulation, which involves the use of different methods or techniques within a method to observe the same object of study, on the other hand was applied in this research. It involved triangulation within method or between methods—further details of how triangulation was built in the methods are within the discussions on the application of the methods.

Triangulation can also be used in a multi-strategy research design that combines the two different epistemological perspectives (qualitative and quantitative research perspectives) to check each

other as discussed in Bryman (2004, Ch. 22), Becker and Bryman (2004, Ch. 3), and Brannen (1992, Ch 1). However this may only occur where qualitative and quantitative perspectives are used in the same proportions with the purpose of checking each other. Although this study applies the multi-strategy approach, the qualitative perspective is used in this case to complement quantitative perspective. Triangulation was therefore not used in this study in the sense described above.

4.5.7. Factor Analysis

In the conclusive part of this study, the PEST variables associated with the enabling environment for artisanal dimension stone have been analysed using Factor Analysis techniques. Factor analysis is defined as 'a branch of multivariate analysis that is concerned with the internal relationships of a set of variates' (Lawley 1971, p. 1). Factor analysis therefore became the most suitable method for this study whose key objective (Objective 4) was to analyse the interrelationships of forces influencing the production and use of artisanal dimension stone for building construction in Nairobi.

According to Brown (2006 p. 12-13) the fundamental intent of factor analysis 'is to determine the number and nature of latent variables or factors that account for the variation and covariation among a set of observed measures, commonly referred to as indicators'. A factor in this case is 'an unobservable variable that influences more than one observed measure and that accounts for the correlations among these observed measures' (Brown 2006 p. 13). It involves analysing the structure of covariance and correlation matrices based on the following fundamental formula (see Lawley and Maxwell 1971, p.3 and Brown 2006, p. 17),

$$x_i = \sum_{r=1}^{k} \lambda_{ir} f_r + e_i \quad (i = 1, \dots, p) \qquad [1.1]$$

where

x_i is the i^{th} of p indicators

f_r is the r^{th} common factor

k is the number of factors

e_i is the residual representing sources of variation affecting only the variate x_i

λ_{ir} is the coefficient denoting the loading of x_i on f_r

p is the total number of measured indicators (variables, also known as items).

Further Lawley and Maxwell (1971) observed that the random variates e_i are assumed to be independent of one another and of the k factors. These factors either may be correlated (oblique) or uncorrelated (orthogonal). The variance of e_i, is usually termed either the residual variance or the unique variance of x_i and denoted by ψ_i. In practice the λ_{ir} and the ψ_i are usually unknown parameters that require estimation from observed data.

There are two main types of factor analysis techniques: exploratory and confirmatory factor analysis. Confirmatory factor analysis (CFA) is the advanced aspect of factor analysis in terms of historical development and analytical rigour. Whereas exploratory factor analysis (EFA) developed from the proposals of Spearman (1904), CFA developed many years later from the ideas of Jöreskog (1969). The CFA require that the researcher must have a priori expectations about: the number of factors; which variables reflect given factors and; whether the factors are correlated (Thompson 2004). Therefore CFA 'explicitly and directly' tests the fit of factor models (Thompson 2004, p. 6). However, this study adopted the EFA, which is ideal 'where data are complex and it is uncertain what the most important variables in the field are' (Kline 1994, p. 10).

Brown (2006) described EFA as a 'data-driven' approach involving no a priori specifications of the number of latent factors or the pattern of relationships between the common factors and the observed variables. Therefore in this study the researcher employed EFA as an exploratory and descriptive technique to determine the appropriate number of common factors and to uncover which measured variables were reasonable indicators of the various latent dimensions (see Brown 2006, p. 14). Therefore the overriding objective of EFA in this study, based on the observations of Brown (2006), was to evaluate the dimensionality of a set of multiple indicators (i.e. items from the interview schedule) by uncovering the smallest number of interpretable factors needed to explain the correlations among them.

There are many ways of generating the interpretable factors but the most common ones are: principal component analysis (PCA) and factor analysis (FA). This study used the PCA method

which involves the transformation of original variables into smaller sets of linear combinations with all of the variance in the variables being used as opposed to the FA whereby only the shared variance is analysed (Pallant 2007). Further discussions of factor analysis and PCA as applied in this study can be found in section 4.8.4.

4.5.8. Statistical Indicators

In the factor analysis, the study relied on two main statistical indicators/parameters to make its conclusions i.e. Eigenvalues and total variance explained. Thompson (2004, p. 21) defined Eigenvalues as 'a set of squared area-world statistics [...] also known as characteristic roots'. They are denoted in mathematical formula by the λ symbol (see formula 1.1). In statistical analyses, its values usually appear in descending order. There are four salient features of Eigenvalues in EFA described by Thompson (2004) as follow:

1. The number of Eigenvalues equals the number of measured variables being analyzed
2. The sum of the Eigenvalues equals the number of measured variables
3. An Eigenvalue divided by the number of measured variables indicates the proportion of information in the matrix of associations being analyzed that a given factor reproduces
4. The sum of the Eigenvalues for the extracted factors divided by the number of measured variables indicates the proportion of the information in the matrix being analyzed that the factors as a set reproduce.

Eigenvalues are useful in Factor Analysis as a deciding criterion on what are the most important factors to be considered in the analysis. The default position in making the decision on the number of factors in statistical packages is the 'Eigenvalue greater than 1.0 rule'. Its logic follows the Guttman argument of 1954 that noteworthy factors should have Eigenvalues greater than 1.0 (Thompson 2004). The Guttman argument posited that factors are latent constructs created as aggregates of measured variables and so should consist of more than a single measured variable. For this reason noteworthy factors, as constructs representing aggregates of measured variables, should have Eigenvalues greater than 1.0. Nevertheless researchers should exercise judgement when applying the 'Eigenvalue greater than 1.0 rule' to determine the number of factors because Eigenvalues, like all sample statistics, entail some sampling error (Thompson 2004). In this study

the researcher additionally applied the *scree test* and further applied the *parallel analysis* when deciding on the number of factors to retain; as explained further in section 4.8.3.

The import of an individual Eigenvalue is indicated by the total variance it explains. Following from salient feature number four above an Eigenvalue would explain a proportion of the information in the matrix being analyzed. Therefore the higher the proportion the greater is the import of a factor underlying an Eigenvalue. In statistical analysis this proportion is calculated as Total Variance Explained.

4.5.9. Variable Definition in Factor Analysis

There are two main types of variables in Factor Analysis: *measured* or *observed variables* and *latent variables*. The measured variables are the scores measured directly while the latent variables are obtained by applying weights to the observed scores. In this study the measured or observed variables were obtained using the measurement instrument (for a full discussion of the design see section 4.8.1, also see Appendix 5). Latent variables, on the other hand, resulted for correlation analysis. Kline (1994) correctly observed that in the social sciences, Factor Analysis usually apply to the correlations between variables. A correlation, in this context, is a numerical measure of the degree of agreement between two sets of scores running from +1 to -1; +1 indicating full agreement, 0 no relationship and -1 complete disagreement (Kline 1994). In Factor Analysis the correlations are rendered in a Correlation Matrix, which refers to a set of correlation coefficients between variables (Kline 1994).

4.6. The General Research Design

Research design is used in this context to refer to the overall structure and orientation of the investigation (Bryman 1989). It aims to provide the framework within which data is collected and analysed in this study. Figure 4.2 is a schema of the design.

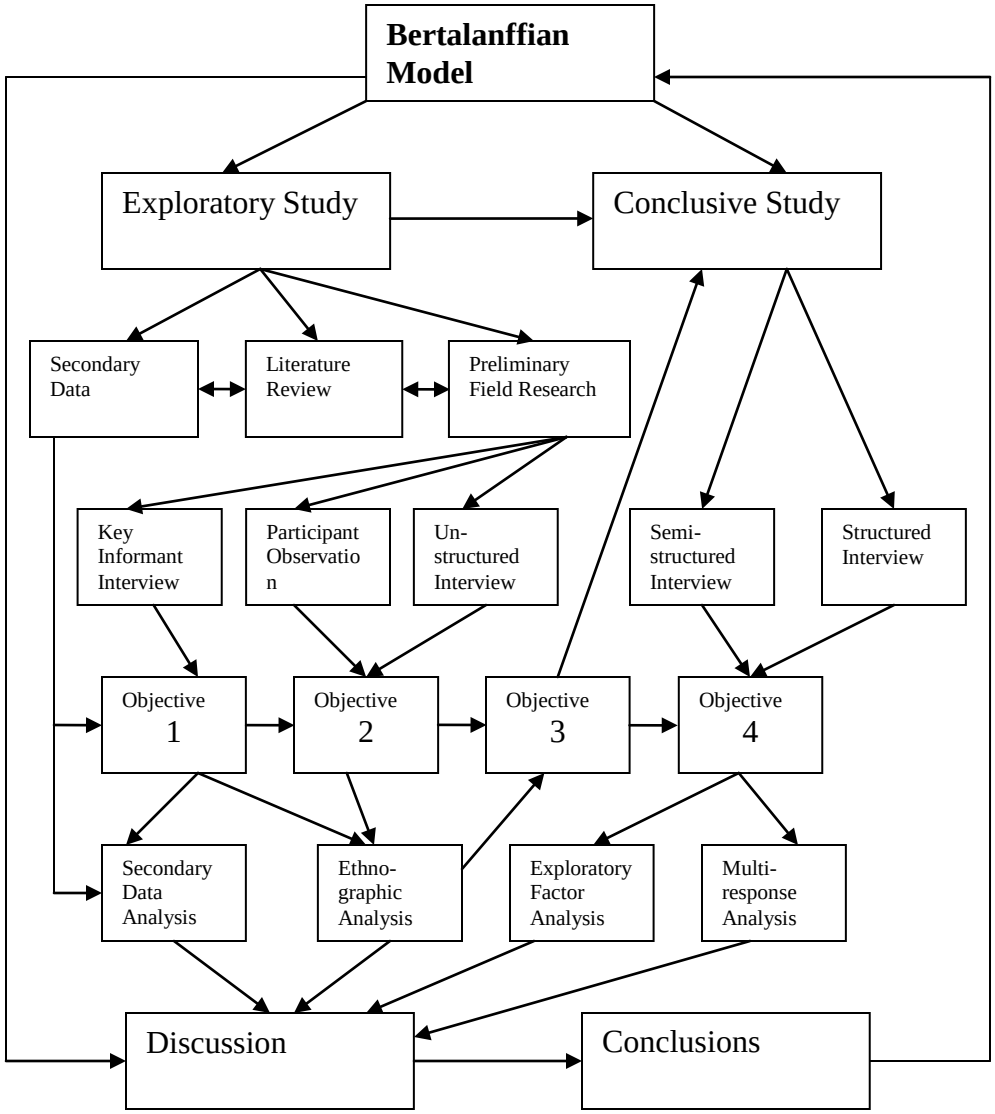


Figure 4.2 Research design schema.

From Figure 4.2, it can be seen that the research starts with the Bertalanffian Model (see Egler 1953, Mulej et al. 2004) after Ludwig von Bertalanffy, the originator of the general system theory on which this study is based. The Bertalanffian Model is therefore the link between this research design and its theoretical basis (see Figure 4.2). By promulgating the general system theory Bertalanffy argued that all systems whether organic or organizational shared similar characteristics and could be analyzed in similar ways (Woolf et al. 1985, Hatch 1997). One unique attribute of the general system theory is that, its meaning and applications go beyond the

theoretical construct implied by the name to encompass issues to do with epistemology and methodology where practical research is concerned as in the case of this study. Although the aim of Bertalanffy was to project the tenets of natural science into the social science, he never advocated the wholesome transfer of scientific methods from natural to social (organizational) science. Bertalanffy's proposition of an open and holistic worldview actually constituted an attack on overspecialization associated with the industrial era and its positivistic science (Davidson 1983) and had the intention of extending the scientific field to include non-traditional areas. This he intended to do by advocating the principle of isomorphism, which refers to the common structures across the sciences or across social phenomena, mechanistic devices and living organisms (see Mulej et al. 2004). These isomorphisms occur in terms of systems.

In the Bertalanffian Model the study of a system (whether mechanistic or organizational) can be demonstrated using the concept of systems elements as shown below.

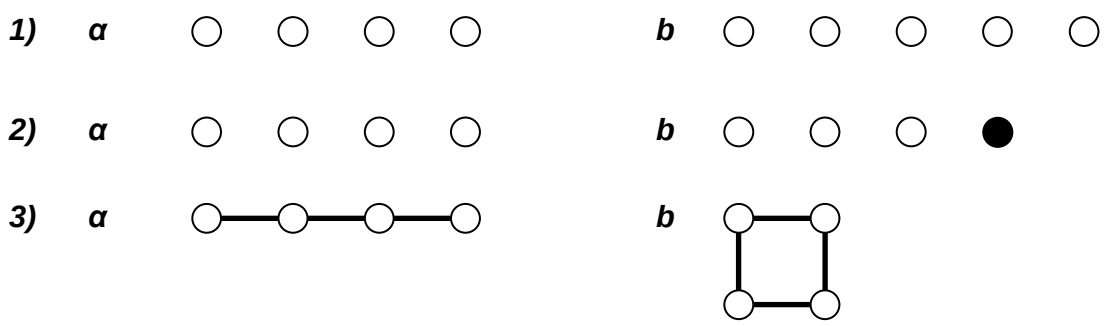


Figure 4.3: The concept of system elements
Source: Bertalanffy (1968, p. 54)

Figure 4.3 above illustrates three kinds of analytical distinctions that can be made when analysing the elements of a system i.e.

1. According to their number
2. According to their typology (variability)
3. According to their relations (or interrelations)

Analysis 1 which simply involves counting how many elements there are in the system has been achieved in the factor retention procedures of factor analysis. However the study relies on Analyses 2 and 3 to answer the core objectives of the research (refer to Figure 4.2 above). In this case Analysis 2 corresponds to Objective 3 i.e. to identify the socio-technical variables in the business environment while Analysis 3 relates to Objective 4 i.e. to model the interrelations of the variables within the business environment.

The process of obtaining data for implementing the model involved two basic stages of the study: exploratory and conclusive stages. The exploratory stage that is associated with Objectives 1 and 2 was intended to establish the background and context of the study and also to explore the research issues that feed into the subsequent objectives of the study. Data for the exploratory research was obtained from secondary (archival data/official statistics) and primary sources (preliminary field research). Secondary data was abstracted and analysed for the purposes of Objective 1—i.e. to define the organizational structure and market environment for the construction industry in Nairobi. For the purposes of this objective, primary data was also collected during the preliminary survey using the key informant technique. In the preliminary field research, primary data was also collected for the purposes of Objective 2 using participant observation in the quarry sites and unstructured interviews with the artisans i.e. ethnography. This was necessary so as to carry out stakeholder analysis to inform Objective 3 on the identity of stakeholders.

Objective 3 where the main body of research begins explored in descriptive form how the work of the stakeholders or their organizations influences the business environment of artisanal dimension stone. This also resulted in a schedule of independent variables that influence the operations of the quarry organizations. The underlying objective of data collection in this case is to explore and identify the forces or variables, within the PEST environments of Lusthaus et al. (2002), which influence the organizations involved in the production of artisanal dimension stone in Nairobi.

Using the forces or variables identified at Objective 3, the purpose of Objective 4 was to identify the perceived interrelationship and magnitude of influence for each of the forces or variables.

Additionally, Objective 4 identified the interrelationships among the influencing forces or variables. The outcome, in this case, was an explanation of the relationships and relative importance of the institutional forces within the enabling environment of producer organizations for artisanal dimension stone. To achieve this, the schedule of variables from the outcome of Objective 3 were developed into a structured interview schedule and administered to a cross-section of randomly selected professionals and a sample of artisanal quarry operators. The interview schedule was administered by an enumerator in order to reduce the impact of low levels of literacy and also to cater for the technical nature of some questions.

Interview schedules were piloted before-hand so as to ascertain that the questions were well understood, to establish how long it would take to complete an interview schedule/questionnaire and if it would be convenient to the respondent, and whether answers were given correctly and could be analysed by the chosen method (Oppenheim 1992). The data obtained from the structured interviews were subjected to exploratory factor analysis (EFA) and multi-response analysis.

Objective 5 did not involve collection of data; instead, it involved the interpretation and discussion of the results of the analysis of interrelationships for purposes of drawing conclusions and making recommendations on the subject matter of research. The discussion was informed by all the outcomes of the analyses and the theoretical information and the conclusions fed back to the body of knowledge according to the Bertalanffian Model.

The research design is in two strands: the exploratory research design and the conclusive research design. The study was informed by the distinctions and purposes of these two strands of research made by Malhotra (2009) and summarized in Table 4.3.

Table 4.3: Basic features of exploratory and conclusive research that informed the study

	Exploratory	Conclusive
Objective	To provide insights and understanding	To test specific hypothesis and examine relationships
Characteristics	Information needed is defined loosely	Information needed is clearly defined
	Research process is flexible and unstructured	Research process is formal and structured
	Sample is small and non-representative	Sample is large and representative
	Analysis of primary data is qualitative	Data analysis is quantitative
Findings/Results	Tentative	Conclusive
Outcome	Generally followed by further exploratory or conclusive research	Findings used as input into decision making [in the case of marketing research]

Source: Malhotra (2009, p. 97)

4.7. The Exploratory research design (Qualitative Study)

4.7.1. **Exploratory Study**

To achieve Objective 1 of the study, the research first relied on the existing literature on the building industry in Kenya. In the existing literature, there are two publications that have specifically profiled the building industry in Kenya i.e. Rado and Wells (1970) and Knowles (1981). These two publications laid out the industry structure, players and procurement system. However the information provided by these two publications was inadequate in two respects:

1. Both publications are dated hence the need to triangulate whether the building industry still functioned as described in the two publications
2. The building industry as profiled by the two publications excluded the informal sector

Therefore, to resolve the inadequacy of the information provided by the two publications the study undertook the following steps:

1. The analysis of the published official statistics on the building industry including inputs (e.g. cement consumption patterns) and outputs (e.g. types of buildings) in the most recent years
2. Purchase of current membership information involved in the industry such as architects, quantity surveyors, contractors and engineers

3. Analysis of statistics released by the Joint Building Council on building types and average cost per square metre
4. A review of the current legislations and policy document applicable to the building industry (the nonmarket environment)
5. Key informant interviews with relevant stakeholders in the building industry

4.7.2. Analysis of Published Official Statistics

Studies concerning the analysis of organizations rely on historical data especially based on their annual returns. However, the organizations this study is dealing with do not file returns hence presenting a great challenge to the research as explained below.

The reference to secondary data in construction research mainly concerns the use of official statistics collected by the state and its agencies (Naoum 2007). The study relies on published construction statistics from the annual statistical abstract and the decennial census statistics on construction that form part of the official statistics (also known as national statistics) in Kenya. National statistics would be useful in providing readymade information on construction activities and products for use by researchers in construction studies. Nevertheless it is necessary to review the national or official statistics in order to establish to what extent they can help in providing information for this study.

4.7.3. Preliminary Field Research I: Key Informant Interviews

The main objective of the key informant interviews was to confirm or triangulate what is in the literature and secondary data. Where specific issues of interest to the study were not addressed the following prompts were used:

1. What are the roles of the following players in the current practice of building procurement?
    i. Client
    ii. Architect
    iii. Quantity surveyor
    iv. Engineer
    v. Contractor

2. What are the relationships between the above main players in the building market?
3. What are the regulations that affect building procurement process in Kenya?
4. What institutions are operational in the building procurement market?
5. How do these institutions interrelate?
6. What are the key features that distinguish the formal building process from the informal building processes?
7. Which are the main sources of finance for building procurement for Nairobi?
8. What is the main material used for wall construction for buildings in Nairobi?
9. How significant is the role played by artisanal dimension in the construction industry of Nairobi?
10. What are the main types of building products that the following categories of clients procure?
    i. Public corporations
    ii. Private corporations and individuals
11. To what extent has the building industry been expanding in the recent past?

Respondents to these questions were head-hunted from the professional institutions in the built environment. These included the chair of Joint Building Council, Kenya Association of Building and Civil Engineering Contractors, and the Architectural Association of Kenya (AAK) overall and Chapter chairs (Architects, Quantity Surveyors, Service Engineers, Planners). Responses to the questions were left unstructured so as to collect a variety of information in a divergent strategy to identify issues concerning the enabling environment. Data obtained from these exercises were subjected to tabular, graphical and descriptive analysis. A summary of the key findings from the said analyses is shown in Appendix 3.

4.7.4. Preliminary Field Research II: Ethnographic Research

No profiles for artisanal production existed from secondary sources.

Since no official records existed of who produce artisanal dimension stone and where they did it or who use artisanal dimension stone et cetera, the study had to explore the field to get initial background information regarding the production and use of artisanal dimension stone in Nairobi. An exploratory study was therefore conducted through *Ethnographic Research*.

Ethnography interweaves participant observation with other data collection procedures (Flick 2006). Its main advantage as a research strategy is that it includes many options of data collection as necessitated by the research issue (Lüders 2004). Further, due to its use of several methods within one research framework, ethnography engenders the potential for triangulation (Flick 2006). The study adopted Atkinson and Hammersley's (1998, p. 110-111) salient features of ethnographic research as its technical guidelines.

1. A strong emphasis on exploring the nature of a particular social phenomenon, rather than setting out to test hypotheses about them
2. A tendency to work primarily with 'unstructured' data, that is, data that have not been coded at the point of data collection in terms of a closed set of analytic categories
3. Investigation of a small number of cases, perhaps just one case, in detail
4. Analysis of data that involves explicit interpretation of the meanings and functions of human actions, the product of which mainly takes the form of verbal descriptions and explanations, with quantification and statistical analysis playing a subordinate role at most

Atkinson and Hammersley (1998, p. 110-111), cited in Flick (2006, p. 228)

Flick (2006, p. 230) has noted that ethnography fits generally into the qualitative research processes and stages as shown below:

1. Ethnography starts from the theoretical position of describing social realities and their making
2. Research questions focus mainly on detailed descriptions of case studies
3. Entering the field has central importance for the empirical and theoretical disclosure of the field under study and is not simply a problem, which has to be solved technically
4. Sampling strategies generally orient to theoretical sampling or procedures based on this
5. Interpretations are mainly done using sequential and coding analyses

In conformity to the salient feature of ethnographic research that was adopted to guide this study the field survey adopted case studies of different quarries.

Since ethnographic research allows for the use of several methods concurrently, other methods used for data collection to complement participant observation included, depth 'unstructured' interviews with individuals and, in some cases, groups.

Since it was not possible to survey all the quarrying sites during this initial survey, a case study approach was adopted for data collection as indicated at point number 3 by Atkinson and Hammersley's (1998) on the salient features of ethnographic research. At the time of the initial survey, there were three main clusters/areas involved in the quarrying of artisanal dimension stone for the Nairobi market i.e. Kahawa, Ngong and Njiru. In the survey, one area (Kahawa) was chosen as case study for collecting data on issues concerning the market environment of artisanal dimension stone. Kahawa was chosen for its convenience of location as the closest quarrying site to the city centre and hence easily accessible to the researcher. The information obtained in the Kahawa case study can be assumed to be indicative of the situation in the rest of the clusters nonetheless unique differences may occur in specific areas. The Kahawa cluster was composed of three sub-clusters: Miharau, Kwa-Hinga and Zimmermann.

The researcher visited all the three sub-clusters at Kahawa. While visiting the quarries open interviews were used to capture data on general issues concerning dimension stone and also detailed information on working practices and market activities. The interviews were conducted with the objective of informing this study on how the production and marketing systems of artisanal dimension stone work, the actors involved and their relationships. Artisans found on site were asked a range of questions as shown below. Since any kind of information was required at this exploratory stage, any participant in the production and marketing of stone who was found on site was approached by the researcher to answer the survey questions. The participants included operators, workers, stone cutters, drillers, blasters and transporters.

In the interviews, the framework of questions used as guidelines for the researcher is shown in Appendix 3: Preliminary Report on Exploratory Study. However it is important that the questions were not posed in the same wording or order in which they appear below. The observations and interviews were recorded as hand written field notes. Additionally observations were recorded

using a handheld digital camera. A summary of the results of these interviews is shown in Appendix 3: Preliminary Report on Exploratory Study.

Data obtained from these two preliminary field surveys together with the analysis of secondary data and literature review were used to construct Chapters Five and Six.

4.8. The Conclusive Research Design (Quantitative Study)

The quantitative study involved the implementation of a measurement instrument designed in the form of an interview schedule. The instrument was administered to 148 respondents drawn from among the building professionals and quarry operators. The responses were then subject to statistical analysis as explained below.

4.8.1. Design of Measurement Instrument

The measurement instrument was in two main parts involving structured and semi-structured responses. The structured part of the instrument was designed as detailed below. From exploratory research (literature review, secondary data analysis and preliminary field survey) the study identified 27, 24 and 26 variables with the potential to influence the production, marketing and legal environments of artisanal dimension stone respectively. These variables were developed into prompts in the measurement instrument as shown in Appendix 5. In the instrument the respondents were asked three question each corresponding to the respective organizational environment as follow.

1. Can you tell me what helps/hinders the making of *jua kali* dimension stone? (Underlying idea: To establish constraints/opportunities available for artisans in the production of artisanal stone).
2. Can you tell me what helps or hinders artisans to sell or distribute *jua kali* dimension stone? (Underlying idea: To establish constraints/opportunities available for artisans in the marketing of artisanal stone).
3. Can you tell me what rules and regulations and their implementation helps or hinders in the production, specification and sale and distribution of *jua kali* dimension stone?

(Underlying idea: To establish constraints/opportunities provided by the legal/administrative system).

Respective variables were listed as prompts under each question and the respondents were further prompted to indicate for each variable whether it was a negative or positive influence. Prompt 2 for instance required the respondents to: 'Indicate whether the following factors are negative or positive influences and grade their strength of influence on a scale of 1-5. 1=least, 5=greatest.' Forty of the respondents were the quarry operators, these were informal investors who were literate/numerate hence extracting the scale from them was not a problem. Since the respondents were not expected to have complete knowledge of the factors of the organizational environment, they were given a third option to indicate that they were unable to comment (or had no opinion) on the variable under consideration.

For purposes of scale development, where the respondents had an opinion on the variable, they were prompted to indicate the strength of the variable's influence on a scale of 1-5 where 1 represented least and 5 represented greatest strength. This gave a total of 11 possible responses; five negative, five positive and one neutral. In the final coding for SPSS dataset the responses were re-coded into an eleven point Likert scale as follow:

Initial Code	**Re-Code**	**Scaled Code**
Negative 5	negative strongest	1
Negative 4	negative strong	2
Negative 3	negative average	3
Negative 2	negative weak	4
Negative 1	negative weakest	5
Unable/no opinion	neutral	6
Positive 1	positive weakest	7
Positive 2	positive weak	8
Positive 3	positive average	9
Positive 4	positive strong	10
Positive 5	positive strongest	11

The dataset generated was thereafter applied to factor analysis.

The second part of the instrument included two open questions as follow:

1. Can you tell me what changes you would suggest to encourage/support the mining, specification and distribution of jua kali dimension stone?
2. What are the advantages of competitor products to jua kali dimension stone?

Responses to these questions were coded and included in the dataset with the structured questions. The main objective of these questions was to elicit opinions of the stakeholders on the possible opportunities for improving the enabling environment for the production and use of artisanal dimension stone in Nairobi. This was partly necessary for answering Objective 5 of the study. The responses were subjected to multi-response analysis.

After designing the measurement instrument it was administered to a sample of respondents in terms of an interview schedule to a sample of respondents who were chosen as explained in the next section.

4.8.2. Sampling Procedure

The study picked practicing architects, quantity surveyors, civil and construction engineers, building contractors of categories A, B and C, and the quarrying operators as respondents to the question schedule. To obtain the sampling frame lists of up-to-date registered and practicing professionals from their respective boards of registration i.e. Board of Registration of Architects and Quantity Surveyors (BORAQS), Engineers Registration Board (ERB) and Registration of Contractors Secretariat within the Ministry of Public Works. The lists obtained from the professional registration bodies were then cleaned by isolating the target professional categories and eliminating those who did not operate within the Nairobi business environment and renumbering the list. This was successfully done for practicing architects, practicing quantity surveyors and practicing building contractors of categories A, B and C (see appendices 6, 7, 8, 9 and 10). Determination of the sampling frame for practicing civil and construction engineers in Nairobi was impossible because the ERB registered all types and published a list of engineers without categorizing them into electrical, mechanical, civil and construction et cetera. Therefore, excluding civil and construction engineers, the total population of professional respondents was estimated at 458.

The appropriate sample size for the survey could not be directly drawn from the generalized total population (458) of the selected respondent groups**.** The professional respondents, distributed into specific professional strata (i.e. the architects, quantity surveyors, civil and construction engineers and contractors of category A, B and C practicing in Nairobi), were sampled according to individual stratum using a simple random sampling without replacement method. The following formula adapted from Nassiuma (2000) was used to determine the appropriate sample size for each stratum.

$$n = \frac{NC^2}{C^2+(N-1)e^2} \qquad [1.2]$$

where

n is the sample size being determined

N is the total number of the targeted population within a stratum in the study area

C is the coefficient of variation 30% usually acceptable

e is the relative standard error, 5% is acceptable

Table 4.4: Sample size for professional respondents

Professionals	**Number Practicing**	**Calculated Sample Size**	**Targeted Sample Size**	**Realized Sample size**
Architects	198	31	35	35
Quantity Surveyors	134	29	32	32
Civil and Construction Engineers	-	-	-	6
Building Contractors;				
Category A	57	22	23	14
Category B	18	12	13	13
Category C	51	21	22	6
Total	**458**	**121**	**125**	**106**

The formula yielded the calculated sample sizes shown in Table 4.4. The sample size the survey targeted was put slightly higher than the calculated; however there was a slight variation in the realization of the sample sizes as seen on the table. After determining the targeted sample size for each stratum of respondents, the sample was drawn from a numbered list (sample frame), as shown in appendices 11, 12, 13, 14 and 15, using the universal random sampling table. The digits of the total population within the sample frames were considered in every stratum. For example, practicing architects being 198, 3 number digits were required; 001-198. Numbers larger than 198 were not usable and passed over, while those less than 198 but repeating themselves were considered only once. Considering the first three digits of the random numbers, selection began at line 196 of the universal random sampling as shown in Appendix 11). Random numbers were picked by reading across the columns from left to right on each successive line of the universal random table until the determined sample size was accumulated. The obtained numbers were then marked on the sample frame to identify the specific architects to be interviewed for the survey. The same procedure was applied for the practicing quantity surveyors who also had a 3 digit total population i.e. 134 (see Appendix 12) and for practicing building contractors of category A, B and C using 2 digits for their total population since their total populations from the sample frames were 57, 18 and 51 respectively (see Appendices 13, 14 and 15).

Nonetheless Bryman and Bell (2007) have argued that *absolute sample size* is a more important consideration than the *relative sample sizes* calculated above. Therefore for the quarry operators the study relied on an absolute sample size. This became necessary because it was difficult to generate a sample frame for the quarry operators since there is no official register in this informal business environment. Compiling a list of the informal quarry operators entailed potential serious dangers as the researcher could not go into the quarries and start asking about names of quarry operators as this would raise a lot of suspicion and meet lack of cooperation. The researcher learnt that the quarrying activities may be a temporary hideout for some criminals and an attempt to establish the identities of people may not be welcome. Therefore, given this kind of difficulty and also the financial and time limitations, the researcher decided on an absolute sample size of 40. This sample was distributed to the four quarrying clusters that were operational at the time of data collection: Ngong (Oloolua), Kenya Quarries, Kwa Hinga and Njiru. On these sites, the first

ten operators who agreed to respond were interviewed using the interview schedule. Two other non-building professionals were interviewed to bring the total number of respondents to 148. The responses were built into SPSS[4] dataset for purposes of statistical analysis as explained in the next section.

4.8.3. Quantitative Data Analysis

The study collected information from respondents using structured interview/semi-structured schedule with the objectives of identifying and analysing the strengths and interrelationships of the forces (variables) influencing the enabling environment of organizations producing artisanal dimension stone. Multivariate analysis, referring to statistical techniques applied to multiple variables was therefore applied to the data collected. Four analyses were carried out on the dataset using the SPSS software:

1. Reliability analysis
2. Frequency analysis
3. Factor analysis
4. Multi response analysis.

The SPSS software was used in this study because it could undertake all the statistical analysis identified as necessary for the successful completion of this research. Secondly it has proved itself in many research studies and is widely accepted by researchers.

Reliability, in this case, refers to the ability of the scale to measure consistently the concepts or constructs under study across different populations (see Hinton et al. 2004). Reliability can be assessed in a number of ways but the study relied on Cronbach's Alpha as the most popular method for testing reliability. Hinton et al. (2004, p. 357) explain that: 'the calculation of Cronbach's Alpha is based on the number of items (i.e. the number of questions in the questionnaire) and the average inter-item correlation. If we assume that the questions are measuring a true score, [...] each individual question will measure the true score plus a certain amount of random error. A high correlation between the different items will indicate they are measuring the same thing as there will be only small values for the error. A low correlation will indicate that there is a lot of error and the items are not reliably measuring the same thing'.

[4] Statistical Package for the Social Sciences

Cronbach's Alpha values range from 0 (i.e. a completely unreliable measure) to 1 (i.e. a completely reliable measure). Hinton et al. (2004) suggested that a Standardized Alpha value of 0.5 to 0.75 is generally acceptable. The test of reliability in this case returned a Standardized Alpha value of 0.745 (see Table 2, Appendix 16), indicating a generally acceptable reliability of scale. This meant that the data was suitable for further statistical analysis. The second set of analysis involved analysis of frequencies, which gave the descriptive statistics of the scale.

The third technique involved factor analysis as the main component of quantitative data analysis. As explained by Hinton et al. (2004), SPSS was used to examine the correlations between variables in the questionnaire data to establish sets of underlying variables or factors that explain the variation in the original (questionnaire/measured) variables. When correlations between the variables are high, it is possible to confuse some of the factors and/or that some variables may be redundant measures. Factor analysis; therefore, allow the large number of the questionnaires variables to be reduced to more limited sets of important and useful factors. The study undertook exploratory factor analysis—a level of analysis that involves examining the variable relationships without a predetermination of a model in which to fit the results (Bryman and Cramer 1997).

Four basic steps were followed in undertaking factor analysis as listed below:

1. KMO and Bartlett's test
2. Factor extraction
3. Factor retention
4. Factor rotation.

Finally interpretation of factor analysis was done from the results of rotation.

Before embarking on the factor analysis, tests were done to ensure the suitability of the data for this purpose; including the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO test). According to Hinton et al. (2004), a KMO test outcome of 0.5 or higher establishes the suitability of the data for factor analysis. Another test that the study performed is the Bartlett test of sphericity, which was to establish whether there are relationships to investigate (Hinton et al. 2004). Further, on suitability and reliability, the study also ensured that the data meets the

recommended sample size. There are various suggestions on the most suitable sample size for factor analysis. Hinton et al. (2004) and Pallant (2007), for instance, recommended minimum ratio of two subjects (respondents) for every one item (variable). However to ensure that the data meets sample size threshold for factor analysis, the study relied on the suggestion by Gorsuch (1983), popularly cited in factor analysis literature, of an absolute minimum ratio of five respondents to every variable and not less than 100 respondents for any analysis. Table 4.5 indicates ratios of five plus, additionally this study beat the 100 respondents' threshold by using 148 respondents.

Table 4.5: Subject variable ratio

Environment	Subjects	Variables	Ratio
Production	148	27	5.48
Market/Use	148	24	6.16
Legal	148	26	5.69

As stated in section 4.5.7, the study used the PCA for factor analysis. According to Fox and Skitmore (2007), PCA successively extracts factors based on the maximum variance between the variables. The first factor extracted accounts for the largest amount of variance in the variables. The second will consist of the next largest amount of variance which is not related to or explained by the first one meaning that the two factors are not related (orthogonal) to one another (Bryman and Cramer 1997). The third factor is extracted from the next largest amount of variance and so on. The first few factors therefore form the principal components (most important factors) at the end of the factor extraction.

The factor extraction process used the Kaiser criterion in which components with Eigenvalues of 1 or more are automatically retained as principal components. Further, following tradition in factor analysis, it was important to look at the screeplot—a graphical demonstration of the Eigenvalues of the extracted components. However for decision on what factors to retain as principal components, Monte Carlo parallel analysis was used. This involved comparison of the Eigenvalues obtained from the Kaiser criterion with Eigenvalues randomly generated from the

Monte Carlo program. Decisions were made to accept the component if its Kaiser criterion Eigenvalue was higher than the Monte Carlo one or to reject if the latter was higher. Hence, using this method, principal components were retained as follow: four for production; six for use and; four for legal environments.

The second round of factor analysis involved factor rotation. Factor rotation involves the moving of the factor axes measuring the locations of the measured variables in the factor space so that the nature of the underlying constructs becomes more obvious to the researcher (Thompson 2004). Factor rotation is quite essential for interpretation. In this study the number of factors considered for further analysis was restricted to the number of components retained after parallel analysis i.e. four-factor solutions for production and legal and six-factor solution for use. Factor rotation can be performed graphically (manual) or analytically (automated). In this case factor rotation was performed analytically using the Oblimin with Kaiser Normalization method. Analytical rotation, because it is automated, will give similar results even if the rotation is performed by different researchers. The results of the rotation demonstrated what factors or variables loaded on which components. Factor rotation generated: the Component Matrix, the Pattern Matrix, the Structure Matrix, and the Component Correlation Matrix which led to the interpretation of results.

The last analytical technique performed on the dataset involved multi-responses analysis applied on responses from the semi-structured part of the interview schedule. The results of these data collection and analysis techniques were used to construct Chapter Seven.

4.9. Summary

In summary, this Chapter has given the details of the methods used and their justification in the study. The main research strategy involves the use of mixed methods i.e. a combination of qualitative and quantitative techniques. The socio-technical systems or the PEST environment of artisanal dimension stone has been analysed using ethnographic and factor analysis techniques. The results of these analyses are discussed in the next three chapters i.e. Chapters 5, 6, and 7.

CHAPTER FIVE

5. THE BUSINESS ENVIRONMENT OF THE BUILDING INDUSTRY IN NAIROBI

5.1. Introduction

This chapter is written in response to Objective 1 of the research that sought to explore the organizational structure of the construction industry in Kenya and identify the prevailing systems of building procurement in Nairobi. Since the study fits in the construction industry, this chapter presents the industrial context of the study by discussing the business environment for building construction in Nairobi. It is within this industrial context that the study material (artisanal dimension stone) is produced, sold and used. As noted earlier, business is the activity of producing goods and services to meet consumer needs by transforming inputs into outputs (Wetherly and Otter 2008). According to Palmer and Hartley (2009) businesses (firms/organizations) exist to turn inputs from their environments (i.e. materials, labour, capital) into outputs (products) which customers in the environment want to purchase and/or use.

According to Baron (2006) the environment of business consists of market and nonmarket components. In the case of the building industry, the market environment would include any interactions between the building firms (contractors), their suppliers and customers (clients) that are governed by markets and contracts. Such interactions usually involve voluntary economic transactions and the exchange of property. On the other hand, the nonmarket environment is composed of the social, political, and legal arrangements that structure interactions outside of (but in conjunction with) markets and contracts (Baron 2006). The nonmarket environment includes interactions between the building firms and individuals, interest groups, government entities, and the public that are mediated not by markets but by public and private institutions (Baron 2006). For this reason the nonmarket environment may also be referred to as the institutional environment. The interactions in the nonmarket environment may be voluntary (such as corporate social responsibility activities) or involuntary (such as conforming to government regulations). For this reason the nonmarket environment may also be referred to as the regulatory environment.

Following the above categorizations, this chapter composes of four main parts: the market environment of the building industry in Nairobi; the nonmarket environment of the building industry in Nairobi; the business implications the market and nonmarket environments; concluding remarks. Before embarking on the main parts of this discussion, a brief presentation on the sources of data immediately follows.

Studies in the construction industry, of which buildings form part, largely depend on official data (K'Akumu 2007a). This chapter therefore heavily relies on published official data especially from the statistical abstracts of 2007 and 2009. Additionally the chapter has relied on the results of the decennial census of housing as contained in *Kenya 1999 Population and Housing Census Analytical Report on Housing Conditions and Social Amenities Volume X* for housing products information (Republic of Kenya 2007a). The statistical abstracts provided data on inputs such as cement consumption and wage labour; on products such as reported new residential buildings; and on processes such as number of approved building plans. The census data include the rate of household formation. The official data sources did not provide information on professionals. This data was mainly obtained from the professional bodies in terms of membership and from the professional registration institutions in terms of lists of registered members. Additional information from non official sources was obtained from national professional journals such as *The Quantity Surveyor*. Information from literature, also, has been subjected to critical interpretation. Data thus obtained were subjected to analysis and presented in terms of tables and bar charts. Interpretative data has also been analyzed and presented in terms of flow charts.

5.2. The Market Environment of The Building Industry

The market environment of the building industry generally is made up of building activities which in the words of Bon and Crosthwaite (2000, p. 2) 'entails the assembly of building materials and/or components on site; the materials and components are supplied by a variety of industries in the manufacturing sector; are delivered to the site by transportation and trade sectors; the assembly proceeds in accordance with plans, designs and management procedures supplied mainly by the business services industry in the service sector; most of the funds required are supplied by the financial services industry in the service sector'. In the Kenyan context, one

of the most precise descriptions of the building industry is by Rado and Wells (1970) that, in this study, has been summed up diagrammatically as shown in Figure 5.1.

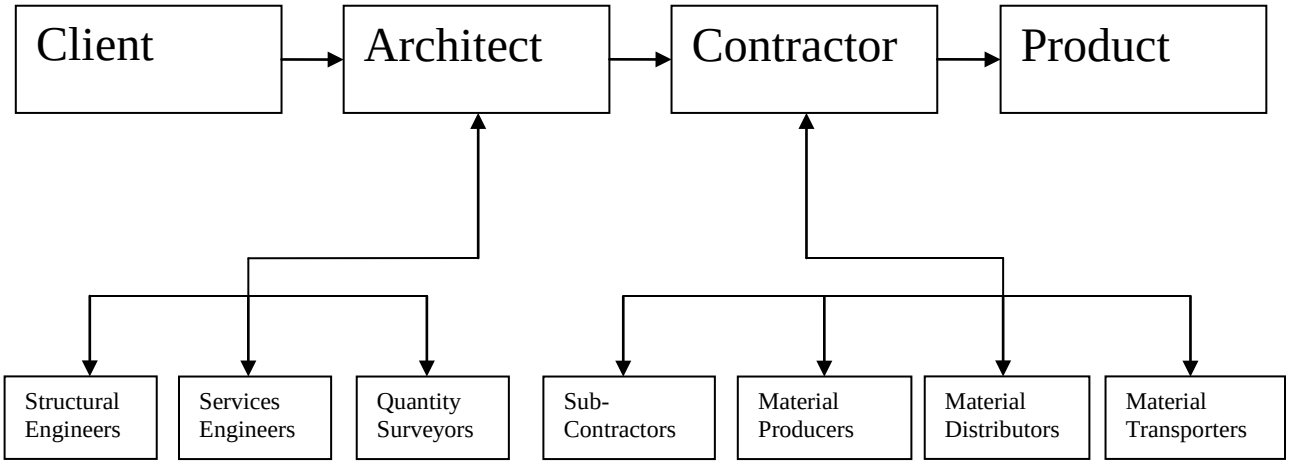


Figure 5.1: The formal market environment of building firms in Kenya
Source: after Wells and Rado (1970)

5.2.1. Building Client

Rado and Wells (1970) designated the client as the principal participant in the building process (see Figure 5.1). The client's role is to commission and finance the building work; financing may come with the backing of financial institutions. The client may also be referred to as 'developer' or sometimes as 'builder'. In the real world clients may be divided into two main types: the private developer and the public developer. Public clients may include central and local governments and parastatals (public corporations) while private clients may include households, private firms/corporations (Briscoe 1988). In the developing world, NGOs and associated development partners are also playing significant roles as procurers of buildings.

In Nairobi it is observable that both the central and local governments are pulling out of the building procurement business as the statistics of building plan approvals discussed under Plan Approvals indicate. However one of the government corporations set up to procure buildings for

residential purposes, the National Housing Corporation, seem to be returning to the Nairobi market as indicated in Table 5.1.

Table 5.1: Number and value of houses completed by the National Housing Corporation

Province	Number					Value (KSh Million)				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
Nairobi	--	--	160	230	230	--	--	137	463	463
Coast	--	--	161	--	--	--	--	196	--	--
Eastern	--	--	--	--	--	--	--	--	--	--
Central	30	--	24	--	--	50	--	45	--	--
Rift Valley	--	--	15	--	--	--	--	33	--	--
Nyanza	--	--	--	69	69	--	--	--	11	11
Western	--	--	--	--	--	--	--	--	--	--
North-Eastern	--	--	--	--	--	--	--	--	--	--
Total	30	--	360	329	299	50	--	411	474	474

Source: Republic of Kenya (2009, p. 140)

Sometimes the client's need is influenced by the user needs; for instance, the market for residential buildings is influenced by the high rate of household formation as shown in Table 5.2. From the table we can see that Nairobi's rate of household formation is higher than the national averages. This explains why Nairobi dominates the urban housing market in the country.

Table 5.2: Rate of household formation in Nairobi in the context of Kenya

Region	Number of Households		Growth Rate
	1989 Census	1999 Census	
Kenya (overall)	4,343,004	6,335,295	1.653
Kenya (urban)	976,849	1,602,044	2.085
Nairobi	382,698	642,906	2.279

Source: Constructed Republic of Kenya (2007a p.13)

5.2.2. Inputs for the Building Industry

The resources include materials, labour and capital. The building materials available in Kenya were listed in Knowles (1981). However one of the comprehensive compendiums on building materials in Kenya is by the Kenya Building Research Centre (2006); which is a compilation and

collation of information on the building materials and components available in Kenya from manufacturers (or producers) and distributors. The materials and components considered in this digest include: timber, building stone, clay products, cement, concrete, gypsum plaster, paints, coatings, ironmongery, non-ferrous metals, steel and iron, glass, adhesives, sealants, plastics, rubber materials and electrical gadgets. The current prices of these materials are given in *The Quantity Surveyor* (Vol 11 No 4 pp 29-34).

Cement is one material that is a significant indicator of the level activity in the business environment. Figure 5.2 presents the data on the consumption of cement in Kenya. The figure indicates a steady rise in the consumption of cement in Kenya, Nairobi included. We can see that the consumption of cement has almost doubled in a period of seven years. The steady rise in consumption of cement implies a consistent growth in the construction industry within the time period. Therefore we can conclude that the building output in Nairobi could be growing too.

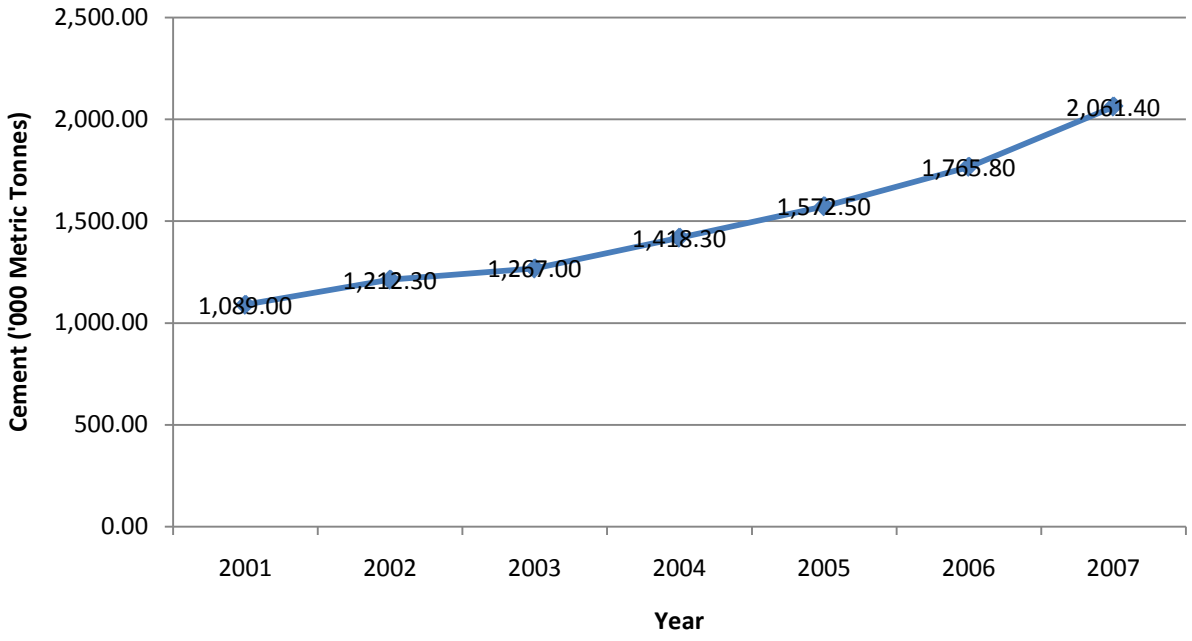


Figure 5.2: Estimated consumption of cement in Kenya

Source: Constructed with data from Republic of Kenya (2009, p. 142)

To assemble the building materials and components, contractors require labour and equipment. Figure 5.3 indicates the level of wage employment in Nairobi for different industries. According to the figure, the construction industry which encompasses building activities employed a total of 43,193 wage earners in the year 2006 representing about 9.25 percent of total labour force in the formal market.

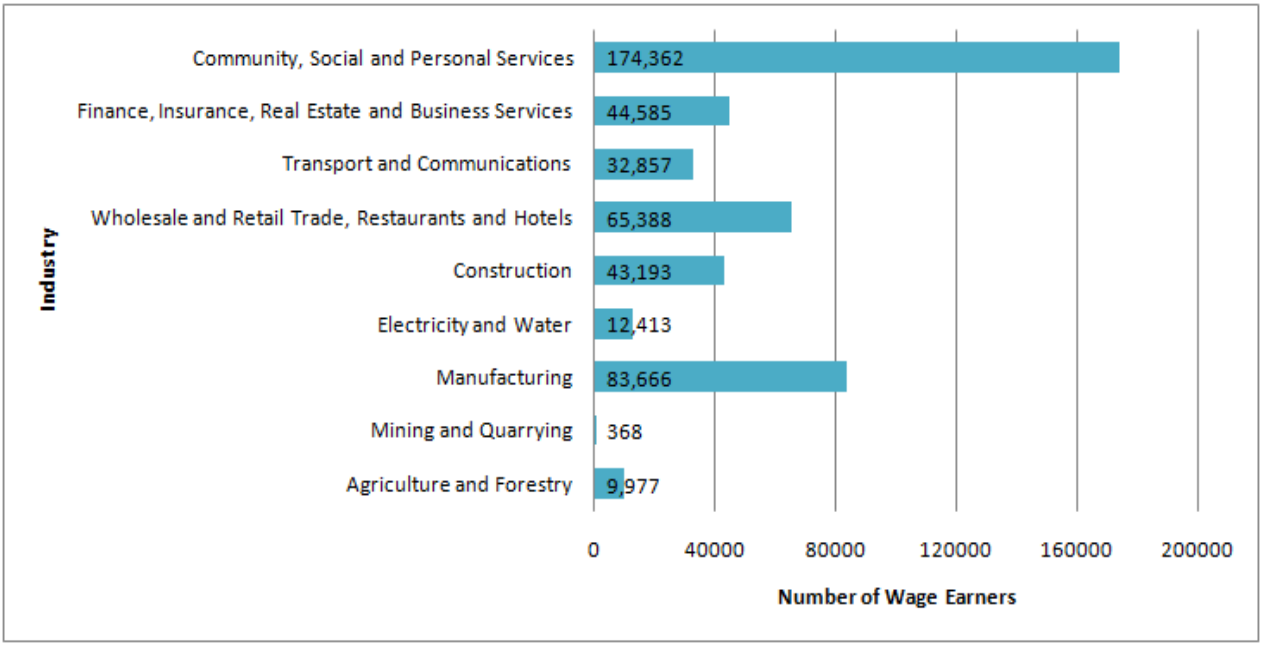


Figure 5.3: Wage employment by industry in Nairobi for a sample year

Source: Constructed with data from Republic of Kenya (2009, p. 253)

Capital is required in liquid form and also in terms of goods like land and equipment in the building process. It is mainly provided by the client from own or loan sources. Before a building can be constructed, the client has to secure a site which may require financing. The client would also pay for initial costs such as requisite approval fees. The client also requires finance for settling the professional fees as well as contractor's costs. Usually the contractor uses own finances to meet the costs of buying and assembling the inputs only for the client to reimburse at various stages of the work. For this reason, the contractor will also depend on short term financing from the banks. The contractor also relies on capital in terms of equipment and machinery for building activities.

Since buildings require huge financial outlays, more often than not the clients have to rely on the capital markets to raise the necessary finances. Usually capital would be available from financial institutions such as insurance companies, social security institutions such as the National Social Security Fund (NSSF). Corporate clients may also raise money from the capital market through issuance of bonds et cetera. All these sources are regulated by various watchdog institutions as shown in Figure 5.5.

5.2.3. **The Input of Architectural Professionals**

As shown in Figure 5.1, the second most important participant is the actor who plays the role of designing the building on the basis of the client's indicated needs and within the cost options for the client (Rado and Wells 1970). For larger buildings the specialist consultants like structural engineers, services engineers (electrical, mechanical, heating etc) may be involved under the coordination of the architect.

Apart from the specialist consultants, a quantity surveyor is also crucial for large projects. The role of the quantity surveyor is to translate the architect's drawings either into technical specifications which the contractor must carry out, or (on larger works) into a detailed "Bill of Quantities" (BOQ) in which a building is broken down into its component elements of precisely defined composition (Rado and Wells 1970). It is on the basis of this document that the third principal participant, the contractor, estimates his requirements of materials, equipment and labour and therefore prices the work accordingly.

The professionals in the building industry in Kenya are organized into specific professional organizations including the Architectural Association of Kenya (AAK) and the Institute of Engineers of Kenya (IEK). The AAK has various categories of members as shown in Table 5.3 including architects, quantity surveyors and building services engineers. From the table we may see that most of the professionals are located in Nairobi compared to the rest of other urban centres in Kenya.

Table 5.3: Membership categories of the Architectural Association of Kenya

Category	Nairobi	Other Towns	Total
Fellow Architects	18	0	18
Corporate Architects	327	33	360
Resident (Non) Corporate Architects	1	12	13
Licentiate Architects	6	0	6
Resident Graduate Architects	171	25	196
Resident Technician Architects	26	8	34
Resident Student Architects	23	7	30
Fellow Landscape Architects	1	0	1
Resident Corporate Landscape Architects	8	0	8
Graduate Landscape Architects	8	0	8
Student Landscape Architects	4	1	5
Fellow Quantity Surveyors	9	0	9
Resident Corporate Quantity Surveyors	147	6	153
Non Resident Quantity Surveyors	0	3	3
Resident Graduate Quantity Surveyors	28	8	36
Resident Technician Quantity Surveyors	9	0	9
Licentiate Quantity Surveyor	1	0	1
Student Quantity Surveyor	7	9	16
Fellow Engineers	5	0	5
Resident Corporate Engineers	31	4	35
Non Resident Corporate Engineer	0	1	1
Graduate Engineers	1	0	1
Technician Engineers	1	0	1
Corporate Environmental Design Consultants	11	0	11

Source: Constructed with membership information from AAK in 2009

Apart from being members of their professional body, architects and quantity surveyors are required to register with the Board of Registration of Architects and Quantity Surveyors (BORAQS), as provided for in the legislation regarding their practice. Apart from registration, the legislation also requires that the professionals obtain an annual practicing licence as discussed under section 5.3.4. The numbers of registered and practicing members are shown in Table 5.4.

Table 5.4: Registered and Practicing Architects and Quantity Surveyors

	Nairobi	Other Towns	Unspecified Locations	Total
Practicing Architects	198	26	--	224
Firms of Architects	194	4	52	250
Practicing Quantity Surveyors	133	17	--	150
Quantity Surveying Firms	118	4	19	141

Source: Compiled with membership information from BORAQS in 2009

Other than architects and quantity surveyors, crucial to the building industry are the engineers (i.e. structural, material and services engineers). The members of the engineering profession belong to the Institute of Engineers of Kenya (IEK). The IEK accommodates all engineering professionals including electrical, mechanical, and civil engineers. Therefore the building services engineers may belong to both the IEK and the AAK. However the structural and materials engineers belong to the IEK only. Like the architecture and quantity surveying, the engineering profession is governed by legislation as discussed under section 5.3.4. The legislation requires professional engineers to register with the Engineers Registration Board (ERB). The official list of current registered and consulting engineers is contained in Gazette Notice Number 4319 of 24th April 2009 (Republic of Kenya 2009a, p. 1065-1081). Unfortunately the gazette list does not give the categories of the engineers hence it is hard to tell the ones who work in the building industry and those who do not.

5.2.4. The Input of Building Contractors

Building contractors are responsible for the assembly of the resources required for building production. The contractor tenders for the building work by stating the sum for which he is willing to undertake the project on the basis of the architect's drawings and the quantity surveyor's specifications or BOQ. The contractor may put in a lump sum tender where only specifications are concerned or make separate estimates for each building element when working to BOQ. In a lump sum contract the contractor agrees to perform the work for a single fixed price regardless of the final outcome of the costs (Franks 1998, Turner 1997). The contractor has a

special role in the building process that involves the assembling of all the resources required for the erection of the building including labour, equipment and materials or components. The contractor may employ sub-contractors to work directly under his supervision. Through market interaction, the contractor also deals with the material and component producers, distributors and transporters. According to Rado and Wells (1970 p. 206) the building industry in Kenya should encompass 'an indeterminate number of specialist sub-contractors, as well as the producers, processors, manufacturers and distributors of building materials'.

5.2.5. Building Products (Output)

Economists have noted that, unlike industrial products, construction products of which buildings form part are unique and distinct as they are custom-made to the specifications of the client (Briscoe 1988, Gann 1996, Hillebrandt 2000, Myers 2004). The production of buildings involves limited automation and standardization thereby making it difficult to make comparison of output. The products of the building industry therefore differ widely according to size, appearance, location and end use (Wells 1986). Products may also differ in terms of new buildings or repair and maintenance (Wells 1986, Briscoe 1988). According to Wells (1986) in the developing country situation the products of the building industry may include housing, hospitals, health centres, schools, offices, factories, agricultural buildings and hotels.

Owing to the fact that within the construction sector there exist considerable scope for substitution between inputs and a high degree of technological flexibility, the products of the building industry may also show wide variations in terms of materials and techniques used in production and the standards of the finished product (Wells 1986). Therefore in a developing country like Kenya the full range of technological alternatives is generally adopted as can be seen in terms of formal or informal settlements in urban areas, traditional settlements in rural areas et cetera. One last unique thing to note about the building products is that, like many other construction products, they may not be required for their own sake but on account of the goods and services that they may provide or help create (Hillebrandt 2000).

In the Nairobi market, building products can be divided into two main aspects: residential and non-residential buildings. Further sub-divisions of these two main categories are considered under section 5.2.6. In this context residential covers buildings used for living purposes while non-residential covers buildings mainly used not for living purposes. For instance, Table 5.5 gives details of building products in Nairobi for the year 2005. Although data in the table has statistical discrepancies, we can see, for example, that the total floor areas for residential and non-residential buildings are close to equal for Nairobi but the cost difference is enormous. Given the small number of non-residential buildings being completed (8 for Nairobi) and the enormous floor area involved, the obvious implication is that they are high-rise buildings. For that matter, we expect their costs to be higher than those of residential buildings; not the other way round.

Table 5.5: Reported completion of buildings by private developers in main towns for the year 2005

Detail	Residential	Non-residential	Total
Number of new buildings	829	8	837
Floor area of new buildings in '000 sq. m.	256	244	500
Estimated cost of new buildings in KSh. Million	1,913	214	2,127
Estimated cost of extensions in KSh. Million	34	81	115

Source: Constructed with data from Republic of Kenya (2007b p.142)

Available statistics divide the residential buildings in Nairobi further into number of rooms. Table 5.6 gives analysis of reported new residential buildings in Nairobi according to the number of habitable rooms. A habitable room is defined as 'a room used for the purpose of working, living, sleeping other than kitchen, bathroom, lavatory, laundry' (Republic of Kenya 2007b p.143). This essentially means that a one-bedroom or double-room dwelling would be considered as two habitable rooms while a single room dwelling would be considered as one habitable room. It is not clear whether the statistics being reported are for dwellings or for buildings. The difference is important since one building may contain several dwellings or dwellings of various room configurations. Nevertheless, data reported on the table show that the number of one and two habitable rooms tend to be lower than the rest of reported building completions. This is a discrepancy given that the former tend to dominate in use; according to the census data.

Table 5.6: Number of reported new residential buildings in Nairobi

Habitable Rooms	2001	2002	2003	2004	2005	2006	2007[5]
One	35	55	19	54	67	99	179
Two	31	64	25	14	43	94	134
Three	40	53	102	180	210	186	191
Four	35	45	140	26	66	80	94
Five	38	47	13	43	101	50	72
Six or more	91	104	6	101	54	69	64
Total	270	368	305	418	541	578	734

Source: Constructed with data from Republic of Kenya (2007b p.143, and 2009, p. 137)

5.2.6. Building Procurement Prices

After considering the various building products, it is important to get an inkling of what they would cost in the market currently. Table 5.7 presents the current unit price estimates for the construction of various residential and non-residential buildings in Nairobi according to the Institute of Quantity Surveyors of Kenya.

After discussing the market environment of the building industry, we can now look at the nonmarket environment in the next section.

5.3. The Nonmarket Environment Of The Building Industry

As noted earlier, the nonmarket environment is composed of voluntary and involuntary obligations for the market players (Baron 2006); where the involuntary obligations consist of regulations that also involve enforcers (regulators). In the Kenyan building industry, the study established that regulations may include: the contract regulations, building regulations and standards, professional regulations, and environmental regulations.

5.3.1. Regulations for Contracting

As has been noted, the interactions in the market environment are based on contracts or private treaty. Contracts in the industry are governed by the Law of Contract Act (Republic of Kenya 1990)—this legislation provides for the application in Kenya of the English common law with regard to contract. The interactions between the contractor and sub-contractors, the contractor

[5] Provisional results

Table 5.7: Cost estimates for building construction in Nairobi and its immediate environs

Item	Building Type (Product)	Cost in KSh/M^2 (Excluding VAT)
A	Office Blocks	
	1) Low rise (four storey)	36,000.00
	2) High Rise (with lift)	45,000.00
B	Industrial Complex	
	3) Factories (two storey)	25,000.00
	4) Warehouse (two storey)	23,000.00
C	Retail Outlets	
	5) Small scale Shopping Centres	23,000.00
	6) Shopping Mall	45,000.00
D	Residential Buildings	
	7) High class single units (maisonettes)	46,000.00
	8) High class high rise flats	50,000.00
	9) Low cost low rise flats	31,000.00
	10) Low cost high rise flats	35,000.00
	11) Site and Service Schemes	17,000.00
E	Social Centres	
	12) Social clubs	30,000.00
	13) Churches (double volume height)	41,000.00
	14) Community Centres	35,000.00
F	Hotels	
	15) Urban low rise	35,000.00
	16) Urban high rise (with lifts)	45,000.00
	17) Game lodges (in remote areas)	47,000.00
	18) Tented camps	23,000.00
G	Health Facilities	
	19) Simple clinics	23,000.00
	20) Urban area clinics	31,000.00
	21) Dispensaries (in rural areas)	21,000.00
	22) Large referral hospitals	36,000.00
H	Sports Facilities	
	23) Stadiums	41,000.00
	24) Simple arenas	33,000.00
	25) Theatres (double volume height)	46,000.00
	26) Health clubs	50,000.00

Source: The Quantity Surveyor (January-March 2009, p. 35)

and the client et cetera are dependent on written contracts that are enforceable through this legislation. Complimenting the law of contract in regulating the interactions between the parties in the market environment of the building industry is the law of arbitration as enacted in the Arbitration Act (Republic of Kenya 1995).

Arbitration is applicable in situations where the interacting parties have an arbitration agreement which require them to submit to arbitration all or certain disputes which have arisen or may arise between them. An arbitration agreement may be in the form of an arbitration clause in a contract or in the form of a separate agreement between the conracting parties. The legislation makes legal provisions on how arbitration is to be conducted including the setting up of an arbitration tribunal. Arbitration is a useful way of dispute resolution especially where technical issues are concerned. It is also a quick way of resolving disputes that do not involve issues to do with interpretation of law and hence need not necessarily end up in protracted court processes.

5.3.2. Building Regulations and Standards

The building standards are enacted and enforced through The Local Government (Adoptive By-Laws) orders of 1968 commonly referred to as the Building Code (Republic of Kenya 1987), and The Public Health Act Chapter 242 Revised Edition (Republic of Kenya 1986). As the name suggests, The Building Code is a standard By-law that is adopted by any local authority in Kenya, in this case the City Council of Nairobi, to enforce building standards within its area of jurisdiction. The Code defines a building as 'any structure movable or fixed of whatsoever kind or any part thereof and includes drainage work and excavation'. Further, at section 5, the Code requires the client to submit plans for proposed erection of new buildings or alterations to existing building to the local authority under whose jurisdiction the building site falls for approval.

The Code gives specifications on standards that a building should meet which is therefore used as benchmark for the proposed building to meet for its approval. The Code stipulates minimum standards concerning:

- siting of and space about buildings

- building materials for foundations, walls, roofs, floors, chimneys, flues hearth, stairs among others
- demolition of buildings

The standards expected of building materials are specified in Part III of the Code. Concerning the masonry material, for instance, the Code states at section 52 that: 'All walls built of stone, bricks or blocks shall be hard, durable and suitable for the purpose for which they are used, and shall be of a resistance to crushing as laid down in rule 3 of the Third Schedule' (Republic of Kenya 1987). Further the said rule 3 states that: 'Bricks or blocks used in any wall […] shall be composed of burnt clay, stone, concrete or sand lime and have a resistance to crushing of not less than—a) 400 lb per sq. in. of gross horizontal area where the wall is a wall of a small house […] or b) 1,500 lb. per. Sq. in. if the bricks or blocks are solid' (Republic of Kenya 1987). Apart from conforming to building standards as provided for in the Code within Nairobi, a proposed building must also satisfy density regulations enacted by the city council.

The Public Health Act, on the other hand, considers issues to do with sanitation and housing. Part IX of the law gives the Minister concerned with public health powers to make rules, concerning the construction of buildings, the provision of proper lighting and ventilation and the prevention of overcrowding. The Minister can confer powers and impose duties on local authorities, magistrates, owners and others to carry out or enforce such rules. In practice, however, the Minister has mainly relied on the Building Code which is reiterated in this part of the Act.

Generally the building standards have been thought of as very rigid and prohibitively high and therefore condemn the majority of urban population into illegal structures (Tuts 1996). This has sparked a lot of debate in Kenya regarding the need for their relaxation.

5.3.3. Building Plan Approvals

Figure 5.4 and Table 5.8 give details of building plans that were submitted to and approved by the Council for construction in Nairobi in the recent past. These may be considered as building starts data (K'Akumu 2007a). For private sector developers, Figure 5.4 gives the number of

approved plans and their estimated costs. The presentation of the data from which this figure has been developed is inadequate in some respects:

- It just counts the number of plans without any breakdowns into blocks, units or floor area, but plans are not the same in terms of what they are trying to cause to be built hence just giving data on number of plans is not all that useful
- It gives estimated cost for the realization of the plans, but these costs are set to vary considerably in case the plans are eventually implemented even as approved
- Approval of plans do not necessarily mean that buildings are constructed, so they are not reliable indication of building starts, but being the only set of data available on building starts, we may have no choice but to rely on it albeit cautiously

The main distinction that the statistics do in terms of differentiation of building products is to divide them into residential and non-residential buildings. The statistics do not give any specific trend in the annual turnover of number of plans. Apart from this, there tend to be fluctuations through the years a phenomenon that occurs for the cost estimates too. One important thing to note about plan approvals is that they distinguish the formal construction sector. Buildings that do not obtain approval in the private developers' case are considered illegal or informal. Nevertheless the figure illustrates the dominance of residential over non-residential buildings both in terms of total number of units and aggregate costs expressed on an annual basis. Housing therefore represents the main market of buildings in Nairobi.

Table 5.8 on the other hand gives statistics on the number of building plans approved by the city council for development by the public sector. The differentiation is again according to residential and non-residential buildings. The public clients are further divided into central government, local authority and public corporation. The trend suggests that the public sector is not procuring residential buildings. Given that the public sector will not break the law by constructing buildings without fulfilling the legal requirements of seeking approval, it can be deduced that, save for the NHC, the public sector players are no longer participating in the procurement of residential buildings. It is the same case with non-residential buildings where the central government and the council are concerned. No plans have been approved for the two public sector clients for the period covered by the statistics. However, public corporations are still participating in the

procurement of non-residential buildings. It is important to emphasize that all developments by the public sector are considered formal; assuming that being custodians of the law, the public sector would not go about constructing illegal structures.

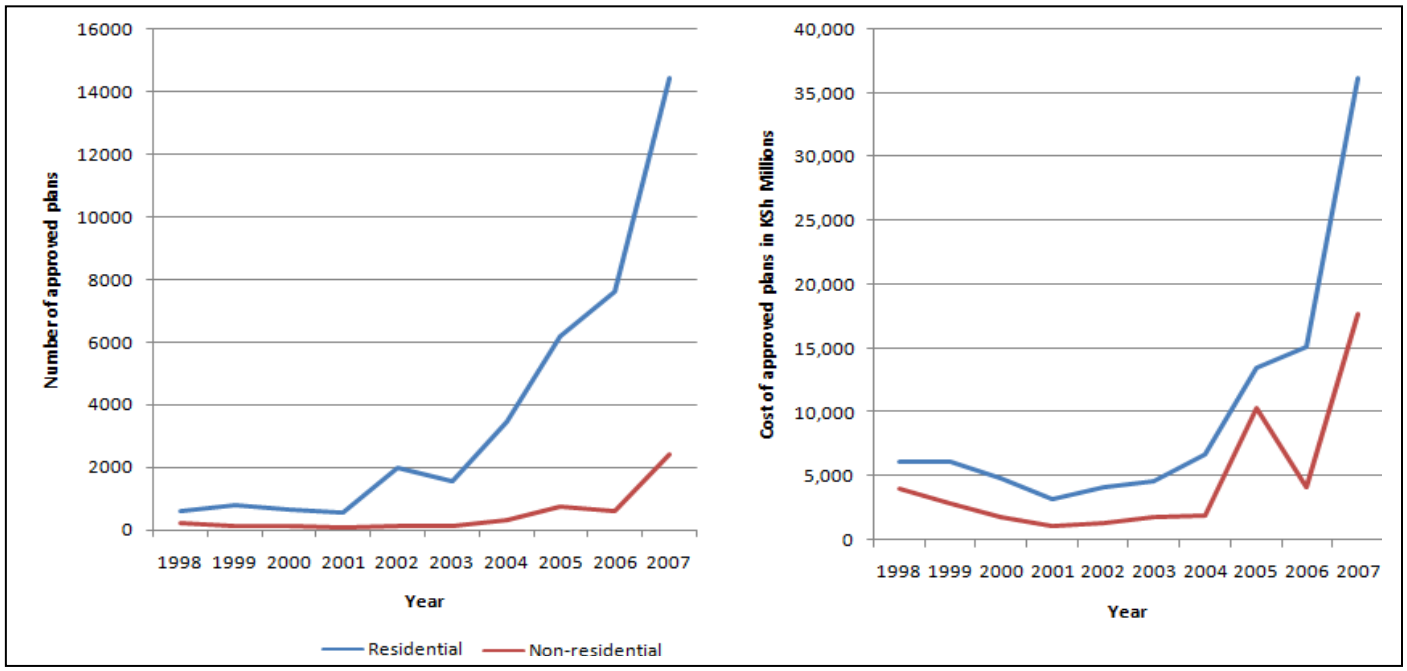


Figure 5.4: Building plans approved by the Nairobi City Council for private development

Table 5.8: Number of building plans approved by the Nairobi City Council for public development

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Residential										
Government	--	--	--	--	--	--	1	--	--	--
City Council	--	--	--	--	--	--	--	--	--	--
Public corporations 68	21	--	--	16	--	--	--	--	--	
Total	68	21	--	--	16	--	1	--	--	--
Non-residential										
Government	--	--	--	--	--	--	--	--	--	--
City Council	--	--	--	--	--	--	--	--	--	--
Public corporations --	38	55	24	92	54	252	65	112	230	
Total	--	38	55	24	92	54	252	65	112	230

Source: constructed with data from Republic of Kenya (2007b p.147 and 2009 p.141)

5.3.4. Professional Regulations

The operations of the professionals in the building industry in Kenya, including Nairobi, are regulated by legislations. For instance, the architects and quantity surveyors are regulated by the Architects and Quantity Surveyors Act that took effect on 1st of April 1934. It is simply described as 'an Act of Parliament to provide for the registration of architects and quantity surveyors' (Republic of Kenya 1978, p. 3). For the stated purpose the Act, at section 4, establishes the Board of Registration of Architects and Quantity Surveyors (BORAQS). According to the Act, no one is allowed to practice any of the professions it is concerned with unless the said person is registered by BORAQS. The Act also gives the board powers to make by-laws concerning, among other things:

- the definition of unprofessional conduct and the penalty to be imposed on any member found guilty of it
- the scale of fees to be charged by architects and quantity surveyors
- the conduct of examinations to verify the professional competence of intending registrants

The Act also sets the minimum qualifications one must attain in order to be registered as a professional by the board including age, academic attainment, professional experience and membership of a professional institution. The number of professionals currently registered by the board is shown in Table 5.3. Should the board find any of these professionals liable of an offence under the Act certain disciplinary actions may be taken against them such as: caution or censure, suspension or complete removal from the register, or payment of fine. The Act stands out as an effective tool for the regulation of architects and quantity surveyors as it allows any aggrieved party in the building industry to file a complaint of professional misconduct to the board that is legally bound to investigate and decide on appropriate action.

Similarly, the engineers are regulated through their own legislation—The Engineers Registration Act—described as 'an Act of Parliament to provide for the registration of engineers and for connected purposes' (Republic of Kenya 1992, p.3). The Act establishes the Engineers Registration Board (ERB) whose mandate is to 'have responsibility for regulating the activities and conduct of registered engineers' (Republic of Kenya 1992). In order to achieve this objective the Act has among other things:

- laid down the minimum qualifications to be attained by a professional for purposes of registration as an engineer
- made provision that to be registered the Board may require that the engineer must be of acceptable professional and general conduct (see section 11(7))
- made provision that the Board may caution or censure, suspend or cancel the registration of an engineer who is found guilty of 'an act or omission amounting to improper or disgraceful conduct in a professional respect' (see section 15(1))
- emphasized that one of the acts of professional misconduct involve a registered or consulting engineer who can be shown to have acted in conflict of interest (see section 15(2))

The Act also provides for engineers of foreign origins to register so as to be able to work in Kenya in projects that involve international sourcing (see section 12).

5.3.5. Environmental Regulations

Environmental issues have assumed utmost importance in the building industry in Kenya following the enactment of the Environmental Management and Coordination Act (EMCA) of 1999 which took effect from 14th January 2000 (Republic of Kenya 1999). This legislation established the National Environmental Management Authority (NEMA) with the mandate of managing the environment in general. At section 58, EMCA calls for environmental impact assessment of all projects before commencement of the implementation process. In the case of building projects, it requires the client to submit to NEMA a project report detailing the principal elements of the intended development. NEMA will then scrutinize the submitted report and if there is likelihood that the proposed development is going to have a significant impact on the environment, it would direct that the client undertake an environmental impact study at the latter's own expense. The client would then submit the Environmental Impact Study report to NEMA which will subject it to the process of participatory environmental consultations. If the client has proposed adequate mitigation measures for the likely impacts and the consultation results are positive, the project may receive approval from NEMA issued as Environmental Impact Assessment Licence. NEMA does not make unilateral decisions concerning the submitted reports; it circulates them to lead agencies in the building industry for comments.

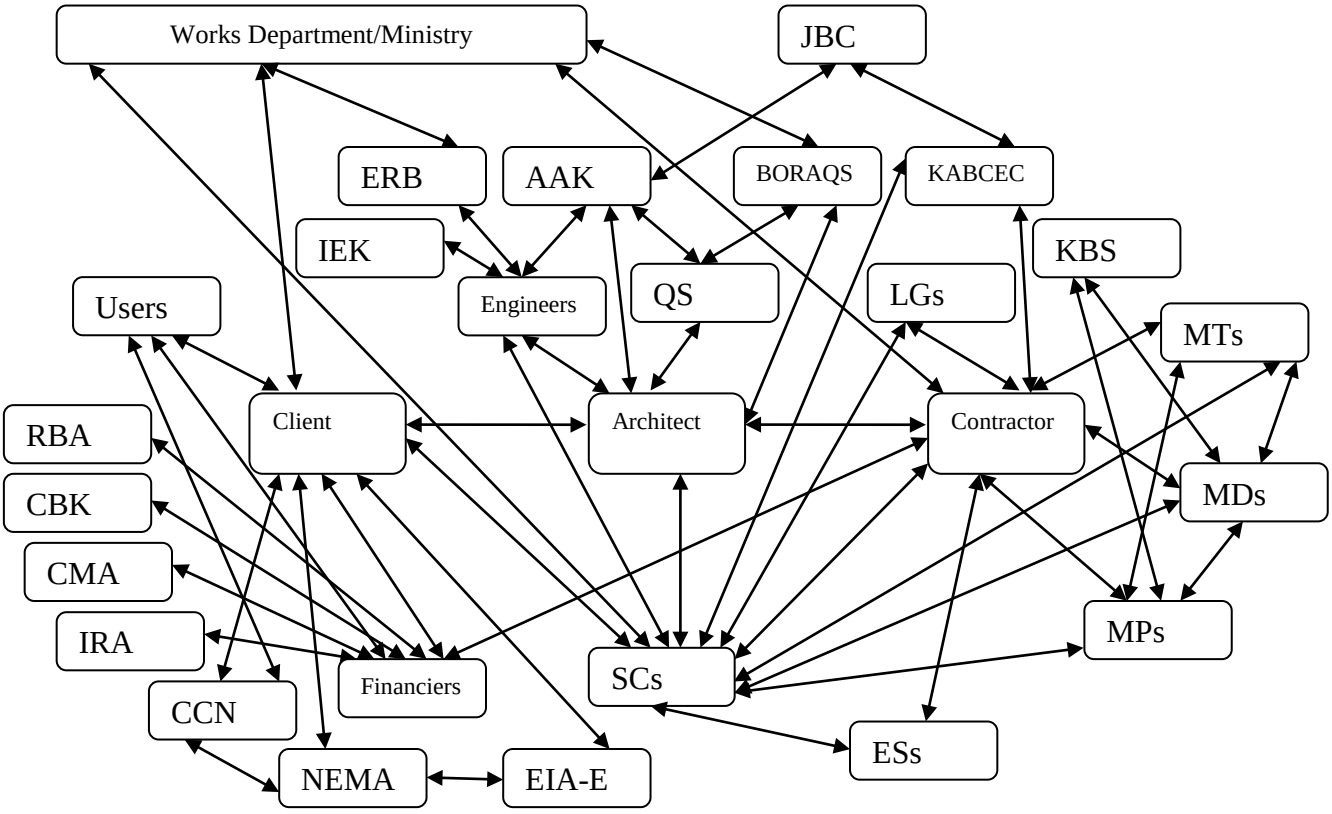
Therefore, apart from building plan approvals required by the Building Code, EMCA has added another round of approvals to the building industry. Likewise it has added another category of professionals to the building industry—the Environmental Impact Assessment (EIA) experts. According to EMCA requirements, the EIA experts are the ones responsible for the preparation of the project reports or the Environmental Impact Study reports that must be submitted in the formats prescribed by the law. These experts are registered and licenced by NEMA. In order to resolve any disputes arising from the outcome of the applications and approval processes, EMCA has provided for an independent environmental tribunal.

5.3.6. Administrative and Policy Regulations

The public works department sometimes referred to as the Ministry of Works or the Ministry of Public Works depending on the prevailing government set up is the key government agency responsible for regulating the business environment of the building industry through policy and administrative instruments. Therefore it is responsible for drawing up the policies and the legislations that directly affect the building industry. It is also responsible for the agencies concerned with the registration of professionals and contractors as shown in Figure 5.5. Where the public sector is concerned as a client in the procurement of buildings the department or ministry will be responsible for the management of the process and employs in-house professionals who may work directly in such projects.

Apart from the public works ministry or department, there is the Ministry of Finance whose regulations directly impact on the procurement of buildings. The ministry has put in place several institutions to regulate the financial and capital markets. It is notable that buildings require enormous capital outlay that more often than not the clients may not be in a position to provide individually (Briscoe 1988, Gann 1996, Hillebrandt 2000, Myers 2004). For that matter, the clients rely on financing from other institutions. The financial market, for instance, is regulated by the CBK as shown in Figure 5.5. Short time financing is required by the contractor who will be paid upon completion of certain tasks. The policies of the CBK will also affect the rate of savings that may be available for long-time financing. Capital financing which is necessary for building procurement since as an investment buildings take long to repay are regulated by the CMA, IRA and RBA. These institutions regulate financial institutions that may avail capital to

the client for the procurement of buildings. The other market regulator is the KBS. Since materials and components that are used to assemble a building are themselves manufactured products, like for all manufactured products the KBS has a mandate to ensure that they are made to established standards. Artisanal dimension stone is one of the informal materials that are not standardized and whose production process has not been ascertained by the KBS.



Key

AAK	Architectural Association of Kenya	ESs	Equipment Suppliers	MPs	Material Producers
BORAQS	Board of Registration of Architects and Quantity Surveyors	IEK	Institute of Engineers of Kenya	MTs	Material Transporters
		IRA	Insurance Regulatory Authority	NEMA	National Environmental Management Authority
CBK	Central Bank of Kenya	JBC	Joint Building Council		
CCN	City Council of Nairobi	KABCEC	Kenya Association of Building and Civil Engineering Contractors	QS	Quantity Surveyor
CMA	Capital Markets Authority			RBA	Retirement Benefits Authority
EIA-E	Environmental Impact Assessment Experts	KBS	Kenya Bureau of Standards	SCs	Sub-contractors
		LGs	Labour Gangs		
ERB	Engineers Registration Board	MDs	Material Distributors		

Figure 5.5: A combined market and nonmarket actors/institutions and their interrelationships in the building industry's business environment

5.3.7. Voluntary Obligations

So far we have discussed involuntary obligations under the nonmarket environment. These are obligations that the participants in the building industry have to comply with whether they so wish or not. Voluntary obligations on the other hand are practices that the participants may choose to comply with or not. In many countries especially continental Europe, for example, professionals of the building industry do not have to belong to a professional body for them to practice their profession (Ashworth 2004). Kenya on the other hand follows a different tradition in which it is mandatory to belong to a professional body before a professional can be registered and licensed to practice. However, in some cases like the contractors, it is not mandatory for them to belong to the KABCEC, see Figure 5.5. The JBC is another voluntary association; it has been formed to enhance the welfare of the constituent bodies, i.e. AAK and KABCEC.

5.4. Implications of the Market and Nonmarket Environments

So far this chapter has discussed the formal aspect of the business environment of the construction industry in Nairobi, Kenya. In order to get a proper perspective of the building industry's business environment, it is imperative to revisit the discussion on the formal building market environment as presented below.

5.4.1. The formal building procurement practice

The building process involves the mobilisation of various factors including labour, capital, materials and equipment. This section discusses the formal processes in the market environment involved in the procurement of buildings in Nairobi. The work of Wells (2001) that sought to unravel the shift of building activities from the formal to the informal sector of the construction industry in Nairobi and its implications gives useful insights into this issue. Her discussion dichotomizes the business environment of the building industry into the formal (colonial) and the informal (postcolonial) building procurement systems.

By the 'colonial' building procurement system, she refers to the traditional British system that was put in place in Kenya during the colonial rule. In this system, the process of assembling material and component factors into buildings begin with the drawing of plans by formal designers, followed by due approvals of the plans which then give way to the tendering process,

see Figure 5.6. Following tender evaluations the contract is awarded to a successful bidder who will be responsible for constructing and delivering a complete building at an agreed price (tender sum).

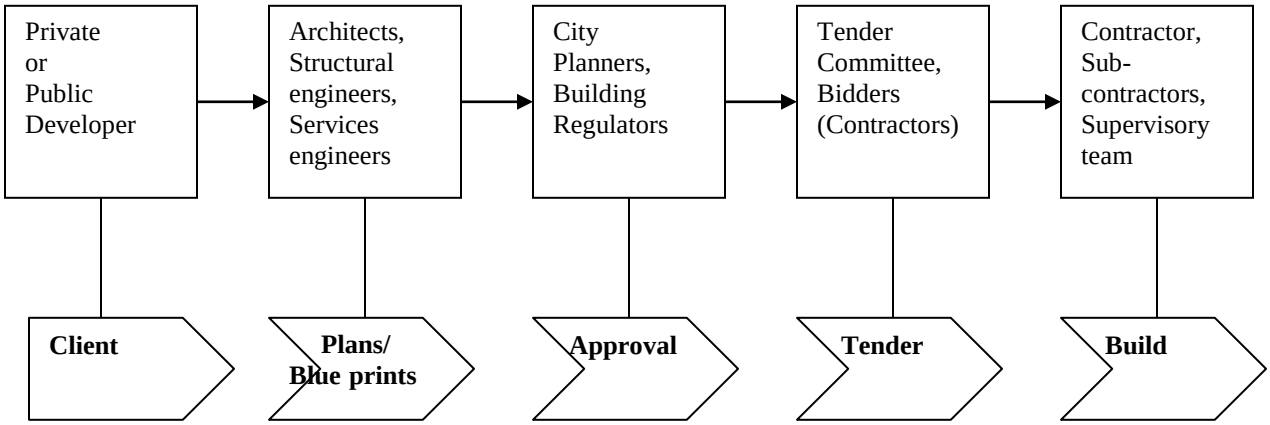


Figure 5.6: The formal building procurement process

Wells (2001) noted that the procedure is still followed in all public projects and large scale private sector projects. Architectural drawings for the proposed building would be prepared by the architects, requisite structural plans by the structural engineers while services plans including drainage, sewerage et cetera are prepared by the service engineers. The blue prints are thereafter submitted to the City Architecture and Planning Department for approval. The building plans are approved by the building regulation section although other planning regulations like zoning and density are considered by the relevant (planning) officers within the Department. Approval is not always guaranteed but if and when granted the process would proceed to tendering.

Open tendering is typically used especially in public projects where the QS would prepare a bill of quantities for the contractors to use for pricing their bids. The bids would be open on a specified day and after evaluation the tender may or may not be awarded to the lowest bidder. The winner of the bid is engaged as the contractor responsible for mobilising materials, equipment and labour into the building site and for assembling the materials using the labour and equipment and gets refunded for the costs incurred by making claims for payment of the work done. The contractor works under the supervision of the architect, the engineers and quantity surveyors who work on behalf of the client to ensure that the building is done according to

specifications in the plan. The contractor can sub-contract parts of the building works to specialist sub-contractors.

Wells (2001) noted that this process has significantly changed in the UK where it originated from, while in Kenya the procedures have remained static. The procedures are employed for public sector and donor funded projects where they may be necessary to satisfy conditions of accountability. However for the local private developer the procedures are continually being ignored for a more informal process (Wells 2001) as explained below.

5.4.2. The informal building procurement practice

Wells (2001) observed that the formal system is continually being ignored by many private developers in Nairobi who directly engage the services of small time operators in the building construction market to provide labour, designs, materials and equipment for their building projects. In this system or structure of provision the proposed building's owner supplies the land or construction site and also provides finance for the purchase of the other factors including materials, labour and for hiring equipment as shown in Figure 5.7

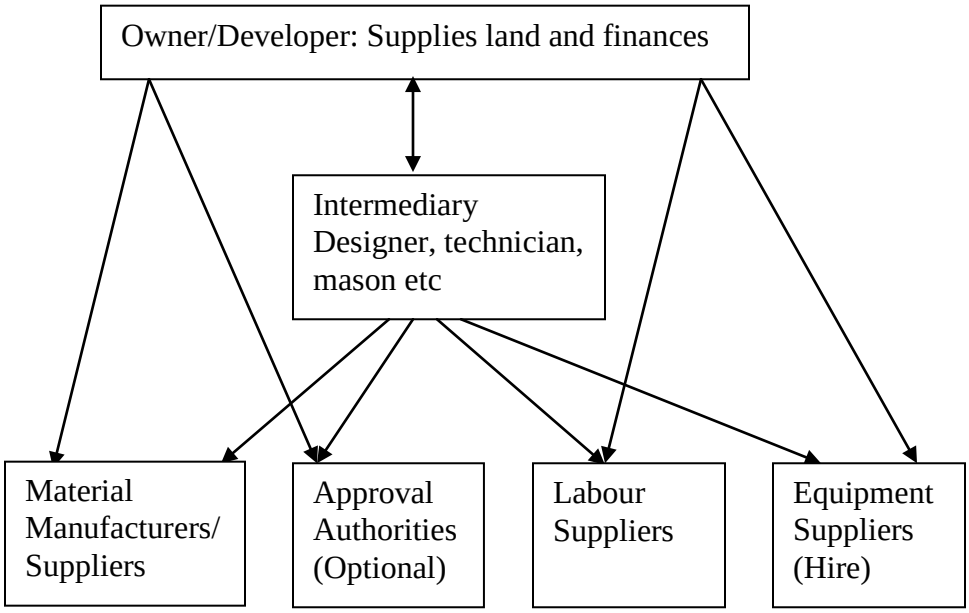


Figure 5.7: The informal building procurement process

In Figure 5.7 it is shown that the building owner, who supplies land and finance for the construction activity to take place, has direct access to other factor providers. Alternatively, the building owner, depending on his/her or their knowledge of and ability to act in the construction process, may use intermediaries such as technicians, masons or brokers to reach the other actors including material suppliers, approval authorities, labour gangs and owners of equipment for hire. Wells (2001, p. 271) pointed out that in this case the owner would obtain plans for the building from 'architects, engineers, planners or technicians, who may or may not be registered' at a simple fee. The source of the plans is most likely to be the intermediary in Figure 5.7. The relationship between the owner and the other actors as shown in Figure 5.7 may vary since the individual owner may also deal in a design, material, labour, or equipment supply. In this scenario, the owner may or may not seek approval of the building (Wells 2001, Huchzermeyer 2007).

Wells (2001) noted several implications of the kind of arrangement represented in Figure 5.7 as follow. They entail cost minimization opportunities and flexibility to the owner who can then build incrementally as and when funds become available. Secondly, by being able to purchase the other factors directly, the developer gains full control of the money spent in the construction process. These two reasons therefore explain why the informal arrangement is gaining popularity with developers in Nairobi.

Alongside the 'informalization' of the building process, Wells (2001) noted the 'informalization' of the materials manufacturing, sourcing and supply. She noted that building materials and components including 'stone, sand, concrete blocks, metal window frames and joinery items are now produced by small scale enterprises in the informal sector and distributed by other such enterprises' (Wells 2001, p. 271). Since the developer/owner is directly involved in the purchase of materials and/or in the hiring of equipment, the contractor (if involved in the building process at all) essentially becomes a labour contractor. In some instances, however, the developer would make direct payments to the labourers (Wells 2001). The contractors may find that this kind of arrangement suitable because private clients/developers of this nature entail the risk of running out of funds during the construction period hence spending money on materials and equipment may not be advisable.

According to Wells (2001, p. 271) the arrangement represented in Figure 5.7 ‘is the same method that has always been used for the construction of individual low-cost houses’ and represents an extension of informal house building methods into the entire building industry in Nairobi. Wells (2001) found the system appropriate for the situation in East Africa where interest rates are very high and loan financing may not be readily available for small time developers.

In summary, the informal construction system implies an efficient and low cost process of building. The costs are brought down because the developer/client absorbs the risks and responsibilities involved in the building process (Wells 2001). The fees paid for design and engineering services, where applicable, are negotiated at a more affordable and realistic prices while contractor’s profits are eliminated (Wells 2001). The informal process described above and represented in Figure 5.7 also constitutes a model of self-help housing.

5.5. Summary

From the discussions in the preceding sections we can conclude that the following are some of the salient forces influencing the business environment of the building industry in Nairobi.

1. A rising rate of cement consumption
2. The Building Code that favours the use of stone and other block/brick materials
3. The building industry is composed of formal and informal actors
4. Actors in the building industry include clients, architects, QSs, engineers, contractors and sub-contractors, materials producers and transporters/distributors, and regulators
5. The formal building industry is defined by the professionalism i.e. architects, QSs etc
6. Residential buildings are the predominant products of the industry see Table 5.5
7. Formal construction market functions only for the public and donor projects for the sake of accountability

Informal construction market applies for the other types of construction projects

The study recommended that these factors should be carried forward as part of the influences in the business environment for artisanal dimension stone. Some of these ideas were included in the final propositions for factor analysis as explained in the next chapter at section 6.7.

In terms of achievement of Objective 1: To explore the organizational structure of the construction industry in Kenya and identify the prevailing systems of building procurement in Nairobi, this Chapter has explored the business environment of the construction industry in Nairobi and brought up its institutional and economic structures.

CHAPTER SIX

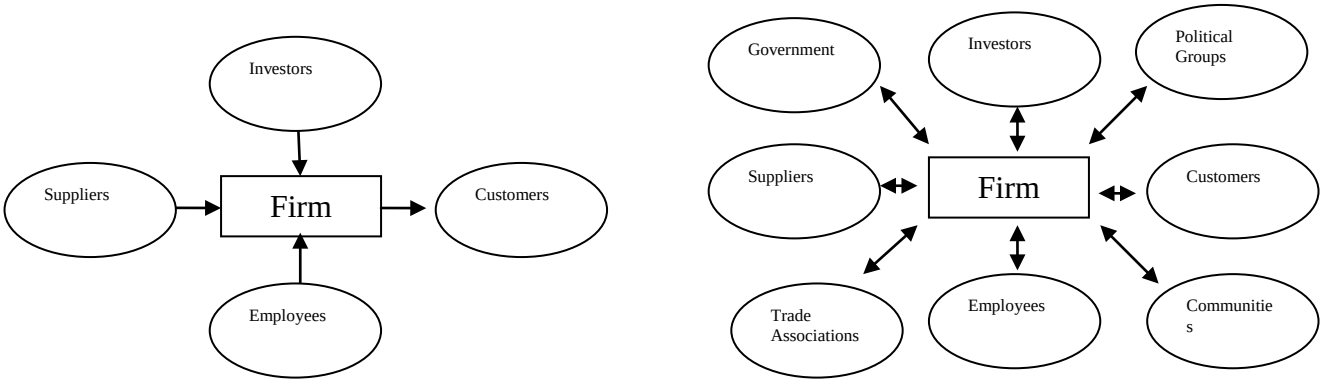
6. THE BUSINESS ENVIRONMENT OF ARTISANAL DIMENSION STONE

6.1. Introduction

This chapter is written in response to Objective 2 of the research, which sought to profile the internal structure and the external environment of producer organizations associated with the use of artisanal dimension stone for building in Nairobi. Therefore the chapter analyses the business environment for artisanal dimension stone in Nairobi. It looks at the business environment in two main foci: the market environment composed of exchange relationships between the actor/stakeholders and the nonmarket environment mainly composed of regulations. The stakeholders identifies include input suppliers, artisanal stone producers, competitors, customers and regulators.

6.2. The Stakeholder Environment

In Chapter Two it was noted that the immediate environment of an organization can be captured using the input output model as shown in Figure 3.1. However following Freeman (1984) stakeholder theory has been included in the mainstream organization theory (theory of the firm) thereby changing the overall set up as captured in Figure 6.1.



Input-Output Model Stakeholder Model

Figure 6.1: The contrasting models of organization

Source: Adapted from Donaldson and Preston (1995: 68-69)

Using ethnographical methodology (see explanations under section 4.7.4) and the stakeholder Model as a conceptual guideline, participants in the production of artisanal dimension stone were asked questions regarding who were their employers, employees, suppliers, and customers et cetera. They were asked also which government and non-government agencies that they dealt with in their operations. This helped with the in-situ identification of stakeholders. Other stakeholders like ITDG/Practical Action and customer agents were identified through literature. Using participant observation, the researcher also made field observations about how artisans produced and sold dimension stone, what materials were involved in the production and which actors were involved. This also helped to confirm information about who the stakeholders were.

6.2.1. Artisanal Production Processes

The exploratory study indicated that the main raw material necessary for the artisanal production of dimension stone is natural rock. Access to natural rock is obtained by the artisanal investor through a concession from the land owner negotiated as an informal contract. After gaining access to the land containing natural rock, the quarrying process would begin through excavation of the overburden to expose the rock (where the rock is not exposed). Excavation is done manually by unskilled workers using hand digging and shovelling tools to peel of the strips of top soils including red soil and or murram that are carted away using hand-pushed wheel burrows, as shown in Plate 1.

Once the rock is exposed, the next procedure is to break it from the great mass into workable pieces. To do this, blasting is necessary but before blasting can be done there is a need to drill the rock so as to create holes for fitting the explosives. Rock drilling is done by a skilled person whose services are available for hire i.e. he is not a member of any single quarrying unit but works for several units as an externally contracted service provider. *Choronge*, the artisanal contrivance is the main tool used in this process. It involves percussive drilling in which a sharp chisel-like bit is repeatedly struck against the rock so as to form a hole (Blyth and de Freitas 1974).

In this case, the *choronge* is a four-teethed iron tip connected to a long wooden handle. To drill a hole, the *choronge* is used to drill the rock by continually hitting the iron tip into the rock and

turning it in a grinding action. The hitting drives it into the rock and the turning breaks the rock. Water is continually added to soften the rock and also to make the broken rock particles sticky so that they can be removed by a mop. The mop is a piece of cloth tied to a long stick that is used to scrub the bottom of the hole and clean it of the wet broken rock particles. The rock driller usually works with a hand-man who helps with hitting or turning the *choronge* in the rock, helps with pouring water into the hole and with mopping up rock particles from the hole. In this way several holes would be drilled along the preferred line of breaking the rock. Once this is done, it is the turn of the blaster.

A blaster, like the driller, is not an employee of any quarry unit but offers works with a number of them as an externally sourced service provider. A blaster simply fixes the explosives in the holes that have been drilled and causes them to explode. The effect of an explosion is to break and loosen a piece of rock from the rock mass (Blyth and de Freitas 1974). Once a workable piece of rock has been broken from the parent mass it is time to cut it into smaller pieces of required dimensions (as stone products). This is the time the stone cutter or stone artisan brings his skills and tools.

Each quarrying unit employs a stone artisan who is assisted by a hand-man. The stone artisan uses a set of chisels and hammers to cut stone and a crowbar to leverage bigger split rocks apart. There are a set of small chisels and a set of big chisels, likewise there is a small hammer and a big hammer. To break the rock into required dimensions a small chisel is used to mark the positions for sticking the large chisels along a preferred line of breakage. The small hammer is used to stick a line of large chisels onto the positions as marked on the rock. The big hammer is then used to drive the large chisels into the rock, causing the rock to split along the line of chisels. The small hammer is also used for trimming and shaping the cut pieces of stone into required dimensions.

6.2.2. Internal Stakeholder Identification

This exploratory study established that the artisans organized their activities in a simple management structure involving the quarry operator/entrepreneur employing a clerk, stonecutter

and menial labourers. These form the internal stakeholders of an artisanal organization. The organizational structure, as shown in Figure 6.2, conforms to the functional typology in which, according to Palmer and Hartley (2006) activities and members are grouped by their common purpose or function. The organogram also gives an indication of who the internal stakeholders within the organization are.

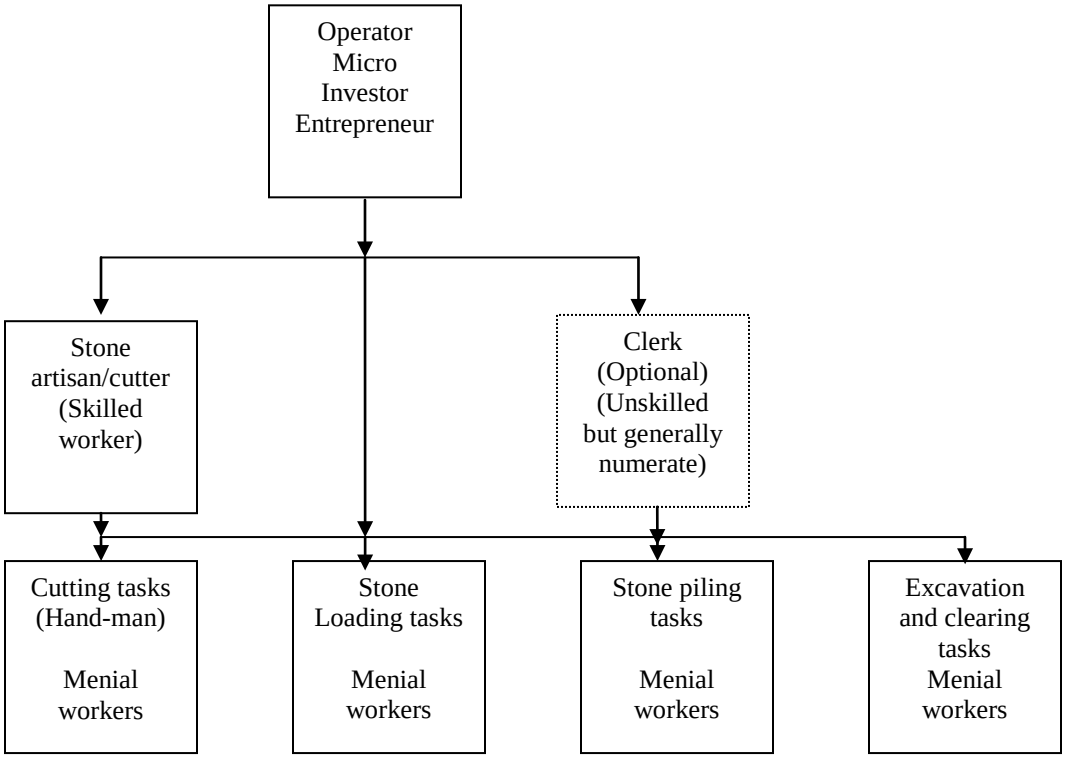


Figure 6.2: A typical organizational structure of an artisanal organization

Following the ethnographical methods mentioned above, the study was able to identify the key stakeholders within the external environment. These may be grouped into the following: suppliers, regulators, competitors, and customers and customers' agents.

6.2.3. External Stakeholder Identification

Suppliers are the stakeholders who deliver resources to the artisanal organization so as to enable the organization to produce dimension stone. The prime resource in this case is land that bears natural rock that is quarried for stone. Quarrying takes place either on private or on public land hence the landowners may be classified as public or private. The next in importance is the blaster.

The blaster offers expert services of blasting the rock in order to break it from the parent rock. The blaster also supplies the explosives to be used for blasting. To do all this, the blaster is licensed by the Government of Kenya's Department of Mines and Geology as an expert. The Department also sells the explosives to him to use in his blasting work. Since the equipment being used is simple and readily obtainable, the tools used are significant for the operations but their suppliers may not be significant for this study. This is the same case with food vendors who are equally important but whose opinions are not significant in terms of the enhancement of the organizational environment for the artisans. Hence the latter two (tool sellers and food vendors) will not considered further in this study.

Regulators are the government agencies that regulate the activities of artisans involved in the production of dimension stone. There is the local government agency (the City Council of Nairobi) that regulates the market of dimension stone according to building codes and regulations that specify the type of building materials that may be used in the city. Because these codes and regulation generally allow for permanent materials such as dimension stone, to this extent they enable the use of artisanal dimension stone. The City Council also taxes the products from these quarries by imposing a cess on each truck load of building materials.

Apart from the City Council, there is the public environmental agency known as NEMA (National Environmental Management Authority) that has been constituted through the Environmental Management and Coordination Act. The Authority does not tolerate any environmentally damaging behaviour through any economic activities and has been trying to apply regulatory measures on the artisans.

The Department of Mines and Geology is another significant government agency involved in the artisanal production of dimension stone. As has been stated, the Department is responsible for licensing the blasters and for selling explosives to them to use in the artisanal quarries. One of the issues that came out from the interviews is that the Department never issues enough explosives hence some explosives that are used in the quarries are obtained from the black market. This was triangulated by having an in-depth interview with an appropriate officer from the Department.

At the local level, the fieldwork established that the Provincial Administration officers are involved as regulators. The officers involved include the Assistant Chief, the Chief and the District Officer. The Police Department is also involved in the disputes that sometimes pit rival gangs in the quarrying business against each other. The police are also available to sort out disputes that may arise in the transactions. All these stakeholders will be considered in the next stage of the study.

The competitors of artisanal dimension stone producers for the Nairobi market are the machine-cut stone producers who are located outside the city boundaries but whose products are transported into the city to be used in building construction. These operators are located mainly around the Juja-Thika area about 30-50 kilometres from the city centre.

The last group of stakeholders include the customers or their agents. The developers/builders form the main customer base for artisanal dimension stone. They may differ according to whether they come from the formal or informal sectors of the building industry in Nairobi. They also may differ according to whether they are developing for residential or non-residential uses. The customer's agents on the other hand include architects, quantity surveyors, structural engineers and other professionals who may specify or not specify the artisanal dimension stone as a building material on behalf of the developers. The contractors who work for the developers also fall under this category as do the transporters who transport the material from the quarry site on behalf of the buyer (developer or the stockist).

The stockists are another category of customers who may buy directly from the producers but, unlike the builders or developers, their intention is not to use but to sell or stockpile for eventual sale in their localities to users. Opinion may vary on their relations with artisanal producers who may sometimes see them as exploitative but they play a significant role in the supply chain of artisanal dimension stone. Given that artisanal producers generally operate under limited supplies of money, they cannot afford to keep stock of stones for a long time in the absence ready buyers. In the absence of user buyers (builders) the stockists come in to buy the dead stock and free the producers' cash flows. Secondly, the stockists help to widen the distribution of artisanal dimension stone by taking it from the quarry to their yards where it can be sold to even piecemeal

buyers, who otherwise would have not made it to the quarry, in small amounts that can be taken away in wheel burrows, hand carts or pickups.

6.2.4. Stakeholder Salience

Following the foregoing discussion and relying on Freeman (1984) guideline on rational stakeholder mapping, a summary list of key stakeholders in the production and use of artisanal dimension stone in Nairobi can be populated as below

1. Internal Stakeholders—operator, stone artisan, menial workers and clerk (optional)
2. External Stakeholders (Suppliers)—land owners, blasters, drillers,
3. External Stakeholders (Regulators)—City Council of Nairobi, NEMA, Department of Mines and Geology; and according to quarrying areas local Assistant Chief, local Chief, local District Officer and local head of Police.
4. External Stakeholders (Competitors)—quarrying operators who use machines
5. External Stakeholders (Customers)—developers
6. External Stakeholders (Customers' Agents)—architects, quantity surveyors, structural engineers, contractors,
7. External Stakeholders (Other Intermediaries)—transporters, stockists, brokers, cartels.

The rational stakeholder map for units producing artisanal dimension stone is shown in Figure 6.3. These stakeholders form a very important point of reference in addressing issues of policy change concerning the production and use of artisanal dimension stone and similarly for conducting further research on the subject matter. However, depending on the issue being addressed, not all stakeholders matter. To determine who matters or not, it is important to perform analysis of stakeholder salience (Mitchell et al. 1997), see discussions under sections 3.2.2 and 3.2.3.

Stakeholders who mattered for this study were those who have knowledge in the business environment of artisanal dimension stone. Their knowledge was useful in informing the study about the forces or variables that influence the production and use of artisanal dimension stone in the building industry of Nairobi. There are many analytic ways of determining who matters of the stakeholders identified. For instance Mitchell et al. (1997) proposed an evaluation criterion involving stakeholder power, legitimacy and urgency. However this study is only interested in

Table 6.1: Analysis of stakeholder salience for artisanal stone production

Stakeholder	Production Environment	Market Environment	Regulatory Environment	Decision
INTERNAL STAKEHOLDERS				
Investor				
Owner/operator	High	High	High	Salient
Employees				
stone artisan	High	High	Low	Salient
menial workers	High	Low	Low	Not Salient
clerk (optional)	High	High	Low	Salient
EXTERNAL STAKEHOLDERS				
Suppliers				
land owners	Low	Low	Low	Not Salient
blasters	High	Low	Low	Not Salient
drillers	High	Low	Low	Not Salient
Government (Regulators)				
City Council of Nairobi	Low	Low	High	Not Salient
NEMA	Low	Low	High	Not Salient
Mines and Geology	Low	Low	High	Not Salient
local Assistant Chief	Low	Low	High	Not Salient
local Chief	Low	Low	High	Not Salient
local District Officer	Low	Low	High	Not Salient
local head of Police	Low	Low	High	Not Salient
Competitors				
Mechanised quarries	Low	Low	Low	Not Salient
Customers				
developers	Low	High	High	Salient
Customers' Agents				
architects	Low	High	High	Salient
quantity surveyors	Low	High	High	Salient
structural engineers	Low	High	High	Salient
contractors	Low	High	High	Salient
Other Intermediaries				
Transporters	Low	High	Low	Not Salient
stockists	Low	High	High	Salient
brokers	Low	High	Low	Not Salient
cartels	Low	Low	High	Not Salient
NGOs				
ITDG/ Practical Action	High	High	High	Salient

stakeholder knowledge in the three categories of the business environment i.e. the production, market and regulatory environments. Therefore the identified stakeholders were evaluated according to their likelihood to have knowledge of procedures on each segment of the business environment, see Table 6.1. The likelihood to have knowledge was scored as 'high' or 'low'. The stakeholders who scored three or two highs were considered salient while those who scored three or two lows were considered not salient in regard to their knowledge attribute of the business environment of artisanal dimension stone as shown in Table 6.1.

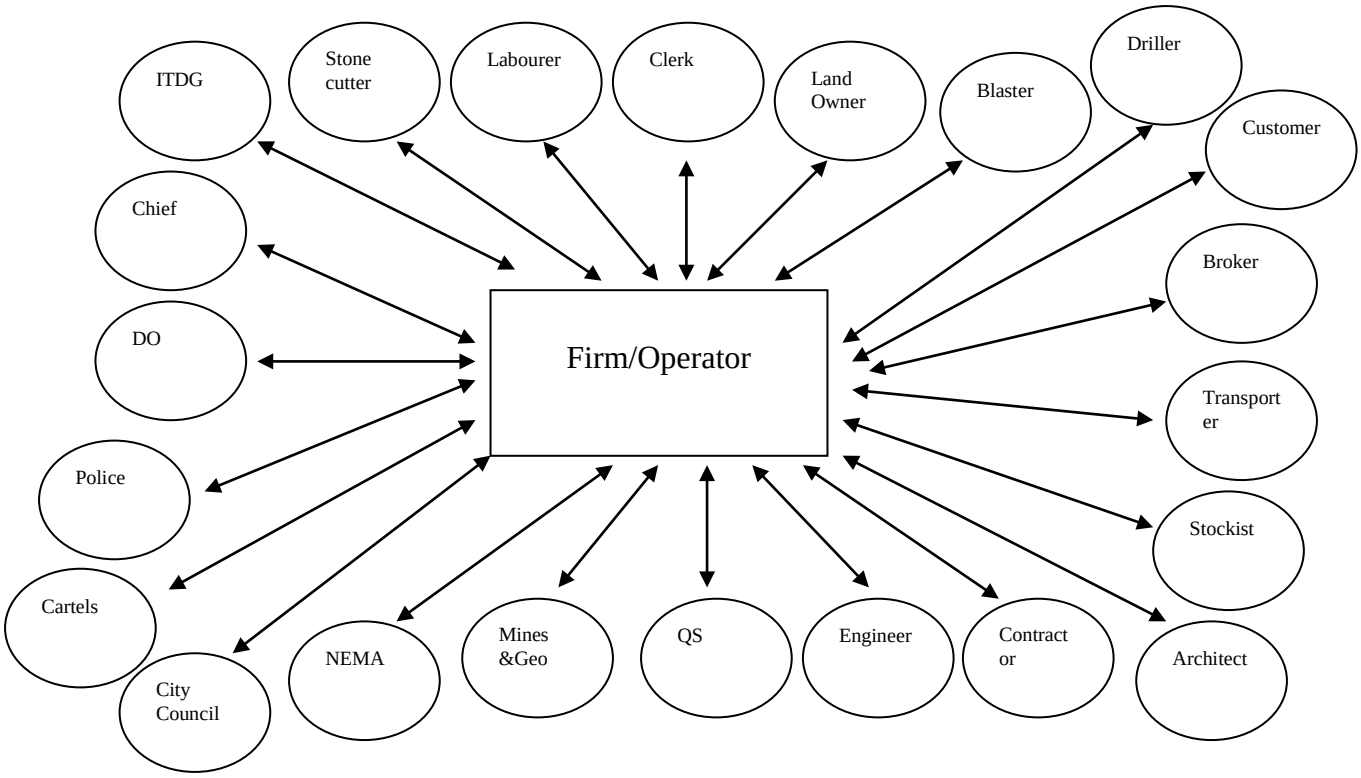


Figure 6.3: The rational stakeholder map for the production of artisanal dimension stone

6.3. Stakeholder Interactions in the Market Environment

In this section, the study applied the marketing systems framework (Figure 6.4) to capture all the variables that compose the market environment for the artisanal dimension stone. As noted earlier on (see section 3.1), the business environment is composed of the market and the nonmarket (regulatory or institutional) environments. The market environment is characterized by exchange relationships between the key players such as suppliers of inputs for manufacturing the product,

the manufacturer of the product and the buyers of the product. These exchange relationships are also governed by several forces that come into play in the market environment. The marketing systems framework forms a conceptual map upon which to trace these exchange relationships for a better understanding of the economic issues surrounding the use of artisanal dimension stone as shown in Figure 6.4.

The concept of market in this case applies to a set of actual and potential buyers of a product who have a particular need or want that can be satisfied through exchange relationships (Kotler and Armstrong 2010). In order to obtain a clearer understanding of exchange relationships, distinctions have been made in the literature between it and communal relationships see for example Clark and Mills (1979). Unlike the communal relationships where benefits are given without quid pro quo, in exchange relationships, the parties concerned in a transaction 'give benefits with the expectation of receiving comparable benefits in return or in payment for benefits previously received' (Clark et al. 1986: 333; see also Clark et al. 1998).

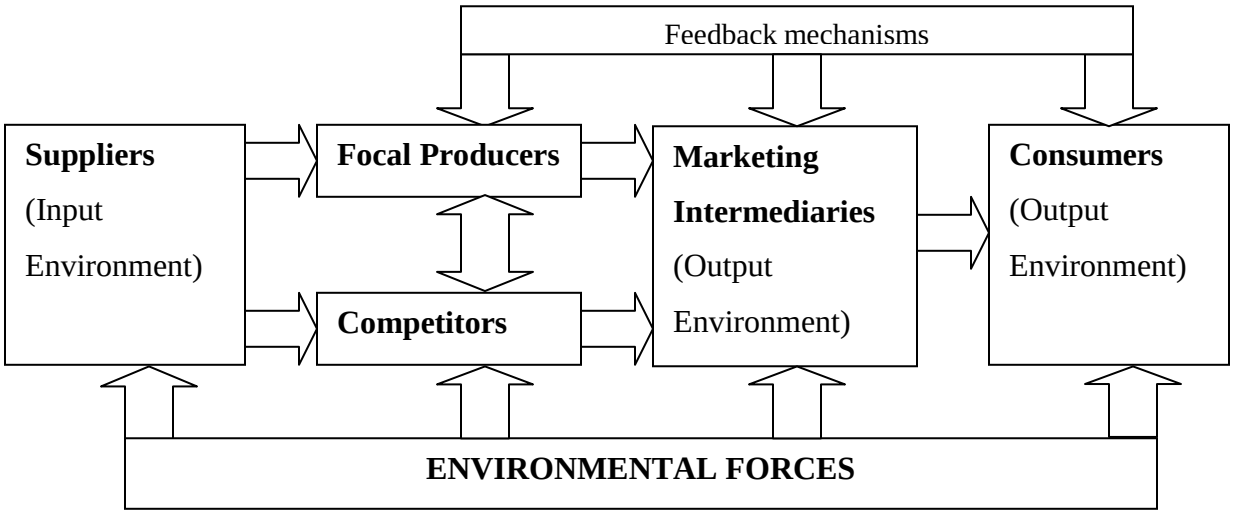


Figure 6.4: Main elements of the market environment
Source: After Kotler and Armstrong (2010: 32)

In this section we examine the exchange relationships generated by the use of artisanal dimension stone in Nairobi. The term use in this case concerns a consumption process that involves the

application of artisanal dimension stone in masonry (a walling material in the construction of building). Within this context, because use generates the need for production, the exchange relationships generated go far back to include the marketing intermediaries and suppliers of inputs for the production of artisanal dimension stone. This perspective is necessary because studies that have been undertaken on the subject matter have not considered the exchange relationship aspects in such a comprehensive manner.

In the marketing systems framework (Figure 6.4) the elements of the exchange relationships that constitute the market environment for a product can be broken down into: the suppliers; focal producers and competitors; marketing intermediaries; consumers and; environmental forces. In this study the suppliers refer to individual or group entities that avail inputs to the producers of dimension stone. For purposes of the production of artisanal dimension stone the research established that the inputs include natural rock, equipment, and labour.

The focal producers on the other hand refer to the organizations that this study focuses on i.e. all the artisanal units engaged in the manufacture of dimension stone in the study area. Their competitors include all other manufacturers of building materials used in wall masonry in the Nairobi market such as machine-cut dimension stone, concrete blocks, bricks, timber walling etc. However in this case the scope is limited to the market of dimension stone hence the competitors may be grouped under producers of machine-cut dimension stone. Therefore both the focal producers and competitors can be referred to as producers of dimension stone. On the other hand consumers are the final end users of the product under study i.e. artisanal dimension stone.

According to Kotler and Keller (2006) in most cases producers do not sell their goods directly to the final end users. Between the two there are a number of intermediaries that perform a variety of functions. These intermediaries may include wholesalers and retailers, brokers, transporters et cetera. The exchange relationships among all these actors in the market environment i.e. suppliers, the producers and competitors, market intermediaries and consumers are determined by environmental forces or what Kotler and Armstrong (2010) termed as ‘major environmental forces’. In this study the environmental factors are considered as part of the enabling environment.

6.3.1. Exchange relationships between suppliers and producers

In the inputs (production) market environment the preliminary fieldwork identified four basic factors involved in the artisanal production of dimension stones: natural rock, labour, entrepreneurship/finance or money and equipment. Natural rock excavated from the earth forms the main input. The natural rock, in most cases, is overlaid with red volcanic soil since the mining sites are former coffee farm lands. Through unstructured interviews with the artisans the study established that between the soil and the rock there would be a stratum of murram. It came out from these interviews that both are useful materials for the built environment, as the murram can be used for infilling or road paving while the red soil is useful in gardening and landscaping. The dictionary meaning of murram is that of reddish soil commonly used in Africa for paving roads, see *Oxford Advanced Learner's Dictionary*, 7th Edition (Hornby 2005).

The key actor in the production of artisanal dimension stone is the entrepreneur or the operator of the quarry who is responsible for initiating the activity by purchasing and assembling the necessary factors. The operator is the investor in the business of artisanal quarrying of stone. The operator's role starts with payment to secure mining rights on a particular land that is endowed with natural rock. There is a premium payment made to the owner of the land where the land is privately owned or to an agency or government officer where the land is publicly owned. In the case of Zimmerman, one of the clusters of quarries considered during the preliminary fieldwork, it was found that quarrying took place in public land without formal permission, an agency collected protection money some of which, according to the artisans interviewed; end up being paid to public officers. Payments may be in the amounts of Kenya Shilling 5,000 (for public land) and Kenya Shilling 10,000—50, 000 (for private land). The premium payment will help the operator secure a measure of land on the ground to start quarrying.

Apart from the payments for land, the operator has to buy tools and pay for labour. The tools required are: excavation tools i.e. hand digging implements like mattocks, hoe, spades and hand-pushed wheel burrow and; rock cutting tools i.e. short chisels, long chisels, small and big hammers. The operator also pays for special services of the stone driller and the blaster; and may

also have to employ a clerk in case (s)he is not going to run the quarry by her/himself at all times. Table 6.2 is a summary of the tasks involved in the artisanal production of dimension stone, the performers of these tasks and their modes and rates of payment.

Table 6.2: Performance and payment summary for stone quarrying tasks

Task	Performance	Payment Mode	Payment Rate
Removal of overburden	two men work together with hand Shovel and wheel burrow	paid per square metre	rate depends on depth of overburden
Drilling of holes for blasting	two men drill the hole manually using a 25-30 ft metal pole with a steel chiselled tip	paid per foot length of hole drilled	Kenya Shilling 30.00 per foot for rock; 25.00 for murram
preparation of explosives and blasting	a licensed blaster is sometimes hired		
splitting and rough shaping of stone	a stone artisan/cutter breaks and roughly shape stone using hammers stone produced and chisels, assisted by a casual worker	paid per foot-run of stone produced	Kenya Shilling
clearing of wastes and piling of stone	done by casual workers	paid per day	
loading of stone onto truck	done by casual workers	group payment, divided according to number of workers participating	Kenya Shilling 50-100 per truck, depending on product

Source: Constructed with field information, see also Wells (2000, pp 30—31) and Wells and Wall (2003, p 331).

The official requirement for blasting is that a blaster licensed and supplied with explosives by the Department of Mines and Geology is to prepare the explosives and blast. In most cases, according to field observations, because only one blaster is available for many quarrying units he or his agent would sell the blasting materials and equipment to the artisans who would then go ahead to prepare them and blast. The blasting equipment consists of ammonium nitrate and a detonator (blasting cap) connected to a safety fuse. The going prices of these items at the time of the fieldwork were as follow. A cup full (vacuum flask cover is used!) of the ammonium nitrate was going for Kenya Shilling 40, a one and a half feet measure of the safety fuse was going for the same price while the detonator was costing Kenya Shilling 50.

6.3.2. Exchange relationships within the production units and for the output

At the centre of the marketing systems model are the production units flanked on either side by the input and output environments see Figure 6.4. In this case the producers are those enterprises involved in the quarrying of artisanal dimension stone. After examining the exchange relations with the external suppliers to the artisanal production unit, the internal exchange relationships are examined here in relation to the labour factor.

Artisanal production is a labour intensive technique relying on little use of machines or automation. Labour is therefore the defining factor of the industry. Both unskilled and skilled labour is applicable. Unskilled labour is required for excavation activities. Excavation is necessary for removing the overburden in order to expose the rock for blasting and cutting. Excavation is done using hand tools and equipments like: mattock, spades and wheel burrow. Unskilled labour is also required: Collection and pilling of stones, loading of stones onto truck, helping hand for stonecutter and clearing the foot of the rock for blasting. On the other hand, skilled labour is required for cutting the stone into proper dimensions. This is done using hand tools like chisels and hammers. The stonecutter works with a hand man to help in leveraging and moving rock et cetera. Details of the payments due to labour are already given in Table 6.2.

After assembling all these resources through the exchange relationships, the operator will then be able to quarry and sell stones plus other products from the site. But every time the products are sold the operator will pay royalties to the land owner or agency per truckload of the product. On the output side, the fieldwork also identified products and by products arising from the process of artisanal production of dimension stone. These are: dimension stone (main product), ballast, hardcore, red soil, murram. The transactions involving the products and by-products of the artisanal production of dimension stone, as established by the study, are shown in Table 6.3. The charges displayed in the table are for a seven-ton truck. For every truck load of the product or by product, royalty would be paid to the land owner reducing the operator’s gain from the transaction by a similar amount. Dimension stone, however is not sold per truck but per foot-run depending on the dimensions of the stone being sold.

The sale price for dimension stone (see piles in Plate 3, for example) will vary depending on the type of stone (colour) and the dimensions usually 6" by 9" and 9" by 9". For instance, the price of a 9" by 9" block for the blue stone ranges about 24-26 shillings per foot run while the price of the 6" by 9" averages Kenya Shilling 14, according to the interviewees met on site.

Table 6.3: Operator's revenue and royalties for quarry sites and rates in Kenya Shillings

	Product	**Zimmerman**	**Miarau**	**Kwa Hinga**
Revenue	Dimension stone[6]			
	Hard core	650	700	800
	Murram	500	700	800
	Red soil	500	700	800
Royalties	Dimension stone	300	600	800
	Hard core	100	250	300
	Murram	100	250	300
	Red soil	100	250	300

Source: Field Survey 2007

6.3.3. Competitors in the masonry market

It is not possible to estimate the total number of buildings that have been constructed or that will be constructed with artisanal dimension stone in Nairobi. However, generally non-residential buildings are of machine-cut dimension stone masonry due to their formal nature of procurement. For the residential buildings, the decennial census data can be used to give an estimate. According to the 1999 census report on housing there are eight key materials used for the wall envelop of residential buildings in Nairobi: stone, bricks and blocks, mud and wood, cemented mud and wood, wood only, iron sheets, grass or reeds, and tin (Republic of Kenya 2002). The percentage scores of these materials according to the number of households occupying houses with walls mainly built of such material were already presented in Figure 1.5. This does not give the number of houses built of these materials but does give an indication of their level of usage in residential construction for Nairobi.

From Figure 1.5, it can be seen that stone is the material used to house most households in Nairobi at 41.12 per cent. Unfortunately the data does not distinguish between machine-cut and artisanal stone. At this juncture it is important to note that building regulations mainly allow stone and brick or block for wall construction. Section 52 the Building Code expressly states that:

[6] Sold per running foot

‘All walls built of stone, bricks or blocks shall be hard, durable and suitable for the purpose for which they are used...’ (Republic of Kenya 1968: 27). The Building Code does not make provision for the use of any other material for wall construction. Hence the other materials used in wall construction as shown in Figure 1.5 are illegal or informal.

In the official context, therefore, the main challenges to stone in the market are the moulded materials i.e. bricks or concrete blocks. If this study is restricted to the stone market only, then the competitors of artisanal dimension stone producers for the Nairobi market are the machine-cut stone producers. These are located outside the city boundaries but their products are transported into the city to be used in building construction. These operators are located mainly around the Juja-Thika area about 30-50 kilometres from the city centre. Plate 2 shows the product of the competitors.

6.3.4. Exchange relationships within the marketing channels

According to Kotler and Keller (2006) intermediaries constitute a marketing channel; also known as trade channel or distribution channel. Marketing channels can be defined as sets of interdependent organizations playing a role in the process of making a product available to the final user or consumer (Kotler and Keller 2006). Therefore the channels constitute pathways a product follows after production, culminating in purchase and use by the final end user (Kotler and Keller 2006). The list of intermediaries of a product may include merchants such as wholesalers and retailers, who buy, take title to and resell the product (Kotler and Keller 2006). In dyadic market analysis they are generally referred to as vendors. Other intermediaries include brokers, manufacturer’s representatives, sales agents, who search for customers and may negotiate on the producer’s behalf (Kotler and Keller 2006). Facilitators are another set of intermediaries for example transporters, warehousing providers, banks and advertising agencies who assist in the distribution process but neither take title to goods nor negotiate purchases or sales (Kotler and Keller 2006). This section presents an analysis of the intermediaries involved in the use of artisanal dimension stone in Nairobi.

The study established transporters, stockists and brokers as some of the intermediaries involved in the marketing and distribution of artisanal dimension stone in Nairobi. The transporters move

the roughly shaped dimension stone from the quarry site on behalf of the buyer; to the building site in case of a developer or to the selling yard in case of the stockist. The stockists are a category of the merchant intermediary or vendor who may buy directly from the producers but, unlike the builders or developers, their intention is not to use but to sell or stockpile for eventual sale in their localities to final end users. Opinion may vary on their relations with artisanal producers who may sometimes see them as exploitative but stockists play a significant role in the supply chain of artisanal dimension stone. Given that artisanal producers generally operate under limited supplies of money, they cannot afford to keep stock of stones for a long time in the absence of ready buyers. In the absence of user buyers (builders) the stockists come in to buy the dead stock and unlock the producers' cash flows. Secondly, the stockists help to widen the distribution of artisanal dimension stone by taking it from the quarry to their yards where it can be sold to piecemeal buyers, who otherwise would have not made it to the quarry, in small amounts that can be taken away in wheel burrows, hand carts or pickups.

For mapping out the possible pathways of artisanal dimension stone from the production point to the consumption (building) site, the study relied on the example of Wuyts et al (2004) on vertical marketing systems. Although considering a triadic perspective of vertical marketing systems, Wuyts et al. (2004) suggested that multiple analyses are possible for more than three tiers; hence this study adopted a polyadic perspective as shown in Figure 6.5.

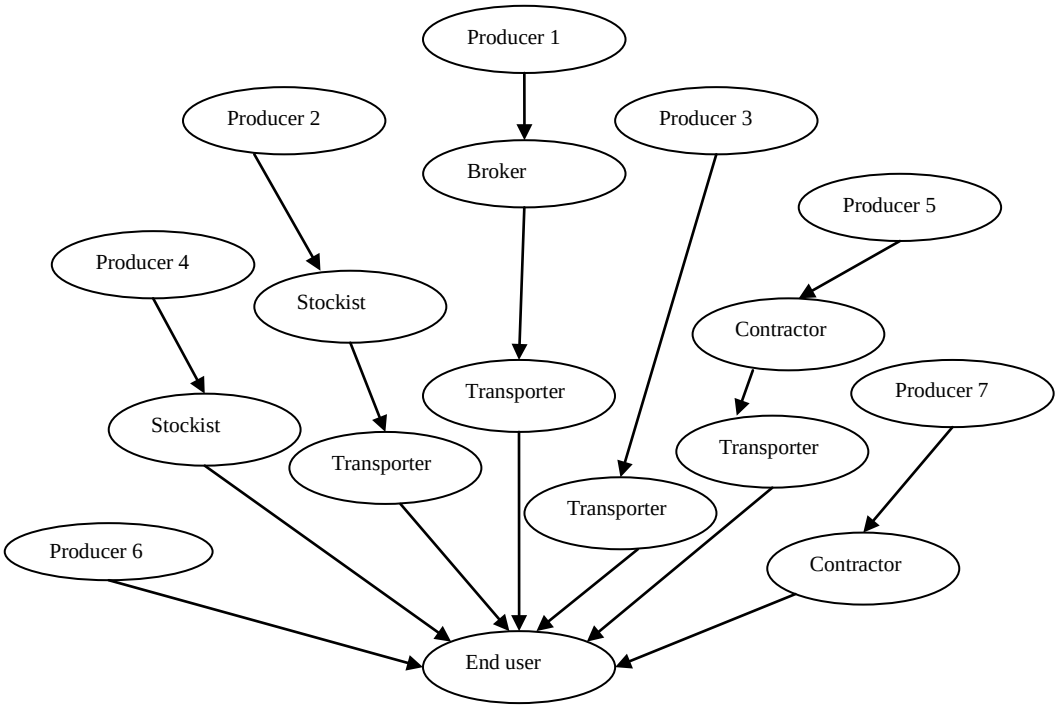


Figure 6.5: The most probable polyadic configurations for artisanal dimension stone in Nairobi (without contractors and stockists sourcing through brokers)

From Figure 6.5, seven most probable pathways can be identified:

Producer 1—the artisanal production unit sells to a developer introduced by a broker and the developer hires transport services to haul the stone to the building site

Producer 2—the artisanal production unit sells to a stockist (vendor) who hires transport services to haul the stone to the sale yard for resale to developers

Producer 3—the artisanal production unit sells directly to a developer who hires transport services to haul the stone to the building site

Producer 4—the artisanal production unit sells to a stockist (vendor) who uses own transport means to haul the stone to the sale yard for resale to developers

Producer 5—the artisanal production unit sells to a contractor who hires transport services to haul the stone to the building site

Producer 6—the artisanal production unit sells directly to a developer who uses own transport means to haul the stone to the building site

Producer 7—the artisanal production unit sells to a contractor who uses own transport means to haul the stone to the building site.

It is observable that within these polyadic configurations, triadic relationships (Producer 3, 4 and 7) and dyadic relationships (Producer 6) are also possible. Secondly, the distribution channels described for producers 1—7 do not involve cases where contractors and stockists source the dimension stone through brokers. These cases are in turn captured through Figure 6.6 as shown below.

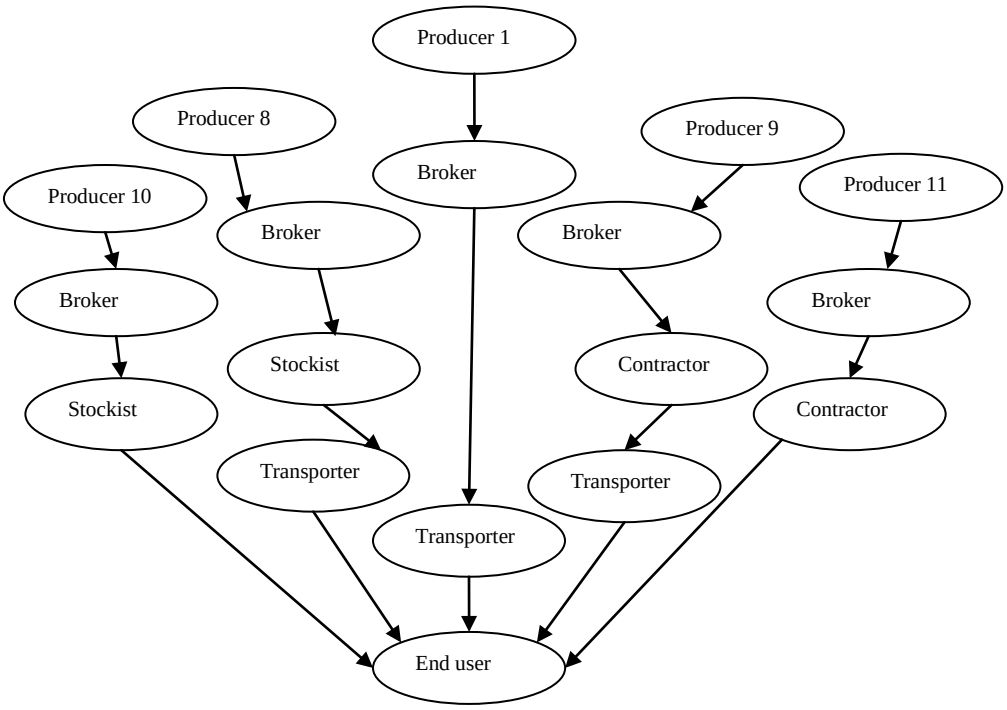


Figure 6.6: the most probable polyadic configurations for artisanal dimension stone in Nairobi (with contractors and stockists sourcing through brokers)

From Figure 6.6, four more probable pathways can be added to the seven already described from Figure 6.5. These are:
Producer 8—the artisanal production unit sells to a stockist (vendor) introduced by a broker and the stockist hires transport services to haul the stone to the sale yard for resale to developers

Producer 9—the artisanal production unit sells to a contractor introduced by a broker and the contractor hires transport services to haul the stone to the building site
Producer 10—the artisanal production unit sells to a stockist (vendor) introduced by a broker and the stockist uses own transport means to haul the stone to the sale yard for resale to developers
Producer 11—the artisanal production unit sells to a contractor introduced by a broker and the contractor uses own transport means to haul the stone to the building site.

It is important, however, to note that the eleven marketing/distribution scenarios obtained from figures 6.5 and 6.6 are merely the most probable. In no way are they exhaustive of all the possibilities. Certain possibilities such as the producer using own transport means to deliver dimension stone either to the developer's or stockist's site have been left out. So too are situations where the producer is a self-builder and produces stone for own use. Concerning the first scenario, Wells (2000: 30) noted that: 'The majority of concession holders [artisanal mining operators] cannot afford to invest in lorries to transport the stone to market. Stone transport has therefore remained a separate business'. The interviews also revealed that artisans participated in the production of dimension stone for sale and not for own use. Therefore from field interviews and observations, the study concluded that artisanal dimension stone is marketed/distributed through a kind of 'pull strategy' whereby the artisanal manufacturer does not have a sales machinery to push its product to the buyers but waits for them to come to the site to buy the stone after production. Therefore, the marketing options for the producer of artisanal dimension stone are hampered to this extent.

6.3.5. Actual and potential customers for artisanal dimension stone

Developers or builders are the final end users of artisanal dimension stone, thereby forming the main customer base for artisanal dimension stone. They may differ according to whether they come from the formal or informal sectors of the building industry in Nairobi. They also may differ according to whether they are developing for residential or non-residential uses. As customers who use the final product in the construction of buildings, they have their agents. These may include architects, quantity surveyors, structural engineers and other professionals who can choose to specify or not the artisanal dimension stone as a building material on behalf of

the developers. The contractors who work for the developers also fall under the category of agents.

In the formal process section 5 of the Building Code requires that the developer must first submit the proposed building's plans to the City Council of Nairobi for approval. Building construction should only start when and if approval has been granted. Rukwaro (2009) notes that the approval process is intended to ensure that the building being constructed meets certain minimum standards including those to do with the materials to be used. When construction of the building starts or is executed without first obtaining an approval, the development will be considered informal. It may not be easy to quantify informal development but studies by Wells (2001) and Huchzermeyer (2007) have indicated that such developments are rampant in Nairobi. In contrast to informal development, formal development can be quantified by counting the number of building plan approvals (according to K'Akumu 2007a, this is the statistic that, in Kenya, may stand for building starts) or counting the number of reported building completions. Table 6.4 indicates the number of building plans approved by the City Council of Nairobi from 1998—2005.

Table 6.4: Number of building plans approved by the Nairobi City Council for development by private and public sector builders

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Private developers								
Residential	604	789	649	542	1,984	1,563	3,433	6,191
Non-residential	215	126	97	60	107	86	310	741
Public developers								
Residential	68	21	0	0	16	0	1	0
Non-residential	0	38	55	24	92	54	252	112

Source: Republic of Kenya (2007b p.147)

From Table 6.4 it can be seen that the building industry is active with both the private and public developments going on in both residential and non-residential sectors although the public sector is not as active as its private counterpart. The data shows that there are fluctuations in the construction of buildings within the formal process but the mere presence of building activities constitute a potential market for artisanal dimension stone. Similarly, the statistical source reported that in the year 2005, 829 residential and 8 non-residential buildings measuring a total of 256 and 244 square metres respectively were reported for completions (Republic of Kenya

2007b). According to Wells and Wall (2003) artisanal dimension stone is mainly used in the informal development hence the formal sector forms a potential customer base.

6.4. The nonmarket/regulatory environment

With regard to Figure 6.4, it has been noted that the environmental forces constitute the enabling environment for the study product i.e. dimension stone in this case. Kotler and Armstrong (2010) pointed out that the 'major environmental forces' include demographic, economic, physical, technological, political/legal and social/cultural factors i.e. PEST factors.

The demographic factors involve the fact that Nairobi's population is growing at a faster rate thereby creating the need to build houses to accommodate the new households. The housing census statistics of 1999 indicate that the annual rate of household formation for Nairobi city was 2.28 percent compared to the general urban rate of 2.085 percent and the overall national rate of 1.63 percent (Republic of Kenya 2002: 13). Apart from the need to build houses, the growing population also creates the need for other services thereby creating the need to construct non-residential buildings to accommodation the provision of such services. This situation has created a growing demand for buildings.

Table 6.4 has already given a hint on the kind of construction activities going on in Nairobi's building economy. The presence of these activities in the industry actually constitutes the enabling environment for the production and use of the artisanal dimension stone. The fact that about 45 percent of residential housing is constructed of illegal materials as shown in Figure 1.5 and discussed below is another potent factor for enabling the production and use of the artisanal dimension stone in Nairobi.

As discussed below, the Building Code only recognizes stone, burnt brick or cement block for wall construction in Nairobi. This makes bricks and blocks the only competitors of dimension stone in wall masonry. According to Wells (2001) the liberalization of the economy following the implementation of structural adjustment policies has promoted the use of artisanal dimension stone in Nairobi. This is because previously it was cheaper to build in concrete blocks than to build in dimension stone. However the freeing up of cement prices resulted into steep rises.

Cement is the most costly component in the production of concrete blocks hence a steep rise in its price meant a rise in the costs of concrete block production which rendered it less cost effective to build with concrete block as compared to dimension stone.

Another economic factor that favours the production of artisanal dimension stone in Nairobi is the availability of cheap labour. According to Taylor (2000) the use of dimension stone in masonry construction diminished considerably during the past century mainly because of increased labour costs that rendered the processes of its extraction, cutting, and dressing uneconomic. Whereas this may be true for the developed world, it does not apply to a developing country situation like Nairobi where labour is available in abundance and hence cheaply. Secondly, Wells and Wall (2003: 330) noted that 'private sector clients building in the informal system tend to be less particular about the standard of finish than public sector clients building in the formal system with its more exacting standards'. Hence the working of artisanal dimension for use in building construction in Nairobi does not required highly skilled and paid manpower.

The major physical factor influencing the production of artisanal dimension stone is the availability of natural rock as a raw material that can be converted into a material for use in the construction of buildings. Geological information indicates that Nairobi is lying on bedrock of volcanic deposits (Saggerson 1991, Williams 1967). The deposits that are extensively quarried for ballast is the Nairobi Phonolite (Williams 1967) whiles the ones quarried for dimension stone is popularly known as the Nairobi Stone; originally termed 'Nairobi Claystone' (Williams 1967, Sikes 1939).

The exploitation of these deposits is enabled by the use of artisanal technology that does not demand heavy investments both plant and machinery and human resources. It has been noted from Table 6.4 that the tasks involved in the excavation, breaking and cutting/shaping of stone are performed by hand or by the use of simple hand tools. No machinery is involved. According to Wells and Wall (2003) these tools are manufactured, supplied and repaired by actors from the informal sector. The labour involved, on the other hand, is generally unskilled if not semi-skilled. This creates an ease of entry situation to potential investors in the production of artisanal dimension stone.

The legal environment is composed of regulators. These are government agencies which regulate the activities of artisans involved in the production of dimension stone. There is the local government agency (the City Council of Nairobi) that regulates the market of dimension stone according to the Building Code and the Public Health Act requirements that specify the type of building materials that may be used in the city. Because the Building Code specifies dimension stone as one of the materials to be used in constructing the wall of a building, to this extent the law enables the use of artisanal dimension stone. Nevertheless the City Council also taxes the products from artisanal quarries by imposing a cess on each truck load of building materials, thereby constraining the operations of artisans.

Apart from the City Council, there is the public environmental agency known as NEMA (National Environmental Management Authority) that has been constituted through the Environmental Management and Coordination Act. The Authority does not tolerate any environmentally damaging behaviour through any economic activities and has been trying to apply regulatory measures on the artisans.

The Department of Mines and Geology is another significant government agency involved in the artisanal production of dimension stone. As has been stated, the Department is responsible for licensing the blasters and for selling explosives to them to use in the artisanal quarries. The department therefore enables the production of artisanal dimension stone by supplying one of the main inputs in the production process. However one of the issues that came out from the interviews is that the Department never issues enough explosives hence some explosives that are used in the quarries are obtained from the black market.

At the local level, the preliminary fieldwork established that the Provincial Administration officers are involved as regulators. The officers involved include the Assistant Chief, the Chief and the District Officer. The Police Department is also involved in the disputes that sometimes pit rival gangs in the quarrying business against each other. The police are also available to sort out disputes that may arise in the transactions.

The enabling environment is also characterised by lack of policy support from the central and local government. For example, the infrastructures on which artisanal activities rely upon, such as roads, are neglected by local government agencies (see for example a section of the main road into the Miarau quarries shown in Plate 3). Yet the same agencies officially tax these activities. The fieldwork established that a cess of Kenya Shilling 1,500 is charged on every truckload of stone by the City Council of Nairobi. The greatest threat from the government agencies, however, involves imposition of a government ban on the activity as was the case with the Zimmerman site during the field visits.

On the socio-cultural side it can be observed that one of the factors constituting the enabling environment for the production and use of artisanal dimension stone is the culture of *jua kali* exchange relationships. *Jua kali* refers to the informal economy as described by King (1996) hence entails a set of exchange relationships that are not familiar in the conventional world but that work for the participants. All the exchange relationships involved in the production of artisanal dimension stone as described in the foregoing sections, including the land transactions are done in a *jua kali* manner.

Avoidance of conventional exchange systems works both positively and negatively for the artisans. The positive aspects of it are that it simplifies transactions, excludes legal costs to keep prices as low as possible. On the other hand the *jua kali* way avoids compliance with legal requirements such as labour and environmental management laws and other regulatory requirements that sets the artisans at loggerheads with the regulatory authorities. However concerning the economic costs to the artisans in going the *jua kali* way is their loss of the formal market customers who are unwilling to rely on non-conventional exchange relationships with the artisans.

6.5. Implications for the enabling environment

The study has noted that the attribute of dimension stone as a permanent material makes it acceptable under the building regulations for construction work whether it is obtained by artisanal means or not. The census of housing statistics quoted in Figure 1.5 showed that approximately 40% of families in Nairobi live in houses with walls built of stone (Republic of Kenya 2001).

One of the weaknesses of the statistics, in this case, is that they do not identify the proportions of artisanal and industrially mined dimension stone used in building construction in Nairobi. Nevertheless it can be seen that dimension stone is a significant material for wall construction of residential buildings in Nairobi. This implies that, potentially, artisanal dimension stone can contribute significantly to the development of housing in Nairobi if the sourcing is recognized, supported and developed.

Other artisanal materials that can be identified from official statistics sources include: grass, tin[7] and *makuti* (palm fronds) for roofing; earth for floor; and stone, mud/wood, mud/cement, iron sheets, grass/reeds, and tin for walls (Republic of Kenya 2001). Most of these artisanal materials are not accepted by the building regulations for Kenya and Nairobi owing to their temporary or semi-permanent nature and hence are mainly used in the informal settlements; which makes dimension stone unique for being the only artisanal material that can be used in both formal and informal settings. This gives artisanal dimension a potentially wide reach in the building industry and the building materials market. Given this potential artisanal stone has for building in Nairobi, it is significant to study its production and marketing by artisans who are at the lower scale of social or industrial structure as this could improve their contribution to the social and economic development of the nation.

By analyzing the exchange relationships involved in the use of artisanal dimension stone the study is able to unravel the vertical economic inter-linkages that characterize this phenomenon in a developing country situation. The production and distribution of artisanal dimension stone provides several micro enterprise development opportunities both in terms of micro investment and micro financing. In the input environment, micro investors include the quarry operators, drillers, blasters, food vendors among others. Micro investors in the output environment on the other hand include transporters and stockists. Transporters invest in trucks and employ drivers and turn boys to haul artisanal dimension stone from the quarry to required destinations while stockists take the role of middlemen who buy artisanal dimension stone to stockpile in their yards or material shops. Micro enterprises are significant players in the developing economy Kenya

[7] Tin is not a conventional material in this context but refers to sheets of material salvaged by artisanal means from containers and used for roof or wall cover.

included (Liedholm and Mead 1999). Therefore the micro enterprises functioning within the market environment of artisanal dimension stone, like micro enterprises in other sectors or sub-sectors, require policy support and development. Opportunities for micro financing potentially exist because all these micro investors would require some type of financing or other but this is not yet possible especially for the enterprises involved in the production since there is lack of official recognition of their activities that are sometimes affected by government bans.

The production and use of artisanal dimension stone has a great potential for contributing to local development to the extent that it uses local resources and fulfills local needs. The study has documented the use of natural rock, local labour power and skills, locally made tools and equipment in the production of artisanal dimension stone. Perhaps the only item that needs to be imported for the production of artisanal dimension stone is the explosive; all the rest are available locally. Stone being a heavy building material it is used in local construction thereby satisfying local demand and needs. This development scenario leads to wealth creation at local levels since little money or less benefit is lost outside the local community through the sourcing of inputs or external value addition to the output. Unlike machine cut stone, the hand cut stone may require further dressing on the building site thereby further utilizing locally available skills. This makes a strong case for policy recognition and support for artisanal dimension stone.

The contribution of the production and use of artisanal dimension stone to employment creation has turned out to be significant. Following the discussion of the micro investment opportunities, it can be noted that each micro investor identified would employ at least one extra person all who add up to employment opportunities. The employment opportunities provided, although temporary in nature, have the potential to play a significant role in livelihood support and poverty reduction. The production and use of artisanal dimension stone also exhibit some potential for social development. Secondly, social ills associated with artisanal and small scale mining such as child labour and prostitution were not observed in the preliminary fieldwork areas.

Four decades ago Kotler and Levy (1969) sought to broaden the concept of marketing by arguing that all organizations, whether business or non-business, are generally concerned about target consumers' perception of their products hence marketing becomes an activity aimed at increasing

the perception of the said products. The concept of product was not limited to goods and services but may include personalities, organizations and ideas. Therefore social marketing as defined by Kotler and Roberto (1989) may be an ideal solution to the negative perceptions of artisanal dimension stone.

This chapter considers the issue associated with social marketing and the role of major influential stakeholders including the policy makers and industrial players at large who have not been paying attention to this aspect of the construction economy. It does this by casting the production and use of artisanal dimension stone as a significant phenomenon in the construction economy that needs to be understood well by stakeholders in the in the industry. From this juncture onwards other development partners can take over the promotion of the use of artisanal dimension stone.

6.6. Summary and Way Forward

From the foregoing discussions, the following have been picked as some of the forces active in the business environment for artisanal dimension stone.

1. The competitors of artisanal dimension stone producers include all the manufacturers of wall construction materials
2. There are four basic factors involved in the production of artisanal dimension stone i.e. natural rock, labour, entrepreneurship and tools
3. Entrepreneurs pay for all the other factors of production
4. Law requires that blasters be licensed by the Department of Mines and Geology
5. Artisanal production of stone is labour intensive involving both skilled and unskilled labour
6. Transporters, stockists and brokers are some of the intermediaries in the artisanal stone market
7. The major physical factor is availability of natural rock
8. NEMA regulates the environmental aspects of stone production
9. The enabling environment is characterised by lack of policy support by both central and local authorities
10. The greatest threat to quarrying is government bans

11. Informal transactions or exchange relationships is used in the stone market

The study recommended that these factors be carried forward in the analysis of the enabling environment as explained in the following section.

In this section the study seeks to consolidate the gains from literature review and exploratory research in order to move forward to the conclusive stage. From literature review (Chapter 3), the study adopted the Dawson Model (Figure 3.6). The model suggested that the business environment can be divided into input, output and regulatory environments which led the study to the six basic research questions, see section 3.3. Further existing literature especially from ITDG studies reported by Jill Wells and others, in addition to literature on SMEs have yielded some empirical factors that may influence the enabling environment for artisanal dimension stone in Nairobi. The outcome of exploratory study i.e. ethnographic methods (participant observation and unstructured interviews) and secondary data analysis (reported in Chapters 5 and 6) also yielded certain facts that could be followed up in conclusive research. This brought the study to the following propositions.

Constraints/opportunities for input

1. Easy contracts to secure land
2. Exposed rock requires little excavation
3. Feuds in land owner families
4. Small amounts of money needed
5. Money easily obtainable from local sources e.g. family, personal, informal sources
6. No credit facilities for financing mining
7. Simple hand tools easy to use
8. Affordable readily available tools
9. Availability of blasting explosives
10. Use of simple drilling technique
11. Availability of unskilled labour
12. Availability of skilled labour (not blasters)
13. Availability of blasting skills
14. Availability of cheap labour

15. Need to pay protection money
16. Bribes to officials for use of land for mining
17. Harassment & intimidation by enforcement officers
18. Random decisions by government agencies about use of land
19. Safety and security of personnel
20. Corruption increases start up barriers
21. Environmental damage
22. Artisanal mining creates waste land
23. Use of explosives damage environment
24. Use of explosives cause low productivity
25. Investment in mechanical plant improves perceived quality and demand for product
26. Scientific approach needed to identify deposits
27. Control by environmental agencies

Constraints/opportunities for output

1. Specified by quantity surveyors
2. Not specified by quantity surveyors
3. Specified by structural engineers
4. Not specified by structural engineers
5. Specified by architects
6. Not specified by architects
7. Specified by formal developer/client
8. Not specified by formal developer/client
9. Decisions by informal developers
10. Specified by informal designers
11. Decisions by stockists to stock
12. Brokers procures directly for customer
13. Availability of transportation
14. Costs of transportation
15. Quality of infrastructure - roads
16. Poor health and safety practices effect production

17. Formal clients do not use jua kali dimension stone because of legal difficulties
18. Competitor's practices limit the demand for jua kali dimension stone
19. Dimension stone used due to security it gives building
20. Dimension stone is used because designers know how to use it
21. Unethical practices in jua kali dimension stone mining reduces demand
22. Dimension stone used historically
23. Dimension stone used due to durability
24. Dimension stone is used because builders know how to use it

Constraints/opportunities in regulation

1. Licenses to blasters
2. Regulations of supplies of explosives
3. Planning laws
4. Environmental laws
5. Building regulations/codes
6. Commonly accepted informal practice in construction
7. Implementation of planning laws
8. Implementation of environmental laws
9. Implementation of building regulations/codes
10. Local administration resolves disputes
11. Issue permission for quarrying
12. Tax/cess issued by Nairobi on stone mined
13. High fees National Environment Management Agency (NEMA)
14. Cartels control market for jua kali stone
15. Industrially produced dimension stone more acceptable to formal sector
16. Police do not enforce law effectively
17. Informal market for jua kali stone works through trust
18. Tribalism effects demand
19. Transportation problems
20. Poor roads
21. Market for jua kali dimension stone unreliable
22. Jua kali dimension stone accepted by Building Regulation

23. Jua kali dimension stone used in buildings because it is low cost
24. Jua kali dimension stone gives poor finish
25. Jua kali dimension stone not acceptable to planning authorities
26. Cartels manage disputes

These propositions were used to develop the survey instrument as explained in section 4.8.1, see also Appendix 5. A question was put to the respondents and the above propositions/factors given as prompts in each category:

1. Question: Can you tell me what helps/hinders the making jua kali dimension stone? (UNDERLYING IDEA—to establish constraints/opportunities available for artisans in the supply of inputs)

2. Question: Can you tell me what helps or hinders artisans to sell or distribute jua kali dimension stone? (UNDERLYING IDEA: To establish constraints/opportunities in the sale, use and distribution of jua kali dimension stone)

3. Question: Can you tell me what rules and regulations and their implementation helps or hinders in the production, specification and sale and distribution of jua kali dimension stone? (UNDERLYING IDEA—to establish constraints/opportunities provided by the regulatory system)

In each case the respondents were prompted to indicate whether each factor either is a negative (constraint) or a positive (opportunity) influence and to grade its strength of influence on a scale of 1-5; 1 being least and 5 being greatest.

The respondents to the questions were selected using the guideline of the analysis of stakeholder salience explained at the beginning of this chapter, Table 6.1. From the Table it becomes apparent that the salient stakeholders are: Owner/operator, stone artisan, clerk, developers, architects, quantity surveyors, structural engineers, contractors, stockists and ITDG/ Practical Action. The owner/operator, stone artisan and clerk come from the same organization (the

artisanal units of study) therefore the owner/operator was picked as a representative respondent for the artisanal organizations having obtained the highest score of all three.

On their strength as formally organized entities with a clear sample frame architects, quantity surveyors, structural engineers and contractors were included in the survey. In order to consider a wide spectrum of contractors, they were selected according to different categories i.e. A, B and C. However developers were dropped out of the list since their views would be ably represented by those who work on these matters on their behalf i.e. the professionals. While, on the other hand, stockists were excluded from the survey owing to their informal and haphazard organization that made probabilistic sampling difficult at this conclusive quantitative stage. Likewise, as a single organization, ITDG was not considered a representational stakeholder in the sampling process and left out in primary data collection at this stage. In deed at the time of research they were not working on artisanal dimension stone anymore.

The responses were subject to factor analysis whose results form the basis of discussion for the next chapter.

CHAPTER SEVEN

7. FACTOR ANALYSIS OF THE ENABLING ENVIRONMENT

7.1. Introduction

Following respondent selection and factor propositions detailed in the preceding discussion, this Chapter reports on the results of quantitative data analysis of the conclusive aspects of the study as was discussed in Chapter Four section 4.8.4. The chapter intends to answer Objectives 3, 4 and 5 of the study. The main objective of this analysis was to confirm the facts obtained through literature review, secondary data analysis and other aspects of exploratory research as reported in Chapters 3, 5 and 6, and consolidated at section 6.7. Further the chapter presents a discussion of the results of the factor analysis (section 7.6) and consequent recommendations (section 7.7) that are finally followed by conclusions (section 7.8).

The analysis reported here began with descriptive statistics shown in Appendix 17 in terms of frequency tables from the statistical analysis of the overall data set. The frequencies reveal that respondents to the question schedule had a minimum experience in the Nairobi building industry of 1 year and a maximum of 36 years (see Table 1.0 of Appendix 17). The mode number of years of experience is 4 and 5 both with a similar frequency of 14. Table 3 of Appendix 17 indicates that all the respondents had experience of producing or using artisanal dimension stone. The frequencies also exhibit a strong case of face validity (where the measure apparently reflects the content of the concept in question, see Bryman and Bell 2007) and internal reliability (where the indicators that make up the scale or index are consistent, see Bryman and Bell 2007). The main body of this chapter however presents the results of factor analysis done for the production, market and legal/administrative environments for artisanal dimension stone. Analysis is performed on the factors listed in section 6.7 as follow:

1. Constraints/opportunities for input (section 7.2)
2. Constraints/opportunities for output (section 7.3)
3. Constraints/opportunities in regulation (section 7.4)

In factor analysis language, the factors are also referred to as components in this and subsequent chapters.

7.2. Opportunities and constraints in the production of artisanal dimension stone

The first step in the SPSS analysis procedures is to assess the suitability of data for factor analysis. This requires the analyst to check the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and the Bartlett's Test of Sphericity value significant (sig value) as shown in Table 7.1. The KMO value should be .6 or above while sig value should be 0.5 or smaller (Pallant 2007, Hinton et al. 2004). In this case the KMO value is .719 while the sig value is .000 hence the data passes this test and factor analysis is appropriate.

Table 7.1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.719
Bartlett's Test of Sphericity	Approx. Chi-Square	1646.347
	df	351.000
	Sig.	.000

Apart from the KMO and Bartlett's table, the SPSS output also gives the Correlation Matrix table. However this table is too large to present here. Nevertheless it is important to look for correlation coefficients of .3 and above because if there are not many in the matrix then factor analysis is not suitable owing to little correlations (Pallant 2007). From the SPSS output table on Correlation Matrix 74 correlation coefficients of .3 and above were counted; confirming that the data is suitable for factor analysis.

In this initial analysis we need to know the total variance in which all components (factors) are extracted as shown in the Table 7.2. However only a few factors, which are significant should be selected for interpretation. One of the methods of selection is the Eigenvalues criterion where values of 1 and above are considered. Any components with Eigenvalues of less than 1 are left out in the interpretation. In this case out of the 27 components in the output only 8 were selected; the rest were dropped out of the analysis. It is noteworthy that the 8 components with Eigenvalues of 1 and above account for the total variance of 67.453 percent, thereby making them the most significant factors.

Table 7.2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.814	17.831	17.831	4.814	17.831	17.831
2	3.653	13.530	31.361	3.653	13.530	31.361
3	2.762	10.229	41.591	2.762	10.229	41.591
4	1.957	7.247	48.838	1.957	7.247	48.838
5	1.421	5.262	54.100	1.421	5.262	54.100
6	1.364	5.050	59.150	1.364	5.050	59.150
7	1.179	4.368	63.518	1.179	4.368	63.518
8	1.062	3.934	67.453	1.062	3.934	67.453
9	.973	3.604	71.056			
10	.865	3.205	74.261			
11	.843	3.121	77.382			
12	.738	2.734	80.116			
13	.681	2.521	82.637			
14	.647	2.395	85.032			
15	.572	2.118	87.150			
16	.441	1.634	88.783			
17	.430	1.594	90.378			
18	.395	1.463	91.841			
19	.338	1.252	93.093			
20	.305	1.131	94.224			
21	.292	1.082	95.306			
22	.267	.988	96.294			
23	.255	.946	97.240			
24	.219	.811	98.051			
25	.210	.777	98.828			
26	.193	.714	99.542			
27	.124	.458	100.000			

Extraction Method: Principal Component Analysis.

Another way of deciding on what components to retain for further analysis is the scree plot. In the scree plot what the analyst need to look for is a change in the shape of the plot especially where it levels off as shown in Figure 7.1. Only the components above this point are retained for further analysis (Pallant 2007). From Figure 7.1 we can see that there is a sharp break between component 5 and 6. In this case it is recommended that only components 1-5 be retained.

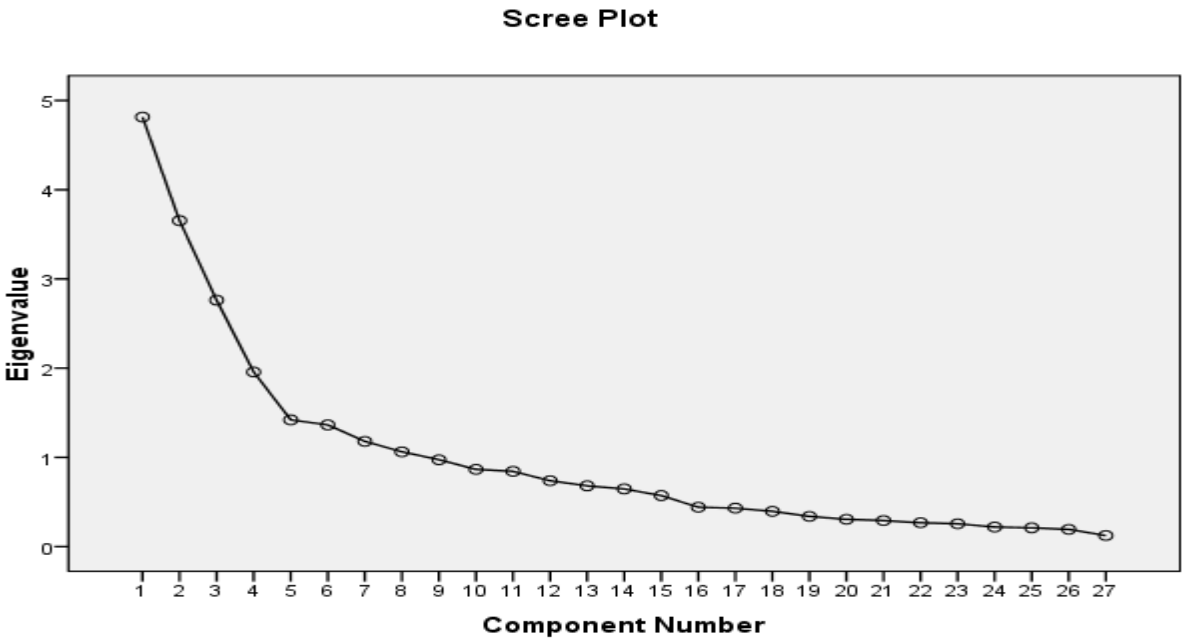


Figure 7.1: Initial Scree Plot

In this study the analysis also considered the Monte Carlo PCA for Parallel Analysis method. This method involves a computer programme in which the number of variables (27), the number of subjects in the sample (148) and the number replications (100) were inputted. The programme then calculated the average Eigenvalues for 100 randomly generated samples as shown in the printout at Table 7.3.

The Eigenvalues that were obtained from the SPSS output (Table 7.2) were compared with the corresponding values from the Monte Carlo output (Appendix 18B), where if the SPSS value was larger than the Monte Carlo value the factor was retained and if less the factor was rejected as shown on Table 7.3. Therefore from the parallel analysis, of the 8 default factors of the SPSS default position, the first four factors were carried over for further analysis while the last four were rejected. This comes closer to the 5 factor solution of the scree plot. Therefore the next step is to force a four factor solution to the dataset.

Table 7.3: Comparison of Eigenvalues from SPSS and Monte Carlo outputs

Component	Actual Eigenvalues from SPSS	Random Eigenvalue from Monte Carlo	Decision
1	4.814	1.8913	Accept
2	3.653	1.7403	Accept
3	2.762	1.6315	Accept
4	1.957	1.5477	Accept
5	1.421	1.4627	Reject
6	1.364	1.3929	Reject
7	1.179	1.3294	Reject
8	1.062	1.2665	Reject

To force a four factor solution to the dataset, the factor extraction and loading procedures were repeated but in this time round using the Oblimin rotation method and limiting the number of factors to be extracted to four. One of the outputs the SPSS would give is the Component Correlation Matrix, Table 7.4. The Component correlations show the strength of relationships between one and each of the other three components (factors). From the table it can be seen that the correlation coefficient between component 1 and 2 is -.034; 1 and 3 is .077; and 1 and 4 is .015. Likewise, component 2 and 3 is .049; 2 and 4 is .118; and 3 and 4 is .142. These are very low values meaning that it was right to assume that the four components are not related. Pallant (2007) suggests that so long as the correlation coefficient is less than .3 there is no strong relationship between two components.

Table 7.4: Component Correlation Matrix

Component	1	2	3	4
1	1.000	-.034	.077	.015
2	-.034	1.000	.049	.118
3	.077	.049	1.000	.142
4	.015	.118	.142	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

The Oblimin rotation method gives as part of its output two tables of factor loadings, the Pattern Matrix (Table 7.5) and the Structure Matrix (Table 7.0 in Appendix 18C). The former shows the factor loadings of each of the variables while the latter shows the correlation between variables and factors.

Table 7.5: Pattern Matrix

	Component			
	1	2	3	4
Random decision by government agencies about use of land	-.783	-.337		
Control by environmental agencies	-.690			
Feuds in landowner families	-.646			
Need to pay protection money	.614			.557
Harassment and intimidation by enforcement officers	-.546		-.320	
Corruption increase start up barriers	-.458			.323
No credit facilities for financing mining	-.453			
Investment in mechanical plant improves perceived quality and demand for product	-.444		.428	
Availability of cheap labour	-.416		.335	
Scientific approach needed to identify deposits	-.405			
Artisanal mining creates waste land		.745		
Use of explosives damage environment		.713	-.389	
Environmental damage	-.444	.572		.325
Money easily obtainable from local sources e.g. family, personal, informal sources		.515		
Availability of blasting explosives	.359	.508	.386	
Use of explosives cause low productivity	-.369	-.404		
Availability of blasting skills		.350		.332
Affordable readily available tools			.844	
Exposed rock require little excavation			.727	
Small amounts of needed			.646	
Easy contracts to secure land			.634	
Availability of skilled labour (not blasters)	.412	-.386	.485	
Use of simple drilling techniques				.761
Availability of unskilled labour				.704
Bribes to officials for use of land for mining				.524
Simple hand tools easy to sue			.353	.508
Safety and security personnel		-.321		-.435

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 17 iterations.

From the Pattern Matrix table, an interpretation of the results was made possible through the identification of factor loadings. For instance, looking at the factors loading on component 1, it was possible to identify it as: *hostile policy environment*. Similarly component 2 can be identified as: *perceived negative impacts associated with quarrying*; component 3 as: *easily obtainable inputs* and Component 4 as: *simple and easily applicable production techniques*. The analysis was thereafter repeated for: Opportunities and constraints in the marketing and use of artisanal dimension stone; and opportunities and constraints in the legal and administrative environment.

7.3.Opportunities and constraints in the marketing and use of artisanal dimension stone

The repeat procedure for the marketing and use environment for artisanal dimension stone yielded KMO and sig values of .661 and .000 (Table 7.6) respectively, meaning that it was appropriate to go ahead with the factor analysis procedures.

Table 7.6: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.661
Bartlett's Test of Sphericity	Approx. Chi-Square	1441.606
	df	276.000
	Sig.	.000

Table 7.7: Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.022	16.760	16.760	4.022	16.760	16.760	2.722
2	3.639	15.165	31.924	3.639	15.165	31.924	3.429
3	2.312	9.635	41.559	2.312	9.635	41.559	2.616
4	1.783	7.431	48.990	1.783	7.431	48.990	1.776
5	1.664	6.932	55.922	1.664	6.932	55.922	3.013
6	1.346	5.610	61.532	1.346	5.610	61.532	2.069
7	1.103	4.598	66.130	1.103	4.598	66.130	1.693
8	.996	4.149	70.279				
9	.929	3.871	74.149				
10	.841	3.504	77.653				
11	.743	3.095	80.748				
12	.680	2.834	83.582				
13	.569	2.370	85.952				
14	.515	2.144	88.096				
15	.497	2.073	90.169				
16	.399	1.662	91.831				
17	.393	1.636	93.467				
18	.328	1.368	94.834				
19	.308	1.283	96.118				
20	.286	1.192	97.310				
21	.209	.871	98.181				
22	.177	.739	98.920				
23	.153	.635	99.555				
24	.107	.445	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

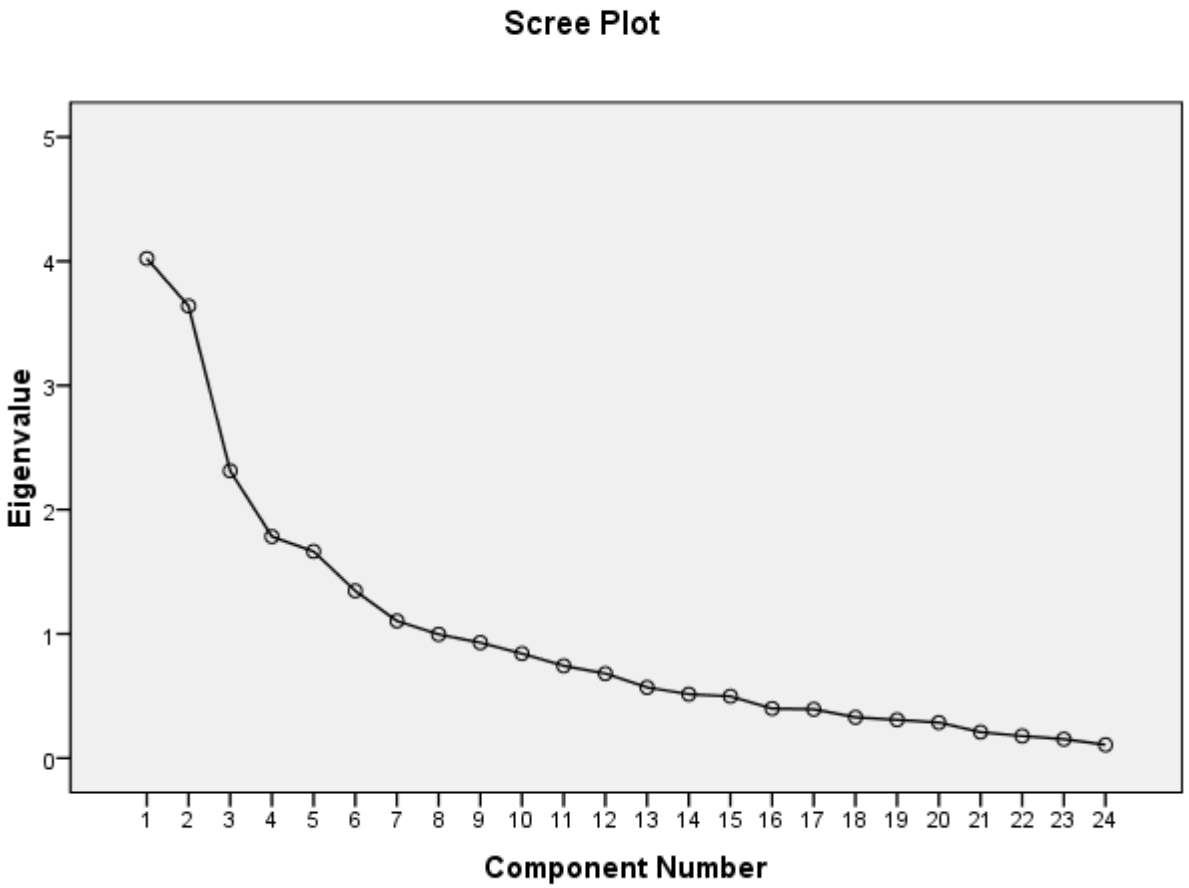


Figure 7.2: Initial Scree Plot

The analysis proceeded to factor extraction, which yielded seven components generated by the default Kaiser criterion as shown in Table 7.7. A scree plot for the components also has been generated as shown in Figure 7.2. The next step was to make a decision on how many factors to be retained in the analysis using the Monte Carlo PCA for Parallel Analysis. The Monte Carlo random Eigenvalues have been generated as shown in Appendix 19B.

A comparison of the default Kaiser with the parallel analysis Eigenvalues led to the retention of six of the seven initial components as shown in Table 7.8.

Table 7.8: Comparison of Eigenvalues from SPSS and Monte Carlo outputs

Component	Actual Eigenvalues from SPSS	Random Eigenvalue from Monte Carlo	Decision
1	4.022	1.8110	Accept
2	3.369	1.6728	Accept
3	2.312	1.5796	Accept
4	1.783	1.4816	Accept
5	1.664	1.4019	Accept
6	1.346	1.3275	Accept
7	1.103	1.2641	Reject

Thereafter another set of factor analysis was conducted with a restriction to six components. The output of this second analysis included the component correlation matrix (Table 7.9) and the pattern matrix (Table 7.10). The component correlation matrix indicates that the components are not correlated since the correlation coefficients exhibited are far less than .3.

Table 7.9: Component Correlation Matrix

Component	1	2	3	4	5	6
1	1.000	.151	.000	.000	-.161	.006
2	.151	1.000	.111	-.109	-.001	.023
3	.000	.111	1.000	-.050	.155	-.133
4	.000	-.109	-.050	1.000	.018	-.077
5	-.161	-.001	.155	.018	1.000	-.122
6	.006	.023	-.133	-.077	-.122	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

On the other hand, the pattern matrix was used to interpret the analysis since it indicates how variables load onto the extracted components.

From the pattern matrix, the following interpretations were made:

- Component 1 is *difficult marketing terrain*
- Component 2 is *general lack of specification by building professionals and formal developers*
- Component 3 is *occasional specification by building professionals*
- Component 4 is *a cumbersome stone procurement system*

- Component 5 is *advantages provided in the use of artisanal dimension stone in building*.

However Component 6 proved indistinct and could not be identified.

Table 7.10: Pattern Matrix[a]

	Component					
	1	2	3	4	5	6
Quality of infrastructure-roads	.842	-.346				
Competitors practices limit the demand of jua kali dimension stone	.668					.352
Cost of transportation	.571					
Dimension stone used historically	-.511					-.429
Formal clients do not use jua kali dimension stone because of legal difficulties	.480					
Not specified by architects		.867				
Not specified by structural engineers		.800				
Not specified by quantity surveyors		.715				
Not specified by formal developer/client		.659				
Poor health and safety practices effect production		.511	.301	.330		
Decision by stockists to stock		.431	.383			
Specified by architects			.752			
Specified by structural engineers			.605			
Decisions by informal developers			.599			
Unethical practices in jua dimension stone mining reduces demand			-.580	.311		-.306
Specified by formal developer/client	.415		.457			
Brokers procure directly for customers				.789		
Availability of transportation				.752		
Dimension stone is used because designers know how to use it					.829	
Dimension stone is used because builders know how to use it					.826	.346
Dimension stone used due to security it gives building					.718	-.323
Dimension stone is used due to durability					.665	-.467
Specified by informal designers						-.636
Specified by quantity surveyors				.385		-.576

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 33 iterations.

7.4.Opportunities and constraints in the legal and administrative environment

The repeat procedure for the legal and administrative environment for artisanal dimension stone yielded KMO and sig values of .848 and .000 respectively (Table 7.11) meaning that it was appropriate to go ahead with the factor analysis procedures.

Table 7.11: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.848
Bartlett's Test of Sphericity	Approx. Chi-Square	2375.910
	df	325.000
	Sig.	.000

Table 7.12: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.558	32.914	32.914	8.558	32.914	32.914	6.793
2	2.925	11.249	44.163	2.925	11.249	44.163	2.670
3	2.293	8.817	52.980	2.293	8.817	52.980	2.303
4	1.708	6.569	59.549	1.708	6.569	59.549	1.914
5	1.400	5.385	64.934	1.400	5.385	64.934	4.931
6	1.194	4.594	69.528	1.194	4.594	69.528	2.935
7	1.085	4.172	73.700	1.085	4.172	73.700	2.793
8	.800	3.075	76.775				
9	.735	2.825	79.601				
10	.621	2.388	81.988				
11	.597	2.294	84.283				
12	.555	2.135	86.418				
13	.459	1.765	88.183				
14	.419	1.613	89.795				
15	.384	1.477	91.272				
16	.340	1.308	92.580				
17	.313	1.203	93.783				
18	.279	1.071	94.855				
19	.247	.950	95.805				
20	.234	.899	96.704				
21	.208	.800	97.504				
22	.173	.664	98.168				
23	.144	.555	98.724				
24	.129	.498	99.222				
25	.103	.397	99.618				
26	.099	.382	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

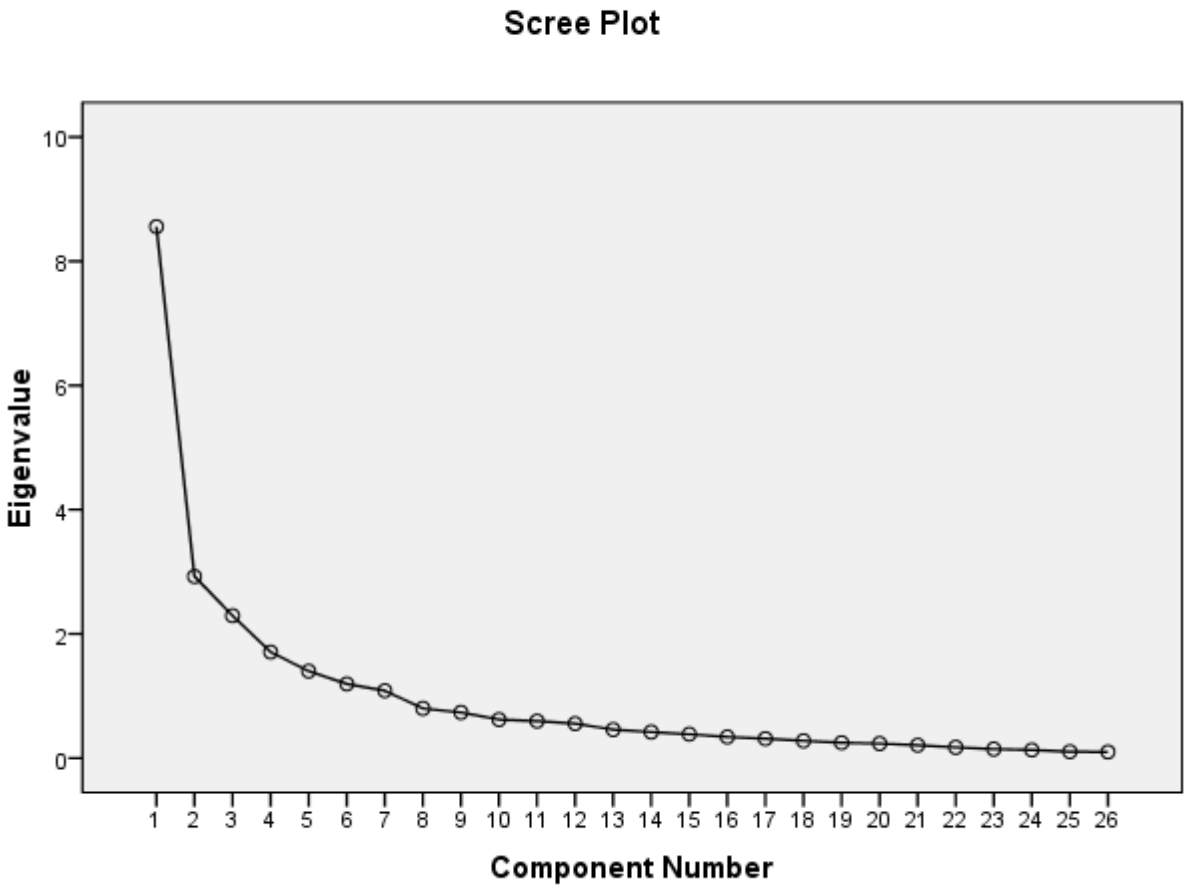


Figure 7.3: Initial Scree Plot

The analysis proceeded to factor extraction, which yielded seven components generated by the default Kaiser criterion as shown in Table 7.12. A scree plot for the components also has been generated as shown in Figure 7.3. The next step was to make a decision on the number of factors to be retained in the analysis using the Monte Carlo PCA for Parallel Analysis. The Monte Carlo random Eigenvalues have been generated as shown in of Appendix 20B.

A comparison of the default Kaiser with the parallel analysis Eigenvalues led to the retention of four of the seven initial components as shown in Table 7.13.

Table 7.13: Comparison of Eigenvalues from SPSS and Monte Carlo outputs

Component	Actual Eigenvalues from SPSS	Random Eigenvalue from Monte Carlo	Decision
1	8.558	1.8662	Accept
2	2.925	1.7165	Accept
3	2.293	1.6139	Accept
4	1.708	1.5299	Accept
5	1.400	1.4548	Reject
6	1.194	1.3708	Reject
7	1.085	1.3036	Reject

Thereafter another set of factor analysis was conducted with a restriction to four components. The output of this second analysis included the component correlation matrix (Table 7.14) and the pattern matrix (Table 7.15). The component correlation matrix indicates that the components are not correlated since the correlation coefficients exhibited are far less than .3.

Table 7.14: Component Correlation Matrix

Component	1	2	3	4
1	1.000	.002	.252	-.198
2	.002	1.000	.056	-.068
3	.252	.056	1.000	-.019
4	-.198	-.068	-.019	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

On the other hand, the pattern matrix was used to interpret the analysis since it indicates how variables load onto the extracted components.

From the pattern matrix, the following interpretations were made:

- Component 1 is *environmental regulations*
- Component 2 is *fiscal rules and regulations*
- Component 3 is *regulatory laws and informal practices*
- Component 4 is *friendly building regulations*

Table 7.15: Pattern Matrix[a]

	Component			
	1	2	3	4
High fees National Environment Management Agency (NEMA)	.901			
Cartel manage disputes	-.870			
Police do not enforce law effectively	-.864			
Building regulations/codes	-.859			
Industrially produced dimension stone more acceptable to formal sector	.858			
Regulations of supplies of explosives	-.723			
Implementation of building regulations/codes	-.691			
Tax/cess is issued by Nairobi on stone mined	.682	-.425		
Cartels control market for jua kali stone	-.664		.463	
Licences to blasters	-.624	.485		
Implementation of environmental laws	.595			
Jua kali dimension stone gives poor finish	.550		.508	
Environmental laws	.368			
Poor roads		-.825		
Transportation problems		-.820		
Issue permision for quarrying		.576	-.543	
Jua kali dimension stone not acceptable to planning authorities		.565	.381	
Implementation of planning laws	.338	.377	.343	
Tribalism effects demand			.676	
Market for jua kali dimension stone unreliable			.632	
Commonly accepted informal practice in construction			-.492	
Planning laws			.450	-.355
Jua kali dimension stone accepted by Building Regulations				.765
Jua kali dimension stone used in building because it is low cost				.709
Informal market for jua kali stone works through trust				.442
Local administration resolves disputes			-.314	.362

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 14 iterations.

7.5.Summary of analyses and way forward

From the three sessions of factor analysis the list of propositions or factors influencing the input, output and regulatory environments have been reduced to four (out of 27), five (out of 24) and four (out of 26) components or factors respectively. Therefore a summary list of the derived principal factors influencing the business environment of artisanal dimension stone was compiled as follow.

1. hostile policy environment
2. perceived negative impacts associated with quarrying

3. easily obtainable inputs
4. simple and easily applicable production techniques
5. difficult marketing terrain
6. general lack of specification by building professionals and formal developers
7. occasional specification by building professionals
8. a cumbersome stone procurement system
9. advantages provided in the use of artisanal dimension stone in building
10. environmental regulations
11. fiscal rules and regulations
12. regulatory laws and informal practices
13. friendly building regulations

These factors are discussed in terms of evaluation of the enabling environment in the next section.

7.6. An Evaluation of the Enabling Environment

This section is a discussion consequent to the data analysis in sections 7.2, 7.3 and 7.4. It responds to the requirements of Objective 5 of the study. The chapter constitutes an evaluation of the enabling environment for the production of artisanal dimension stone in Nairobi. This evaluation is divided into the three components of the enabling environment i.e. the Production/input (section 7.6.1), the market/output (section 7.6.2) and the legal/administrative (regulatory) environments (section 7.6.3). Further this section presents an overall evaluation of the enabling environment in terms of whether the environment is friendly or hostile to the production and use of artisanal dimension stone (7.6.4). Additionally it evaluates the enabling environment in terms of the distinctions suggested in the Bertalanffian system elements (section 7.6.5). Lastly it evaluates the enabling environment in terms of the advantages competing products portend over artisanal dimension stone (section 7.6.6).

7.6.1. Production (Input) Environment

Four principal factors were identified, as already indicated in section 7.2. The first, *hostile policy environment* is a negative factor concerning production of artisanal dimension stone. The variables loading on this factor, according to Table 7. 5, include:

- Random decision by government agencies about use of land
- Feuds in landowner families
- Use of explosives cause low productivity
- Harassment and intimidation by enforcement officers
- Corruption increases start up barriers
- No credit facilities for financing mining
- Scientific approach needed to identify deposits
- Environmental damage
- Need to pay protection money

All the variables listed above concern policy making or implementation. Further they are all negative in nature thereby implying hostility. As common in factor analysis, the first component to be extracted is more general in nature; however, in this case the first factor is a summary of the status of the enabling environment. This is a general factor which is best deferred to section 7.6.4.

Second factor, *perceived negative impacts associated with quarrying* also is a negative factor affecting production. The variables loading onto it include the following:

- Artisanal mining creates waste land
- Use of explosives damage environment
- Environmental damage
- Use of explosives cause low productivity
- Safety and security of personnel

These variables concern the perception that stone extraction and cutting is not an environment friendly activity. The use of explosives has featured prominently in this factor making it a major socio-environmental concern. This confirms the observations made by Wells (2000) that the blasting process shatters the rock leading to wastages and extensive environmental degradation; see the discussions at paragraphs 6 to 9 of section 3.7 under literature review. Looking at environmental impact of quarry-blasting in Istanbul, Turkey, Kuzu and Ergin (2005) noted that the key impact included ground vibration, air blast and fly rocks. To mitigate such impact, the authors discuss scientific solutions like limiting of maximum peak-particle velocity depending on distances, use of scaled distance factor, derivation of modified scaled distance equation, and use of blasting charts. These solutions obviously will not work for informal artisanal operations. On

the other hand, Wells (2000) as a more practical solution applicable to artisanal activities by recommending the discontinuation of the blasting method and suggesting the benching method.

One of the techniques that can be used in the absence of blasting in this case involves the plug and feather tool. The plug and feathers is a compound wedge consisting of two half round tapering bars inserted into a drilled hole and then forced apart by a flat wedge the plug driven in between them with a hammer or sledge (Manx Heritage Foundation 1994). The process would involve drilling of rock along the desired line of crack. Instead of filling the holes with explosives the feathers would be inserted into the holes. Thereafter the plugs would be hammered into the feathers causing them to expand and crack the rock. This would solve the problem of wastage and environmental risks associated with blasting.

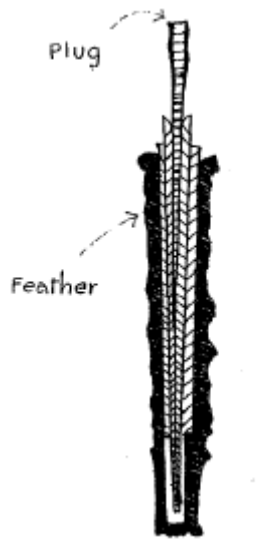


Figure 7.4: Plug and feathers
Source: Manx Heritage Foundation (1994 p.62)

Third factor, *easily obtainable inputs* on the other hand is a positive factor with the following variables loadings:

- Simple hand tools easy to use
- Availability of cheap labour
- Availability of blasting explosives

- Affordable readily available tools
- Exposed rock require little excavation
- Easy contracts to secure land
- Small amounts of money needed
- Availability of skilled labour (not blasters)
- Investment in mechanical plant improves perceived quality and demand for product

These variables describe the opportunities available for artisanal operators in the business environment.

Fourth factor, *simple and easily applicable production techniques* also is a facilitative factor. Some of the variables loading onto this factor include:

- Need to pay protection money
- Availability of blasting skills
- Exposed rock require little excavation
- Use of simple drilling techniques
- Availability of unskilled labour
- Simple hand tools easy to use
- Bribes to officials for use of land for mining
- Safety and security of personnel

These variables too describe the opportunities obtaining for artisans in the business environment for stone production. The variable loadings on this factor conform to observations made in existing literature, see for example paragraph 3 of section 3.7. Therefore this is an instance where factor analysis has triangulated what was noted in literature review. The proposed plug and feathers technique will fit well into this technological configuration of labour intensive and manual techniques.

7.6.2. Market (Output) Environment

All references to this part should be made to Table 7.10. From the results of factor analysis displayed in that table, it has been pointed out that the first factor in the market environment is *difficult marketing terrain*. As already observed, the first component is usually general in nature. The variable loadings on this factor include:

- Quality of infrastructure-roads
- Competitors practices limit the demand of jua kali dimension stone
- Cost of transportation
- Formal clients do not use jua kali dimension stone because of legal difficulties

The variables can be associated with a negative factor in the enabling environment. It becomes apparent from the factor loadings that the main challenges to the marketing of artisanal dimension stone is the poor state of the roads leading to the quarry or forming the outlets to the quarry operators' product. This is tied to the cost of transportation that is implied in poor roads. The other factor is the advantage that competitor products have over artisanal dimension stone, see section 7.6.6. Lastly the inability of formal customers to transact with artisanal producers because the latter rely on *jua kali* exchange relations (see section 6.4), is another important factor loading onto this component. It is important to note that this factor is general in nature but its solution lies on the improvement of the transportation infrastructure, the need to make artisanal products more competitive in the market and the need to establish legal formal transaction other than the *jua kali* exchange. Artisanal dimension stone would be made more competitive in the market if transport problems are solved; this would lower its price and hence give it market advantages and improve sales volumes. Secondly the establishment of legal formal transaction will attract more formal customers. As discussed further on, one of the ways of establishing a legal formal system of transaction is by the operators initiating a cooperative. A marketing cooperative would be a corporate body with a formal status that can legally transact business with formal end-users of artisanal dimension stone or their representatives.

The second factor in the market environment is *general lack of specification by building professionals and formal developers*. The variables that loaded onto this factor are:

- Not specified by architects
- Not specified by structural engineers
- Not specified by quantity surveyors
- Not specified by formal developer/client
- Poor health and safety practices effect production
- Decision by stockists to stock

This too is a negative factor in the market environment as demonstrated by the variables. Here it can be said that by achieving legal and formal business transactions, it will become easy for end users and their intermediaries to purchase more of artisanal dimension stone

The third factor in the market environment is *potential and occasional specification by formal actors and actual specification by informal actors in the building industry*. The variables loading onto this factor are:

- Poor health and safety practices effect production
- Decision by stockists to stock
- Specified by architects
- Specified by structural engineers
- Decisions by informal developers
- Specified by formal developer/client

This factor represents a positive force in the market for artisanal dimension stone. It is a positive aspect of the market that could be promoted through social marketing as discussed under section 6.5.

The fourth factor in the market environment is *a cumbersome stone procurement system*. The variables that loaded onto this factor included:

- Poor health and safety practices effect production
- Unethical practices in jua dimension stone mining reduces demand
- Brokers procure directly for customers
- Availability of transportation
- Specified by quantity surveyors

This is a negative force in the market for artisanal dimension stone in Nairobi. It conforms to the findings under the exploratory study as reported in section 6.3.4 under: Exchange relationships within the marketing channels. The exploratory study found that the quarry operators lacked enough cash to buy their own transportation means. Secondly they could not market their products through the ‘push strategy’. Instead they had to rely on the ‘pull strategy’ that involved customers or their intermediaries coming to purchase the products from point of production.

Therefore, especially from the point of view of the producers, factor analysis confirms the findings of the exploratory study concerning stone procurement.

This point is a subset of the first factor, *difficult marketing terrain*. As noted earlier on, the first component or factor is usually a general one. However some of the solutions proposed for the first factor such as formation of a marketing cooperative may become handy for *a cumbersome stone procurement system*.

The fifth factor is *the advantages provided in the use of artisanal dimension stone in building*. The variables that loaded onto this factor included:

- Dimension stone is used because designers know how to use it
- Dimension stone is used because builders know how to use it
- Dimension stone used due to security it gives building
- Dimension stone is used due to durability

This factor represents a positive force in the market for artisanal dimension stone in Nairobi. Again this confirms the findings from the exploratory study; see section 6.4 where it was reported that the Building Code and the Public Health Act preferred the use of stone as walling material in building construction within the city because of its permanency in nature and weather exclusion properties. Therefore this is an advantage that artisanal producing units have to take full advantage of by improving their production and marketing systems as already suggested in the foregoing discussion.

7.6.3. Legal/Administrative (Regulatory) Environment

All references to this part should be made to Table 7.15. From the results of factor analysis displayed in that table, it has been pointed out that the first factor in the legal/administrative environment is *environmental regulations*. Again this is a general factor as is always the case with the first component. The factors loading onto this factor were:

- High fees National Environment Management Agency (NEMA)
- Industrially produced dimension stone more acceptable to formal sector
- Cartel manage disputes
- Police do not enforce law effectively

- Building regulations/codes
- Regulations of supplies of explosives
- Implementation of building regulations/codes
- Tax/cess is issued by Nairobi on stone mined
- Cartels control market for jua kali stone
- Licenses to blasters
- Implementation of environmental laws
- Jua kali dimension stone gives poor finish
- Environmental laws
- Implementation of planning laws

The variables point majorly to a negative force in the legal/administrative environment. As stated before, this is a very general factor; therefore it may defy specific solutions. However solutions given to specific factors that follow may add up to its solution. For further discussions refer also to section 7.6.4.

The second factor in the legal/administrative environment is *fiscal rules and regulations*. The variables that loaded onto this factor included:

- Tax/cess is issued by Nairobi on stone mined
- Licenses to blasters
- Poor roads
- Transportation problems
- Issue permission for quarrying
- Jua kali dimension stone not acceptable to planning authorities
- Implementation of planning laws

This factor too represents a negative force in the legal/administrative environment. The negative connotation in the fact that as the City Council of Nairobi collects revenue in terms of cess from the produce of artisanal stone quarries the roads and transport infrastructure is neglected. There are also issues to do with the licensing of blasters that is done by the Department of Mines and Geology and quarrying permission under the docket of NEMA. Concerning the issue of taxing

the produce it is imperative that the city council should provide road and transportation infrastructure. This would boost productivity and achieve greater revenue collection.

Licensing of blasters and issuance of permit to quarries on the other hand are necessary controls. This may also be a governance issue that requires initiatives from the artisanal operators themselves. One of the reasons why the artisans may find these regulations prohibitive is because they work as solo operators. If they were to form an association as producers it would be easy for them to tackle such governance issues. For example the World Bank is promoting associational activities of artisanal miners through the programme: Communities and Small scale Mining (CASM). CASM's main objective is to address the socio-environmental problems stemming from artisanal and small scale mining such as the ones being tackled in this study. Several other countries have their national body of CASM except Kenya. Since artisanal stone quarrying operators fall under CASM program, they could form such a group and benefit from

The third factor in the legal/administrative environment is *regulatory laws and informal practices*. The variables that loaded onto this factor included:

- Cartels control market for jua kali stone
- Jua kali dimension stone gives poor finish
- Issue permission for quarrying
- Jua kali dimension stone not acceptable to planning authorities
- Implementation of planning laws
- Tribalism effects demand
- Market for jua kali dimension stone unreliable
- Commonly accepted informal practice in construction
- Planning laws
- Local administration resolves disputes

This factor also represents negative forces in the legal/administrative environment for artisanal dimension stone. It implies the failure of formal laws to benefit players in the artisanal sector of the industry and the emergence of informal practices to rule over these players. The fairness of informal regulation such as cartelism, tribalism can be gainsaid obviously. Again the solution to this lies in the governance possibilities that would arise from associational initiatives of artisanal

operators such as forming a marketing cooperative or another body that could plug into CASM at national or international level.

The fourth factor in the legal/administrative environment is *friendly building regulations*. The variables that loaded onto this factor included:

- Planning laws
- Jua kali dimension stone accepted by Building Regulations
- Jua kali dimension stone used in building because it is low cost
- Informal market for jua kali stone works through trust
- Local administration resolves disputes

This factor represents a positive force in the legal/administrative environment for the production and use of artisanal dimension stone in Nairobi. It ties with the fifth factor under market/output environment i.e. *the advantages provided in the use of artisanal dimension stone in building*. It is important that in practice, the business environment operates as a uniform whole and drawing distinctions into input, output and regulatory environments may not be necessary. This is especially with the regulatory forces because they affect all other aspects of the environment. Since the friendly building regulations would enhance the marketing of artisanal dimension stone, it behoves the artisanal operators to take advantage of this positive situation in the market. They can do this by implementing the solutions that have been recommended so far in the foregoing discussion.

7.6.4. Hostile or Friendly Environment

This sub-section undertakes an assessment of the forces to establish whether the enabling environment is hostile or friendly, or whether the business environment is full of opportunities or constraints. It is also necessary to go back to the research questions to determine to what extent the factor analysis results provide answers to them. To that effect the factor analysis results answer the research questions as summarized in Table 7.16.

Table 7.16: Research questions and answers

	Research Questions	Answers/Factor Analysis Results
Inputs	1. What opportunities does the business environment provide for inputs?	• easily obtainable inputs • simple and easily applicable production techniques
	2. What constraints does the business environment impose on inputs?	• hostile policy environment • perceived negative impacts associated with quarrying
Outputs	3. What opportunities does the business environment provide for outputs?	• occasional specification by building professionals • advantages provided in the use of artisanal dimension stone in building
	4. What constraints does the business environment impose on outputs?	• difficult marketing terrain • general lack of specification by building professionals and formal developers • a cumbersome stone procurement system
Regulations	5. What opportunities does the business environment provide through regulation?	• stone friendly building regulations
	6. What constraints does the business environment impose through regulation?	• environmental regulations • fiscal rules and regulations • regulatory laws and informal practices

From the Table it becomes apparent that the conclusive part of the study has provided some answers to the key research questions. The table also classifies the factors according to opportunities and constraints (Dawson 1996) or according to friendly and hostile environmental factors (Lusthaus et al. 2002), see the discussions at section 3.3.

7.6.5. Implications of Analytical Distinctions in System Elements

This study used the Bertalanffian model, Figure 4.2, as the systems construct for analysing the forces (factors) influencing the enabling environment for artisanal dimension stone in Nairobi, see section 4.6. As shown in Figure 4.3, three kinds of distinctions were made when analysing the elements of a system i.e.

1. According to their number—factor retention in factor analysis
2. According to their typology—total variance explained in factor analysis
3. According to their relations—variable correlations in factor analysis

The exercise of factor analysis shown in sections 7.2, 7.3 and 7.4 has accomplished all the three important distinctions. Through PCA the analysis was able to isolate specific number of factors through factor retention procedures. For the production environment 4 number components were

isolated while 5 and 4 number components were isolated respectively for the market and legal/administrative environments.

Table 7.17: Eigenvalues for and total variance explained by retained factors

Environment	Factor	Eigenvalues	Total variance Explained (%)
Production	Hostile policy environment	4.814	17.831
	Perceived negative impacts...	3.653	13.530
	Easily obtainable inputs	2.762	10.229
	Simple production techniques	1.957	7.247
	Total	-	*48.838*
Market	Difficult marketing terrain	4.022	16.760
	General lack of specification	3.639	15.165
	Occasional specification	2.312	9.635
	Cumbersome stone procurement system	1.783	7.431
	Advantages provided by stone material	1.664	6.932
	Total	-	*55.922*
Legal/ administrative	Environmental regulations	8.558	32.914
	fiscal rules and regulations	2.925	11.249
	regulatory laws and informal practices	2.293	8.817
	Stone friendly building regulations	1.708	6.569
	Total	-	*59.549*

The distinctions between the types of components are based on factor variance. As already explained, the PCA successively extracts factors based on the maximum variance between the variables. For instance the first factor extracted accounts for the largest amount of variance in the variables while the second consists of the next largest amount of variance which is not related to or explained by the first one meaning that the two factors are not related (orthogonal) to one another and so on, see sections 4.5.7 and 4.8.3. From the statistical applications the following variances were explained through factor analysis, see also Tables 7. 2, 7.7 and 7.12. Both the Eigenvalues and percentage of total variance indicate the magnitude or relative strength of each factor within its environmental category. It is worth noting that in this case, the first principal component in each of the three PEST environments is classified under constraint (Dawson 1996) or hostile (Lusthaus et al. 2002), see Table 7.16. It is worth noting also that for every category of environment the constraints explain more variance than opportunities i.e. 31.361% (total for hostile policy environment and perceived negative impacts) out of 48.838%, 39.416% (total for difficult marketing terrain, general lack of specification, and cumbersome stone procurement) out of 55.922%, and 52.980% (total for environmental regulations, fiscal rules and regulations, and regulatory laws and informal practices) out of 59.549%, as shown in Table 7.17. Therefore the

study may conclude that the business environment for artisanal dimension stone in Nairobi is relatively hostile from the point of view of the artisanal producers.

Apart from being an exercise in the analysis of variance, factor analysis is foremost a correlation analysis. Indeed Cattell (1978, p. 4) hailed factor analysis as 'the furthest logical development and reigning queen of the correlational methods'. The correlation attribute, in this case, engages the Bertalanffian third point on the analysis of system elements i.e. variable interrelationship. Essentially factor analysis examines the associations between variables based on the correlations between them to see if there are underlying factors (Hinton et al. 2004). The underlying factors identified through correlation analysis are discussed in sections 7.6.1, 7.6.2 and 7.6.3.

7.6.6. Disadvantages from Competing Products

In the measurement instrument, a semi-structured question was asked concerning advantages that competitor products had over hand-cut (artisanal) dimension stone. The answers were then subject to multi-response analysis. The results of the analysis are displayed in Table 7.18.

From the table the following reasons can be picked as the major advantages the competitor products (mainly machine-cut stone) have over artisanal dimension stone.

1. Use less mortar in construction
2. High quality finishes/give good finish
3. Machine cut stone are ready to use hence reduce workforce and cost in dressing
4. Competitor products are cheaper compared to the alternative
5. Reliable sources of supply hence more profitable, able to meet demand and available in variety
6. Competitor products are more exact in dimensions compared to *jua kali* stone/friendly to use
7. Competitor products do not require chiseling hence saves time
8. Competitor products are recommended by building professionals; some believe they are easy to quantify

Table 7.18: Advantages of competitor products

	Responses		
	N	Percent	Percent of Cases
Use less mortar in construction	17	6.6%	13.0%
High quality finishes/give good finish	72	28.1%	55.0%
Reduce cost on transportation and infrastructure maintenance because some are manufactured at the construction site e.g. concrete blocks	3	1.2%	2.3%
The cost of construction is less due to the quantity of mortar applied on artisanal stone	2	.8%	1.5%
Lead to improve products	3	1.2%	2.3%
Quality can be improved through materials combination	1	.4%	.8%
Recommended for foundation/strong foundation	2	.8%	1.5%
Has good texture	2	.8%	1.5%
Easy to construct	2	.8%	1.5%
Machine cut stone are ready to use hence reduce workforce and cost in dressing	17	6.6%	13.0%
Cheaper compared to artisanal stone	13	5.1%	9.9%
Reduces material wastage when applied to large building projects	1	.4%	.8%
Competitor products are lighter than jua kali stone which make work more faster to labourers	4	1.6%	3.1%
Competitor products are more exact in size compared to jua kali stone/friendly to use	16	6.2%	12.2%
Competitor products do not require chiseling hence saves time	19	7.4%	14.5%
Recommended by building professionals; some believe it is easy to quantify	13	5.1%	9.9%
Competitors products have good shape and easy to join during building	3	1.2%	2.3%
Less risks to tall building/stronger	4	1.6%	3.1%
Reliable sources of supply hence more profitable, able to meet demand and are in more variety	31	12.1%	23.7%
It gives mansions easy time to get level when building/they are uniform in size	1	.4%	.8%
Less expensive when building big stone buildings compared to jua kali stone	5	2.0%	3.8%
Competitor products have no huge waste compared to jua kali dimension stone	3	1.2%	2.3%
Products are attractive and lure customer	6	2.3%	4.6%
The production cost is low and this lead to high quality production	4	1.6%	3.1%
Their production such as building block has minimal environmental impacts compared to jua kali dimension stone	2	.8%	1.5%
They are produced in more formal manner and enjoy loaning facilities and they are accessible by the rich or high income developers	4	1.6%	3.1%
Their prices are stable compared to that of jua kali dimension stone	3	1.2%	2.3%
Centralized production for some/produced on the site and cut cost of transportation	1	.4%	.8%
Adopt to new building technologies	2	.8%	1.5%
Total	256	100.0%	195.4%

These therefore represent the disadvantages artisanal dimension stone face in the business/enabling environment. At section 7.6.2 in response to the first factor, it has been noted

that artisanal dimension stone need to face up to competitors' products. What is generated above is a useful checklist of what can be done possibly to make artisanal dimension stone more competitive in the market. For example 1-4 and 7 of the list could be addressed if blasting is discontinued so that the resulting stone is more regular. Secondly on-quarry stone dressing could give a feel of a finished product. Number 4 on the list is not quite clear whereas number 6 could be solved through a marketing cooperative that would pool together products from different small producers to ensure regular and reliable supply of products.

Lastly the problem of lack of recommendation by the building professionals has been tackled at section 7.6.2 regarding the second factor: *general lack of specification by building professionals and formal developers*. Secondly the problem with artisanal dimension stone is that it roughly conforms to width and breadth standard dimensions but has no standard length. Hence length is measured per foot-run. This means one cannot count the number of stone as is possible in other products with three standard dimensions but has to measure the foot-run for purposes of quantification. As far as number 8 is concerned, the discontinuation of blasting and the application of benching techniques could give standard dimensions making it easy to quantify artisanal dimension stone like machine cut stone, concrete block or clay brick.

7.7. **Respondent's Suggested Adjustments to the Enabling Environment**

In the measurement instrument the respondents were asked also another semi-structured question about what changes they would suggest to support and encourage the production and use of artisanal dimension stone in Nairobi. The answers to this question were subject to multi-response analysis and the results are displayed in Table 7.19.

In the tabular analysis responses with N values less than five were lumped together under others. Some of the most outstanding suggestions include:

1. Previous mining area to be rehabilitated to avoid conflict with resident where mining have taken place
2. Provision of modern mining equipment through government support to both formal and informal operators; this include generators to pump out water from the pits, tractors and machines to cut stone

Table 7.19: Changes to the enabling environment suggested by stakeholders

	Responses		
	N	Percent	Percent of Cases
Previous mining area to be rehabilitated to avoid conflict with resident where mining have taken place	12	4.2%	9.0%
Licensing of mining to be centralized in one place/ministry, improved licensing procedure by the government of licensing bodies	5	1.8%	3.7%
Provision of modern mining equipment through government support to both formal and informal operators; this include generators to pump out water from the pits, tractors and machines to cut stone	26	9.2%	19.4%
Provision of facilities and services to the mining areas i.e. roads or improved transport network, sanitation facilities and first aid kits	41	14.4%	30.6%
Review regulation on blasting	9	3.2%	6.7%
Allow mining in protected areas where deposits are in abundant	12	4.2%	9.0%
Government should introduce financing of members as in other sectors of economy	42	14.8%	31.3%
The minimum set-up standard for Jua Kali stone to be industrially produced	6	2.1%	4.5%
Ministry should introduce safety training to miners	11	3.9%	8.2%
Government should stop cartels that control mining through provision of security	12	4.2%	9.0%
Miners should be trained on co-operation and improve their welfare	9	3.2%	6.7%
Issue permit to quarry operators	12	4.2%	9.0%
Government should set-up finishing industries for jua kali stone; this will improve the jua kali stone value	7	2.5%	5.2%
Promote security/Eliminate Mungiki and fence the sites	20	7.0%	14.9%
Government should regulate building regulations to allow jua kali dimension stone to be used in large building industries (tall buildings)	5	1.8%	3.7%
Government should separate and plan mining areas to reduce quarry and human conflicts	6	2.1%	4.5%
Others	49		
Total	284	100.0%	211.9%

3. Promote security/Eliminate Mungiki and fence the sites
4. Allow mining in specific areas where deposits are abundant
5. Government should introduce financing of members as in other sectors of economy
6. The relevant government agencies should introduce safety training to miners
7. Government should stop cartels that control mining through provision of security
8. Issue permit to quarry operators
9. Provision of facilities and services to the mining areas i.e. roads or improved transport network, sanitation facilities and first aid kits

Rehabilitation of quarry pits has been suggested before in the previous studies but is still not being done. However suggestions requiring government to provide finance and equipment (see

numbers 2 and 5) to quarry operators may not be workable in the current political dispensation where the government is reluctant to make direct investments in the economy. Promotion of security and the elimination of cartels (see numbers 3 and 7) has come out strongly also. Provision of infrastructure like road network and facilities for sanitation and emergency treatment will however be necessary from the side of the government since it benefits from tax revenues accruing from quarrying activities.

7.8. **Summary**

This chapter has reported on the factor analysis results of the three main aspects of the enabling environment i.e. production/input, marketing/output and legal/administrative. A total of four underlying factors have been identified for the production/input environment as follow:

1. hostile policy environment
2. perceived negative impacts associated with quarrying
3. easily obtainable inputs
4. simple and easily applicable production techniques

Likewise for the marketing/output environment five underlying factors have been identified as follow:

5. difficult marketing terrain
6. general lack of specification by building professionals and formal developers
7. occasional specification by building professionals
8. a cumbersome stone procurement system
9. advantages provided in the use of artisanal dimension stone in building

Lastly, for the legal/administrative environment four underlying factors were identified as follow:

10. environmental regulations
11. fiscal rules and regulations
12. regulatory laws and informal practices
13. friendly building regulations

Further in the chapter an evaluation of the enabling environment using Eigenvalues has been carried out leading to the conclusion that the business/enabling environment for artisanal dimension stone is hostile to the artisans.

Results of the multi-response analysis have been presented also in this chapter regarding the disadvantages presented to artisanal dimension stone by competing products and the respondents' suggested adjustments to the enabling environment. For the former these include:

1. Use less mortar in construction
2. High quality finishes/give good finish
3. Machine cut stone are ready to use hence reduce workforce and cost in dressing
4. Competitor products are cheaper compared to the alternative
5. Reliable sources of supply hence more profitable, able to meet demand and available in variety
6. Competitor products are more exact in dimensions compared to *jua kali* stone/friendly to use
7. Competitor products do not require chiseling hence saves time
8. Competitor products are recommended by building professionals; some believe they are easy to quantify

While for the latter the following points came out strongly:

1. Previous mining area to be rehabilitated to avoid conflict with resident where mining have taken place
2. Provision of modern mining equipment through government support to both formal and informal operators; this include generators to pump out water from the pits, tractors and machines to cut stone
3. Promote security/Eliminate Mungiki and fence the sites
4. Allow mining in specific areas where deposits are abundant
5. Government should introduce financing of members as in other sectors of economy
6. The relevant government agencies should introduce safety training to miners
7. Government should stop cartels that control mining through provision of security
8. Issue permit to quarry operators
9. Provision of facilities and services to the mining areas i.e. roads or improved transport network, sanitation facilities and first aid kits

Conclusions and recommendations drawn from these analyses are presented in the next chapter.

CHAPTER EIGHT

9. STUDY CONCLUSIONS

9.1. Summary

This study set out to analyze the socio-technical forces influencing the enabling environment for artisanal dimension stone in Nairobi, Kenya. It relied on the theory of organization as its conceptual basis and the general system theory as its methodological basis in order to undertake this analysis; further relying on PEST analysis as its general analytical technique and factor analysis as its quantitative technique. The analysis began from a qualitative strategy (exploratory research) and finally morphed into the quantitative strategy (conclusive research). The analysis has achieved the following.

Concerning Objective 1, the analysis has demonstrated that the business environment of the building industry is composed of two main categories: the market and the nonmarket environments. The market environment has been described in terms of clients, inputs (including cement, labour and the services of architectural professionals) contractors, building products, and building procurement prices. The nonmarket environment, on the other hand, has been described in terms of regulations for contracting, building regulations and standards, building plan approvals, professional regulations, administrative and policy regulations, and voluntary obligations. Both the market and the nonmarket environments define the formal sector construction activities and, by so doing, also define (‘as that which is not formal’) the informal building industry.

In respect to Objective 2, the analysis has attempted to capture the business environment of artisanal dimension stone in Nairobi. The analysis indicated that the business environment for artisanal dimension stone also existed in two main categories: the market and the nonmarket environments. The market environment was captured in terms of exchange relationships: between suppliers and producers, within the production units and for the output, within the marketing channels. It also involved the identification of competitors and actual and potential customers in the market of artisanal dimension stone. On the other hand, the nonmarket forces noted include the ‘major environmental forces’ i.e. demographic, economic, physical, technological, political/legal and social/cultural factors or PEST factors.

The forces identified under Objectives 1 and 2 were thereafter assembled to meet the requirements of Objective 3 that sought to identify and ascertain the socio-technical forces (variables) influencing the operations of the business environment associated with the use of artisanal dimension stone in Nairobi. The forces were then subjected to Factor Analysis in order to satisfy the requirements of Objective 4 that sought to analyse the interrelationships of forces influencing the production and use of artisanal dimension stone for building construction in Nairobi. Through the interpretation of Eigenvalues and Total Variance Explained the results of Factor Analysis have conclusively shown that the enabling environment for artisanal dimension stone is relatively hostile or fraught with constraints. Therefore, in line with Objective 5, the study has recommended adjustment to the enabling environment. The adjustments recommended in this respect include: rehabilitation of disused quarries, use of improved technology, promotion of security within the quarrying business environment, safety training for miners, and provision of infrastructure like road network and facilities for sanitation and emergency treatment.

9.2. **Conclusions**

The study's main strategy was to begin with exploratory research (qualitative study) and end with conclusive research (quantitative study). Under the qualitative study, the research explored by way of PEST analysis the socio-technical factors that determine the enabling environment for artisanal dimension stone in Nairobi. The factors identified through this exploratory research were then subjected to Factor Analysis by way of conclusive research. At the end the conclusive research, using two main indicators of factor analysis i.e. i) the Eigenvalues and ii) the Total Variance Explained (see Table 7.17) have pointed to the inevitable conclusion that the enabling environment for artisanal dimension stone is relatively hostile. This is due to the fact that the greater variance in the enabling environments (i.e. production/input, market/output and legal/administrative) are explained by constraint factors.

The second conclusion of the study may be based on its methodological innovation. The successful application of Factor Analysis as a quantitative statistical technique in this study to analyse the enabling environment and PEST factors leads to the inevitable conclusion that Factor Analysis is a useful tool that can be used to analyse the business environment of any organization

or group of organizations within any industry whether formal or informal. Factor Analysis, therefore, may be used alongside other techniques such as the Delphi Technique among others.

Finally, it is important to note that the findings of this research are specific to artisanal dimension stone and to the situation in Nairobi. The study took a specific focus on the situation of Nairobi and the issue of the socio-technical processes involved in the production and use of artisanal dimension stone. Although there is a rationalised assumption that the findings may apply in other places apart from Nairobi and for other artisanal materials apart from dimension stone these may be issues that would be confirmed through further research.

9.3. **Recommendations for Practice**

As noted under discussions within section 7.6 on An Evaluation of the Enabling Environment, there are two key steps that if taken by the artisanal units will help solve so much of their constraints. These two steps are:

1. Formation of an association that would plug onto CASM at national or international level, and
2. Formation of a marketing cooperative to help in the sales and marketing of their product.

Formation of a CASM related organization would help the unit operators achieve a milestone in the area of governance of artisanal quarrying activities. It will give them a stronger voice to negotiate with government bodies where policies are concerned so as to enhance their welfare in the economy. It will also open up opportunities for empowerment through association with non-governmental organizations who may provide assistance in terms of training, market research and development, and advocacy. This would help in reduce the inhibitions created through hostile policy environment.

Formation of a marketing cooperative, on the other hand, will help them with formal transactions that hitherto have not been possible thereby denying the artisanal stones a good part of the formal sector of the market. Formalization of the market transactions will not only help in expanding the market but will also help small producers to pool their products together and hence be able to supply large orders that are not possible for them currently. Another issue that has come to the

limelight concerns the movement from blasting to alternative techniques such as benching and cutting with plug and feathers where possible. Moving from blasting will help in a lot of ways:

1. It will reduce wastages involved in the shuttering of rock hence lead to more economical exploitation of this non-renewable natural resource
2. It will eliminated the side effects of blasting such as ground vibration and fly rocks that pose danger to adjoining property and quarry workers themselves respectively
3. It will help in bring to the market less rough stone products with standard dimensions that would match the standards of competing products such as machine-cut dimension stone or concrete block.

Additionally at page 126, section 4.8.2 under Sampling Procedure, it was noted that: 'Determination of the sampling frame for practicing civil and construction engineers in Nairobi was impossible because the ERB registered all types and published a list of engineers without categorizing them into electrical, mechanical, civil and construction et cetera'. To this end the study recommends that specialization of civil engineers should be indicated in the database of the Engineering Registration Board.

9.4. **Recommendations for Further Studies**

Lastly this study mainly considered dimension stone as one artisanal material however there exist several artisanal materials such as bricks, blocks, and ballast. Further studies should be done on these materials to see how their enabling environments compare or contrast with dimension stone.

Secondly, this being a pioneering study in an area that has been neglected for so long, studies in other towns in Kenya and other cities in the developing world could be undertaken to see how the phenomenon of artisanal production of dimension stone compares across cities and across countries. These researches would lead to the further development of knowledge in this sector.

Finally this being a pioneer study, it only applied the exploratory factor analysis (EFA) as part of its Factor Analysis. Under CFA the researcher does not make any *a priori* assumption about the variable interrelationships. However this study opens up opportunities for further research that

would involve confirmatory factor analysis (CFA) since the variable interrelationships are now known a goodness of fit model can then be used to confirm the interrelationships established in this study.

9.5. **Contribution of the Study**

The study has made the following contributions to knowledge and practice in the building and other sectors and business environments. The study has added to the body of knowledge of artisanal building materials in developing countries by contributing the Nairobi aspects to the existing literature. Principally the research was conducted to fill the gap on the socio-technical aspects of artisanal dimension stone and this marks the major contribution of to knowledge by the study as discussed in section 1.3. Secondly the study has rendered a specific focus on the artisanal dimension stone that has been a neglected area in world literature. The focus on Nairobi where existing literature did not explain the phenomenon of artisanal dimension stone (see section 1.3) is a unique perspective and contribution.

At section 1.5 it was noted that the study was guided by the philosophy of critical social science that involved the following activities:

1. Problem identification; unmet needs, suffering, false beliefs—this has been done in terms of the unmet needs of artisanal dimension producers who suffer under the false belief that their product entail negative impact to the industrial order in Nairobi.
2. Identification of sources or causes of those unmet needs, suffering, false beliefs—this has been done in terms of constraints in the enabling environment for artisanal dimension stone in Nairobi.
3. Passing to a negative judgement of those sources of illusion and oppression—this has been done in the discussions concerning the evaluation of the enabling environment.
4. Favouring, other things held constant, actions that remove those sources—this has been done by making recommendations to adjust the enabling environment.

This study therefore has achieved its implied goal of applying emancipatory social science in its examination of the phenomenon of artisanal production of building materials in order to bring change to the life of the actors. This is particularly important for artisanal production that employs many workers who cannot cope with the demands of employment in the formal sector,

hence whose livelihoods are threatened by the negative publicity attributed to artisanal stone production. Since the socio-technical practice of stone production contributes positively to employment, livelihood support systems and poverty reduction, a study that may lead to the enhancement of the practice therefore is a major contribution to local economic development.

In terms of knowledge development the study has demonstrated that factor analysis can be used for analysis of the business environment as a quantitative aspect of PEST analysis. So far text books rarely list factor analysis as a method of analyzing the business environment. The discussion at section 3.2 on Analysis of the Business Environment identified the traditional PEST analysis and its variants, stakeholder analysis, Porter's five forces analysis, SWOT analysis, Alternative Scenario analysis and the Delphi technique. Therefore this research has applied factor analysis in a new area with considerable rate of success. On Table 7.17, see section 7.6.5, the analyses of Eigenvalues for, and total variance explained by, retained factors have led to the rational conclusion that the enabling environment being measured is relatively hostile. In addition, the said section has also confirmed the proposition of the Bertalanffian model that analysis of a system would bring up (see Figure 4.3) the following distinctions about system elements:

1. According to their number
2. According to their typology (variability)
3. According to their relations (or interrelations).

Factor analysis has made such distinctions for the enabling environment of artisanal dimension stone in Nairobi as has been explained in the said section. These contributions are not restricted to the area of artisanal materials in developing countries but spill over to the theory of organization, or business management theory, among others.

9.6. **Limitations of the Study**

Nevertheless it is important to note that factor analysis is not an entirely perfect tool in this respect. One weakness, for example, concerns the extraction of the first factor that is usually too general. This has proved true in all the three instances of factor analysis performed in this study. This reduces the number of meaningful factors to consider by less than one in each case. The

study also had difficulties arising from the division of the business environment into three parts which proved intractable in the final analysis because clear cut divisions do not exist.

Secondly this study applied Factor Analysis as an analytical technique in the conclusive part of the study. In this respect Factor Analysis was used to confirm socio-technical issues to do with artisanal stone mining in Nairobi that had been generated through literature review, secondary data analysis and ethnographic studies. Nevertheless the study has only applied the exploratory aspect of the technique i.e. EFA. A firm grounding on the socio-technical issues could be achieved if a confirmatory oriented technique i.e. CFA is applied to confirm the exploratory results.

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