APPLICATION OF SYSTEMS APPROACH TOWARDS DEVELOPMENT OF GOVERNANCE AND A MODEL OF AN EFFECTIVE REGULATOR IN A LIBERALISED ELECTRICITY SECTOR IN BOTSWANA

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A EXTENDED ABSTRACT

The extended abstract is presented in a SCQARE format. The guide to the abstract is as follows. The situation is presented first; the concern is second; the question is third; the answer is fourth; the rationale is fifth; and the evaluation which comprises relevance, utility, validity and ethics comes last.

A.1 The Situation

This research work is based on the use of systems approach towards developing governance and designing electricity regulator in a liberalised electricity sector in Botswana. The current organisation of the sector is based on the underegulated paradigm in which the electricity sector is owned and regulated by the Government of Botswana. However the Government has entrusted the business of electricity generation, transmission and distribution to the Botswana Power Corporation, which is a public electricity utility. The sector is currently facing several issues and challenges related to its overall performance that threatens its medium and long-term goals. Of significance are the following security of supply, the demand profile, which shows a great dependence on the mining sector, access to electricity particularly in rural areas, the relatively high tariffs, the unattractive rate of return on investments, the proposal to liberalise the sector, and regional corporation.

The research context is concerned with the electricity sector when it becomes liberalised in the near future as proposed by the Government. In 2003, the Government of Botswana appointed consultants who recommended that the sector should be liberalised. As a result the Government has started preparations for the process. The Government White Paper on Privatisation Policy was adopted in 2000, and Public Procurements and Asset Disposal Act was approved and became operational in 2001. In 2001 the Public Enterprise Evaluation and Privatisation Agency (PEEPA) was established and began operations in that year. The main responsibility of the Agency is to administer the privatisation process for public enterprises with speed and transparency. In addition the Agency has to identify candidate public sector organisations for privatisation,
keeping in view the desirability of privatisation in each particular case in terms of the potential benefits, such as improvement in productivity, the possibility of attracting foreign participation; new technology and participation of international investors.

The electricity sector is targeted for liberalisation and initial steps on the road to privatisation such as commercialisation of the Botswana Power Corporation has already been initiated. However a complete menu of the privatisation process has yet to unfold but it is already known that it will cover the following elements of reform: implementing a new legal framework for electricity sector reform; framework for private sector participation; unbundling of monopoly type national utilities; introduction of Independent Power Producers; establishment of third party access to electric networks. These are the reforms or liberalisation process intended to deal with concerns faced by the electricity sector in both developing and developed countries.

Liberalisation process is intended to introduce competition and to enhance efficiency in the electricity sector through the separation of electricity business into two enterprises: service and transport. The operation of the market requires a governance body to ensure that the market upholds ethical values; and an electricity regulator to promote competition and to enhance efficiency of the market.

A more detailed look at the regular reveals that its functions as an electricity market involve: quality of service provided by market participants; conflict resolution; issuing licenses; monitoring performance, setting standards, developing human resource for regulation. In countries where electricity regulators operate, their performance has been less than expected. There are many reasons for that: regulating electricity markets is relatively new. It only started in the late 1980's electricity when the pioneering liberalisation of the electricity sector was adopted in the UK and Chile. Since then several countries have followed suit. However the process of regulation is not yet fully understood among many regulators (Ogus, 2003). Countries that have established electricity regulators have not invested adequate resources to promote their effectiveness
and that has resulted in such institutions of regulation not performing well. In the Botswana context, there are anxieties about the ability of liberalisation, governance and the electricity regulator to improve the performance of the sector when it is liberalised.

A.2 The Concern

The current electricity sector in Botswana, which is not liberalised, faces several challenges. The country is able to supply only 30% of its demand from local thermal generators, and the remaining 70% is imported from Eskom of S Africa and the Short Term Energy Market (STEM) of South African Power Pool (SAPP) (BPC Annual Report, 2003). The situation is likely to get worse because demand will continue to rise as a result of demographics and economic growth while local generation stagnates. This current trend is set to continue even after liberalisation of the sector. In the post-liberalisation era, this will be a great challenge to the electricity regulator, a matter that will depend on the effectiveness of the regulator.

The current trend in the electricity sector shows a declining performance as reflected in the drop in net profits from P165.3 in 2002 compared to P135.3 in 2001. There was also a comparable drop in return on equity. The return on total assets has also been affected. In 2002 the target on return on assets was set at 6.6% but the sector achieved 5.5% (BPC Annual Report, 2003). Such performance figures reflect the relative efficiency of the sector. What appears to be clear is that the efficiency of the sector is not meeting its targets.

The current mode of Government regulation of the electricity sector is through policy with no direct mechanism of enforcement except through the legal system. The current regulation in government for the sector is weak, both in terms of manpower strength and requisite variety to deal with the problems of the sector. The annual turnover of the sector was P450 million (BPC Annual Report) in 2002/02. Although this reflects a large turnover in terms of the local economy, it is surprising that only two officers in Government are in charge of regulating the sector. Given the circumstances, the stakeholders of the sector, some with
financial clout and others with political clout, are able to influence policy in ways that are not in the interest of the nation.

Electrification is at the core of Government policy, both involving rural and urban areas and between the two, rural electrification constitutes a greater concern. The cost of rural electrification remains high because of remoteness of rural households and sparseness of population in Botswana, which relates to increased costs of electricity equipment for distribution and reticulation. Moreover rural households are poor, and their electricity consumption, from empirical observation, are low while their ability to pay bills regularly and on time are doubtful. These circumstances are unlikely to attract foreign investment in the electricity sector after liberalisation, a problem that governance and regulatory institutions will need to grapple with.

In addition to the concerns discussed, other pressing issues that governance and the electricity regulator will need to focus on are: the shortage of manpower and skills capacity for regulation, a situation made difficult due to no history of regulating an electricity market in Botswana; devising tariffs which are affordable and sustainable but at the same time responsive to investment opportunities; maintaining technical standards and quality of supply of electricity; ability to be self-sustaining.

In the medium to long-term, the implications of these concerns will translate to failure of achieving the goals of electricity sector liberalisation, namely improving the efficiency and promoting competition in the sector. These in turn will have ripple effect on investments in the supply sector, continued increase in tariffs among consumers, and stagnation in electrification.

A.3 Question

There are three sets of questions around which the problem may be structured.
(i) How can systems approach be applied in analysing and diagnosing the generic model of electricity regulatory institutions (electricity regulator and governance body) in a deregulated electricity market?

(ii) What are the contextual characteristics of the environment of the electricity industry in Botswana?

(iii) How can the results of the analysis and diagnosis of a model of electricity regulatory institutions and the results of study of contextual characteristics of the environment of the electricity sector, in Botswana be integrated to design a model of governance and electricity regulator to suit Botswana?

A.4 Answer

Organisational cybernetics whose main vehicle of transporting insights to managers is the Viable Systems of Model, Systems Dynamics, case studies of newly formed electricity regulator agencies in Namibia and S African, theory on organisational management synthesized from the EMBA4 programme have been applied appropriately to analyse and diagnose the model of present day generic electricity regulator agency and to design and produce a suitable model for such agency in Botswana. Concurrently a suitable form of market governance model for Botswana has been developed in the research process. The methods cited that have been used in the development of an electricity regulator and market governance as follows.

A4.1 Viable Systems Model (VSM)

The VSM has been applied to two main instances: to interrogate the Botswana government policies upon which liberalisation of the electricity sector hinges, of which the proposition to establish an electricity regulator and a market governance body is of major interest to the current research; and to design the institutions of electricity regulation; namely electricity sector regulator and an electricity market governance body. The philosophy of the design of the regulator agency that allows its management to respond to changes in the environment of the electricity sector (development management) while addressing the
management challenges it faces on an on-going basis (control management) within the sector. At the same time evolving regulatory agency has been designed to eliminate or minimize the current weaknesses found within similar organisations worldwide where they operate. The outcome of the processes achieved via the VSM is as follows.

**Policy Issues: Policies Associated with Electricity Reforms and The Sector Regulator**

The application of policy matters associated with the electricity sector stipulated that a coordinated approach to the reforms in the electricity sector involving the ministries of Finance and Development Planning; and Mineral Energy and Water Resources as well as the implementing institutions comprising the Botswana Power Corporation and the Public Enterprises Evaluation and Privatisation Agency (PEEPA) needs to be pursued.

The coordinated approach would facilitate or initiate the articulation, realisations and implementation of the following goals: (i) Reform objectives; (ii) studies needed to inform the reform process; (iii) establishing the power sector reforms task forces; (iv) and implementing the reforms.

The policy contents need to be specific on issues related to goals, measures and implementation if the policy is to be well implemented. The policy contents should be guided and informed by further studies of the sector, both in terms of diagnosis and new and final forms and options preferred of the electricity sector and its regulation. The studies should link their findings to government objectives and goals for the electricity sector reforms, and the establishment of an electricity regulator. In particular, detailed attention needs to be directed at sector institutional guidelines and the regulatory principles to be pursued. The reform timeline for activities and programmes envisaged for the reform need to be articulated.

The management of change should be entrusted to a Government Committee established specifically to steer the reform process. The Committee, in turn,
should establish task forces among its rank: to deal with specific issues identified as major components of the sector reform.

Based on the activities of the power sector reform committee and its task forces. The related outcome should identify action plans for policy implementation. This should result in the formation of an Implementation Committee. The Implementation Committee will then activate all measures intended to initiate the reform and kick-start the operation of the new liberalised electricity sector. This measure will include contracts for generation, distribution and launching the new electricity regulator.

**Policies y on Market Governance Body**

A clear policy associated with the formation, structure, functions and composition associated with a market governance body is needed. The government, and the proposed power sector reform committee in consultation with stakeholders should spearhead the policy formulation process for the purpose.

**Models Of Governance And Electricity Regulator To Suit Botswana**

The recommendations in Chapter 9 involves the product of the design process for a regulatory agency based on the integration of the inputs from the results of the research drawn from the following areas discussed earlier, namely: case studies of the regulator agencies from South Africa and Namibia, management theory from the EMBA4, contextual characteristics of the electricity sector in Botswana, policy framework on electricity sector in Botswana, and the application of VSM.

The model of the regulator agency for Botswana predicated on the principles indicated should incorporate four key modules:
Module 1: Primary Activities

Primary activities which form the main drivers of the operation of the regulator; drawn from reform agenda in the electricity sector and the contextual characteristics of the industry in Botswana, namely: sustainability of the sector (efficiency, safety, affordability, environment); promoting competition; rural electrification; renewable sources of energy; links to other energy sources; research and development.

Module 2: Regulatory Functions and Practice

Module 2 consists of a list of regulatory functions and practice that define the effectiveness and efficiency of the electricity regulator. The efficiency and effectiveness factors and should be supported through value adding functions. Elements of modules 2 are shown in the Table 9-12.

<table>
<thead>
<tr>
<th>Value adding functions: (Facilitation)</th>
<th>Core Functions (Effectiveness factors)</th>
<th>Regulatory Practice (Efficiency factors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Finance;</td>
<td>• Licensing</td>
<td>• Consultation</td>
</tr>
<tr>
<td>• Human resources;</td>
<td>• Tariffs and pricing</td>
<td>• Consistency</td>
</tr>
<tr>
<td>• Research &amp; development</td>
<td>• Quality of Service</td>
<td>• Predictability</td>
</tr>
<tr>
<td></td>
<td>• Customer relations</td>
<td>• Flexibility</td>
</tr>
<tr>
<td></td>
<td>• Enforcing rules and standards</td>
<td>• Independence</td>
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<td></td>
<td>• Policy development</td>
<td>• Accountability</td>
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<td></td>
<td>• Communications</td>
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<td>• Legitimacy</td>
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<td></td>
<td>• Timely</td>
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<td></td>
<td></td>
<td>• Responsive approach</td>
</tr>
</tbody>
</table>

Table A-1: Regulatory functions and practice of the regulator agency.

According to Ashby's law, the efficiency functions are a reflection of the complexity that the implementation system of the regulator agency must have to deal with in the environmental complexity while the effectiveness functions are the complexities that the management system must deal with in the environment.
Module 3: Control and Development Management

The factors, which characterise control and development management elements, are shown in Table A-2. Note that these are based on the functions of the regulator.

<table>
<thead>
<tr>
<th>Management responsive to (intelligence) the &quot;outside and then&quot; (Development management)</th>
<th>Management related to control &quot;inside and now&quot; (Control management)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Finance</td>
<td>• Finance</td>
</tr>
<tr>
<td>- Human resources</td>
<td>• Human resources</td>
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<td>- Licensing</td>
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<td>• Timely</td>
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<td></td>
<td>• Responsive approach</td>
</tr>
</tbody>
</table>

Table A-2: Control and Development Management elements

There should be two forms of overlap between the functions:

(i) Intra-management functions overlap, that is, overlap between functions in one element of management;

(ii) Cross-management functions overlap. That is, overlap between functions across both elements of management.

Both cross management functional and intra-management functional overlaps are driven by system 5 or policy function in the VSM of the organisation. The aim of policy should be to adapt the organisation to environmental changes.

Module 4: Organisational Structure

The organisational structure is based on the primary activities (here referred to as directorates) that the regulatory agency must fulfil in the electricity sector, namely: access and rural electrification; research and development; technical and economic regulation; renewable energy and energy planning; finance and administration; legal arbitration and stakeholder affairs. The structure is shown in Figure A-3.
Figure A-3: Organisational structure for electricity regulator.

Module 5 essentially shows the power relationship between the directorates, which are designed to relate to primary activities of the regulator agency.

It is important to note that these modules have incorporated the following insights:

- The contextual characteristics of the electricity sector in Botswana;
- Management theory developed from the EMBA programme;
- Case study results of electricity regulators in S African and Namibia;
- Analysis of the current policy framework in Botswana formulated to guide and legitimise the electricity reform agenda and the establishment of the electricity regulator;

**Multi-Class Stakeholder Board**

A Multi-Class stakeholder Board as an Electricity Market Governance Board is preferred for a liberalised electricity sector in Botswana. The key advantage of such a Board is that it would contain the relevant stakeholders of which government representatives would form a part and hence ensure that government development goals are linked to the evolution of the market.

**A4.2 Systems Dynamics**

Qualitative systems dynamics has been applied to gain insight into the contextual characteristics of the electricity sector in Botswana. The key variables and the relations between them variables associated with their impact on the sector were explored using systems dynamics and subsumes of:
(i) Promoting of rural electrification;
(ii) Perpetuating electricity sector sustainability (affordability, environment, safety, efficiency);
(iii) Promoting usage of renewable energy;
(iv) Enhancing usage of renewable energy;
(v) Maintaining financial strength.
(vi) Improving electricity access.

These factors characterise the electricity sector in Botswana, which have been integrated into the primary activities of the regulator. The causal relations between these variables are captured in chapter 7.

A4.3 Case Studies

Case studies of electricity regulators for liberalized electricity sectors, typified by the National Electricity Regulator in S Africa and the Electricity Control Board of Namibia were carried out. The case studies offer substantial insights and practical means of establishing a new regulatory agency, such as the one being mooted for Botswana. The following areas drawn from the case studies were applied and appropriately integrated in developing and enhancing the regulatory agency designed for Botswana:

(i) Generic organisational structure of an electricity regulatory agency;
(ii) The core functions and regulatory practice of the electricity regulatory agency;
(iii) Areas of key skills needed to operate an agency effectively;
(iv) Likely areas where the regulatory performance is likely to suffer.
A4.4 EMBA4 Theory on Organisational Management

Causal Loop Diagram (CLD) representing the theory on organisational management constructed from the EMBA4 programme applied in the design of the electricity sector regulatory agency encapsulated levels of the following themes:
(i) Normative management in entrepreneurship and innovation;
(ii) Effectiveness of leadership;
(iii) Strategic management and performance;
(iv) Marketing effectiveness.
Each of the above themes is a CLD theory on its own right. These theories themselves are derived from CLD theories from the position papers. Through the research process the theory was integrated into designing the regulator organisation via Capacity building for regulation, which subsumes of the following drivers: institutional analysis involving; management proficiency components; capacity building enhancers; specification of regulatory capacity – which underscores regulatory impact; and Management performance that reflects effectiveness and efficiency.

A.5 Rationale

The approach used in this research is triangulated at three levels:
(i) Methodological level using the following approaches:
   ▪ Organisational cybernetics (the VSM) for electricity sector policy analysis and the design of the electricity regulator agency;
   ▪ System dynamics to establish the cause - effect and feedback relations among key variables within the electricity sector in Botswana;
   ▪ Qualitative research methodology as a vehicle for gaining insights used in system dynamics;
   ▪ Two case studies based on operational, functional and structural perspectives of electricity sector regulators in S Africa and Namibia;
• CLD-based theory on organisational management as a construct from EMBA4.

(ii) Methods of inquiry were based on both inductive (qualitative method) and deductive approaches (system dynamics and the VSM).

(iii) Sources of data and information embraced – questionnaire survey (quantitative method, case study), interviews (quantitative, system dynamics, VSM); literature and document review (case study, VSM); workshop processes (VSM).

The rationale is a product of the above processes leading to the design of an electricity regulator agency and proposed market governance body when the sector becomes liberalised in Botswana. The processes indicated embrace both functionalist and interpretive systems approaches. In the functionalist approach the organisations-as-systems tradition holds sway and systems dynamics, and organisational cybernetics are the means used to gain insights by analysis and diagnosis of the regulator (Jackson, 2000). In using the systems approaches neurocybernetic metaphor and the organismic metaphor have been applied to illuminate and focus on the context.

System dynamics and qualitative research, the latter being the vehicle of conveying insights to the system dynamics of the contextual character of the electricity sector in Botswana addressed the question:

*What are the contextual characteristics of the environment of the electricity industry in Botswana?*

The CLD theory of the contextual characteristics of the electricity sector is depicted in Figure 7.1 of Chapter 7. The theory identifies security of electricity supply as a central requirement for the sustainability of the sector through which national economic development and individual pursuits can be realised. Sustainability in turn enables access to electricity to increase through electrification under two scenarios: economically sustainable electrification undertaken by ESI; and rural electrification achieved through funding from both government and the ESI. The second scenario is driven by the principle of social equity. A well functioning economy in turn supports economic sustainability. The
security of supply and sustainability of the industry must be maintained at all costs. From Figure 7.1, this can be realised from a variety of options, namely: local generation, imports, and other configurations for generation (such as PV, solar thermal). The prime requirement is for the industry to attract more investments to be made in the supply sector of the industry – to offset the increasing dependence on imports, which in turn reduces security of supply. There were other important characteristics of the sector reflecting the following issues: exposure to excessive electricity imports; preparations and developments towards the electricity sector reforms and implications for the national utility – the Botswana Power Corporation; current state of relatively weak electricity sector governance and regulation; relatively high electricity tariffs; and promoting renewable energy usage.

Other critical factors which promotes investment climate into the sector requires an attractive rate of return on revalued assets of the ESI, driven by efficient operation of the industry achieved through high performance standard. The efficiency of operation of the industry can be improved through various devices and interventions such as: cost reflective tariffs, restructuring the industry to introduce competition and attract private investment, technology innovation.

Stafford Beer's Viable Systems Model was used to assess the adequacy of policy requirements needed for electricity sector reforms and launching an electricity market regulator or the market governance body. From the study, several policy problems were identified: policy gaps related to co-ordination between the two ministries responsible for policies on electricity sector reforms; namely: the Ministry of Finance and Development Planning (MFDP), and the Ministry of Minerals Energy and Water Resources (MMEWR) are not co-ordinated in their approach to policy formulation. This has an adverse spill over effect on the electric utility affected by the reforms it faces as well as the Public Enterprises Evaluation and Privatisation Agency (PEEPA), which is the institution responsible for executing the reforms. Under the circumstances optimal means of achieving the reforms in the electricity sector including the establishment of regulatory institutions cannot be realised. The impacts may be recognised in the form of failure to develop skills and management capacity to start and sustain the sector
reforms process (restructuring and privatisation); ineffective approach to evolving regulatory institutions of a liberalised electricity sector; poor formulation and implementation of reform policies. Already policy gaps are evident in the sector reform process. For example policies on formation of a market governance body has yet to be formulated, as well as preparation and enactment of a legal framework to guide the creation of the sector regulatory institutions for a liberalised electricity sector have to be made.

The case study approach examined two relatively new electricity regulatory agencies – the National Electricity Regulator of S Africa and the Electricity Control Board of Namibia. The purpose of the case studies was to provide insights into structures, functions, operations and effectiveness of regulatory agencies that could contribute to the design of electricity regulatory agencies in Botswana, rather than starting from a clean scratch. In particular avoiding replication of weaknesses embedded in their performances to the proposed one was at the core of the study.

The results indicate that, each of the two agencies have core functional similarities relating to economic and technical regulation such as pricing and tariffs; licensing; customer services; technical standards and performance. It is also evident that the practices in these organisations involve transparency, communication, accountability, transferability, flexibility, timeliness, consultation and consistency. The level at which the practices indicated are performed within the organisations define their relative effectiveness.

The structures of these organisations are heavily dependent on their mission, which reflect four areas of functional performance: economic and technical regulation, legal services (including dispute resolution), value adding services (financial and human resources) and stakeholder consultation. The functional areas above define the minimum requirements of fields any regulatory agency need to have in order to perform with any degree of credibility.

From sample employee survey, weaknesses in performance of these organisations were identified in such practices as: timeliness; understanding the
rules, policies, and of such as inadequate professional and skills capacity; responsive approach.

At the root of the problems is the relative lack of experience gained in the practice of electricity regulation. The ECB has been in operation for slightly over three years and the NER has been in practice for slightly over five years. The second point is that there is a shortage of professional and management skills in these two organisations. These shortages are particularly apparent among technical cadres of staff. Again these shortages may be due to a number of factors: general national skills shortages in technical fields; skills shortages due to the late appearance of electricity regulation as a practice and, by default, a lack of experience in the same; plus the slow strategic approach in dealing with problem.

The CLD-theory from the EMBA on organisational management capturing normative management in entrepreneurship and innovation; effectiveness of leadership; strategic management and performance; and marketing effectiveness were consistent with the ideals of an effective regulatory agency and were integrated into the design concept of a regulatory agency for Botswana through the DoMain model of management synthesized from the works of Hoebbeke, Espajo and Van Der Heijden. The framework of integrating the CLD factors into designing the regulator agency involved: capacity building for regulation; institutional analysis; articulating management components; application of capacity building enhancers; and specifying regulatory capacity – which underscores regulatory impact.

When the regulatory agency proposed is realised what has been suggested above comprehensively deals with performance management in terms of efficiency and effectiveness, at operational and strategic levels respectively. Managing at normative level calls for more intuition, innovation through inquiry and advocacy.

The design of an electricity sector regulatory agency was based on the VSM for organisational fitness and incorporating the features and characteristics discussed in the foregoing sections drawn from the following areas of research:
case studies of the regulator agencies from South Africa and Namibia, management theory from the EMBA4, contextual characteristics of the electricity sector in Botswana, policy framework on electricity sector in Botswana, and EMBA theory on organisational management. The final outcome of the designed electricity regulator (organisation) agency is modular comprising of:

Module 1- primary activities;
Module 2: regulatory functions and practice;
Module 3: Control and development management;
Module 4: Organisational structure

The purpose of module 1, that is, primary activities is to represent the approach or action, which the proposed regulatory agency must focus on that are contextual and relate to issues and problems of the electricity sector in the country of concern, in this example it is Botswana. The legitimacy of the regulator in a national context may be justified form such a perspective as it would be seen to be participating in national development agenda. Within the structure of the agency, the directorates of rural electrification and renewable energy are typical examples.

The purpose of modules 2, that is, regulatory functions is intended to embraces the traditional areas of electricity regulation, namely economic and technical regulation. That module represents how the agency must regulate the electricity market in order to promote efficiency and competition within the market. Failure to perform well in this area would render the market ineffective and self-defeating in purpose. In the agency's structure this is achieved under the directorate of economic and technical regulation.

Module 3, that is, control and development management embraces two levels of management: control management, which aims at optimisation of using available human and physical resources to achieve acceptable levels of management performance; and development management which aims at adapting the regulator agency to environmental changes within the electricity sector. To achieve development management the research and development directorate in the organisational structure is essential.
Module 4, that is, organisational structure, indicates not only the power relations between the CEO and the directorates of the electricity regulatory agency but is based on the primary activities (here referred to as directorates) that the regulatory agency must fulfil in the electricity sector, namely: access and rural electrification; research and development; technical and economic regulation; renewable energy and energy planning; finance and administration; legal arbitration and stakeholder affairs.

Finally a Multi-Class stakeholder Board as an Electricity Market Governance Board is a preferred option for a liberalised electricity sector in Botswana. The key advantage of such a Board is that it would contain the relevant stakeholders of which government representatives would form a part and hence ensure that government development goals are linked to the evolution of the market.

**A6 Evaluation**

The evaluation of the research dissertation presented here is summarised of the same undertaken in Chapter 11 and is covered under relevance, utility, validity and ethical dimension.

**A6.1 Relevance**

The Botswana Power Corporation is responsible for the generation, supply, transmission, and distribution of electricity in Botswana. It is a parastatal organisation, which is controlled and regulated through policy set by the Government.

The main stakeholders of the industry are- the Government of Botswana; Botswana Power Corporation (the power utility); the Public Evaluation of Enterprises Agency (PEEPA); electricity customers; electricity importers (South African Power Pool, and Eskom); business and society. The Government owns the utility 100% and regulates its functions through policy. It has the power to liberalise the sector with the means at its disposal. PEEPA is responsible for the
economic operation of the sector and was established by the Government to oversee the liberalisation of public utilities, the electricity sector included. PEEPA reports to the Ministry of Finance and Development Planning. The task of liberalising the sector is still at an early stage – the commercialisation stage of the process of liberalisation of the utility.

Customers for the electric utility consist of the mining sector, Government (local, urban and central), households, business, Government, Water Utility Corporation. The main customers are the mining industry consuming 51% of electricity supplied; Government consuming 29%; households, business 13%; households 10% (BPC Annual Report, 2003). It is important to note that, the electricity requirements of the mining sector should be met at all times, as it is the nerve centre of the economy.

The community, which controls the industry through Parliament, expects all sections of the society to be electrified in both urban and rural areas, according to national development plans. At the moment access to electricity to rural areas is 20% while for urban areas stands at 40% (BEMB, 2002). Imports of electricity from Eskom and SAPP Short Term Energy Market (STEM) now constitute 70% of total electricity supplied in the country. Imports thus constitute a lifeline source of supply for the country.

The current concerns of the sector are as follows: The current electricity sector in Botswana is not deregulated. There are a number of concerns that the industry now faces from different stakeholders. The efficiency of the industry is a major concern to stakeholders. The relative inefficiency in managing the industry is manifested in the increasing operating expenses. Although the main cost drivers were attributed to a rise in the salary bill, other factors such as depreciation, increase in tariffs, increase in volume of imports at relatively cheaper prices, ought have more than compensated for salary bills.

A very critical aspect of concern within or about the industry involves the level of security of supply. With imports comprising 71% of total supply, and local generation complementing the remaining requirement for supply, the
Government is concerned about the security of supply. This situation is definitely going to get worse before it gets better because the national load demand is continuing to grow due to developments and growth in the macro-economy and demographics, while current local generation remains constant, resulting in further increase in imports.

Thus the government's response to problems affecting the electricity sector is the proposal to liberalise the sector and the set up of an electricity sector regulator to oversee the operation of the emerging market, as well as setting up a market governance body. The problems and concerns of the electricity sector does not end with establishing an electricity regulator but extends to the ineffectiveness of regulators. Such ineffectiveness are explained in Chapter 3 of which the key ones are: capacity to regulate the sector, current state of poor regulation worldwide; gaps in data and information for regulation; gaps in policy and legal framework; resources and capacity for regulation.

The purpose of the research is therefore to evolve an electricity sector regulator, which is able to deal with the current regional and international problems, and weaknesses associated with the regulation of the sector in countries where it has been liberalised while at the same time meet the national needs of the sector. Such problems involve, upon liberalisation of the sector in Botswana:

- Failure to introduce and sustain competition in the electricity market;
- Failure to enhance efficiency.

The outputs of the research are two-fold:

- Model for an electricity sector regulator for Botswana based on the design of an organisation using the VSM;
- An electricity market governance body.

The model of the electricity sector developed integrates characteristics that make it responsive to the local requirements and problems of the sector in Botswana, which have been enumerated and elucidated in Chapter 3. The Model is adequately infused with good concepts and practice drawn from literature, case studies of electricity sector regulation in S Africa and Namibia, and new
Botswana policy needs to guide its establishment. The relevance of the approach adopted were three-fold:

- To reduce the level of regulatory weaknesses encountered in electricity regulation demonstrated worldwide;
- To ensure that Botswana does not import models of electricity regulatory agencies that have not delivered in accord with their missions; and thereby ensure that Botswana does it right first time when it establishes its regulator upon liberalisation;
- To ensure that the objectives for liberalisation of the sector is fulfilled.

The stakeholder views on the model of regulatory agency proposed varied according to the type of stakeholder as indicated below.

The government of Botswana would supports the models proposed as the purpose of the model is in line with government policy. However government concern would be about the cost of establishing it. Such concern would emanate from the blotted structure of the proposed organisation in comparison to the leaner structures of similar organisation in S Africa and Namibia.

The views of the current employees of the national electric utility, the Botswana Power Corporation would be connected to fears of possible loss of employment or changes in employment opportunities. Other employers on the other hand, particularly skilled professional and management cadre would welcome new opportunities and challenges that liberalisation of the sector would usher.

Investors, both national and international would welcome opportunities for new investments when the opportunities meet their expectations such as taxes; returns on their investments; government policies; and foreign exchange repatriation.

A6.2 Utility

The model of institutional set-up of the electricity regulator designed as a result of the research incorporates four key modules:
(a) Module 1: Primary activities which form the main drivers of the operation of the regulator; drawn from reform agenda in the electricity sector and the contextual characteristics of the industry in Botswana.

(b) Module 2: Regulatory functions

Module 2 is about the regulatory functions that define the effectiveness and efficiency of the electricity regulator.

(c) Module 3: Control and Development Management

(d) Module 4: Organisational Structure

These modules are infused with the following insights:

- The contextual characteristics of the electricity sector in Botswana;
- Management theory developed from the EMBA programme;
- Case study results of electricity regulators in S African and Namibia;
- Analysis of the current policy framework in Botswana formulated to guide and legitimise the electricity reform agenda and the establishment of the electricity regulator;

The utility of the model for electricity regulator agency proposed for Botswana are intended to address the research questions cited Chapter 1 and the Concerns elucidated in Chapter 1. The utility of the answers to those concerns and questions are intended to contain challenges of electricity sector regulation through:

- Promoting Competition
- Purposefully building capacity for Regulation
- Initiating and sustaining research and development
- Implementing economic and technical regulatory functions effectively; by world-class standards;
- Achieving a high level of organisational management which cultivates a high degree of performance and productivity;
- Establishes an effective organisational structure, which demonstrates fitness and ability to achieve the mission of the regulatory agency.

The utility of the answers are subject to qualifications and varying degrees of robustness. For instance, one of the primary activities of the regulator will be to promote competition. This will not be possible to accomplish effectively, because in the Botswana situation, there is no competition policy or law. Such policy or
law usually precedes regulatory reforms and electricity sector deregulation and restructuring in countries where reforms have been implemented. The void created by competition law in the regulatory regime has to be filled in the first instance in order to promote competition in the liberalised sector in the long run.

To create an environment of effective management in the domains of both control and development management, appropriate policies initiated at the leadership level for the regulatory agency will be needed for the two domains of management to be tightly coupled to achieve adaptation, as deemed essential in the VSM theory. And in practice, three key ingredients are needed if both forms of management are to be judged as effective as well as meeting the expectations of stakeholders, that is:

- **Strategic planning**, which requires that all managers place emphasis on the need to think strategically and place their actions within an agreed strategic framework;
- **Work system design**, which conceptualises the organisation as a system driven by intention that consists of a series of interdependent processes. Each process is broken down into a series of tasks and it is important for those involved to understand how tasks transform inputs into outputs, the essential interrelationship between the tasks and how effectiveness of the processes can be measured;
- **Performance management**, which come in various forms but all of which are intended to achieve management commitment by supporting a continuous dialogue between managers and their staffs on how results may be achieved and learning activities focused on priorities.

While the structure of the electricity regulator proposed embodies features consistent with organisational cybernetics, particularly the VSM, nevertheless it is important to recognise that the structure does not reflect many subtle and yet important aspects of an effective organisation. The subtle factors that the structure omits include the following: organisational culture; organisational learning; teamwork; communications; change management; and diversity. High achieving organisations have integrated these concepts in their management outfit for an effective organisation.
Up to the time Botswana establishes an electricity regulator, it will not have had prior experience with regulating a liberalised electricity sector. Manpower for professional skills and management capacity need to be developed from the start. The regulator to be established will need qualified people to manage it, unfortunately there is no pool of skilled regulators to recruit from within Botswana. Even in situations where a reasonable pool of regulators is available the problem of skills remains a reality. As Centre for Regulatory Competition (CRC) notes:

“CRC research on the performance of regulatory institutions has uncovered a lack of conceptual understanding on the part of regulators of the management and organisational aspects of putting regulatory intentions into practice”

Research and development is critical for new regulatory institution such as the one proposed for Botswana. It has a key role in supporting decisions related to untested grounds (particularly in the areas of economic and technical regulation), and seeks to determine and define the trajectory of progress that regulation should follow. However such aspirations for research and development are usually constrained by limited budgets and inadequate attention paid to it by senior management in organisations where they are functional.

A6.3 Validity

The answers arrived at in this research is built upon positivist, phenomenological and pragmatic paradigms of research philosophy. Sociological (functional and interpretive) and systems thinking (systems dynamics and organisational cybernetics (VSM)) frameworks were the vehicles of gaining insights from the research philosophies applied in the research context. Both deductive (case studies, VSM) and inductive (qualitative, EMBA4 theory on organisational management) methods of inquiry were applied in the research process.

Therefore for purposes of this dissertation, the approach adopted for this research is triangulated at three levels: philosophical position, methodological
approach, and methodological process; data and information collection. This has enabled a very rich insight to be generated that has been applied to the task at hand.

Systems dynamics using qualitative methodology was applied to gain insights into the contextual environment of the electricity sector in Botswana. Data and information was gathered through interviews, questionnaires and focused workshops to generate relations between the key variables in the electricity sector. The CLD-theory derived from qualitative systems dynamics identifies sustainability and security of electricity supply as a central issue, which should be maintained in such a way as to attract investments for expansion. The electricity supply must meet demand at all times both in the short and long term and at affordable cost while generating adequate returns on investment through efficient management of the sector. The sector should meet the needs of rural electrification, in spite of the unpredictability of the business in this area of electricity supply, and increase access to electricity in both the urban and rural areas.

Cybernetic approach through the VSM was applied in the functional design of the electricity regulator agency as well as to assess the adequacy and requirement for relevant policy needed reforms in the electricity sector. The VSM approach establishes the structural needs of the organisation, in this case the model of an electricity regulator agency for fitness in such a way that the organisation is able to adapt itself continuously with changes in the environment through adaptation process which tightly couples control and development management via policies emanating from system five of the regulatory agency. Through design of filters and attenuators the regulator should contains adequate variety to absorb the complexity of the environment.

The VSM approach to policy analysis suggests that a well co-ordinated policy is needed between three levels of recursion: Government as the supra-systems (recursion level 0), electricity sector reform and implementation agencies as the system of interest (recursion level 1), and stakeholders as the sub-system (recursion level 2). Such policies cover reforms in the sector and implementation
strategies. Similarly a policy that is co-ordinated between the following levels of recursions is required for a coherent policy in the sector: that is, recursion between the electricity sector (recursion level 0), the electric utility (recursion level 1), and consumers (recursion level 2). From the research policy gaps were identified between the recursion levels indicated which as a result adversely affects the implementation of establishing a regulatory agency.

Case studies of operating electricity sector regulators in S Africa and Namibia were undertaken to collect up-to-date information and characteristics of functional regulatory institutions using interviews, literature and document survey, and questionnaire survey of selected individuals. The outputs of the case studies were used to enhance the set up of the regulator for Botswana and to strengthen and improve confidence in the effectiveness of the proposed electricity regulator model for Botswana when it is established. Further the case studies served to direct effort at minimising importation of unnecessary features from the regulators studied to the one proposed for Botswana while maximising incorporation of feature considered desirable.

The CLD-theory on management of organisations developed from the EMBA programme was adapted and used in the development of the effectiveness of management aspects of the model for the regulator for Botswana. In particular the DoMain model of management was suited for the effectiveness of the regulator agency proposed.

A6.4 Ethics

In the context of regulatory institution in the electricity sector, the ethical concerns embrace the following critical issues:

(i) Regulatory functions and practices versus ethics;
(ii) Sustainability of the electricity sector in relation to affordability, environmental degradation resulting from harmful generation technologies, safety of people at work, and efficiency;
(iii) Rural electrification as one of the primary activities of the regulator;
Regulating functions and practice cover activities as approving and withdrawing licences; approving tariffs and prices; resolving disputes. The issues should be achieved in a way that is consistent with ethics, rights and justice among stakeholders.

In terms of ethics concerning sustainability of the electricity sector, the choice for regulating the electricity sector should be consistent with the ethics of utility, rights and justice among stakeholders. Ethical practice however embraces problems which are systemic, organisational and individual such as limitations in skills and management capacity, resources, policy, appropriate legislation, and co-ordination.

Regarding the ethics of rural electrification practices for the electricity regulator should be ethical in terms terms of utility, rights and justice. The ethical approach is however fraught with problems that are systemic, organisational and individual. Typical obstacle in rural electrification involves sustainability of financial resources, technical issues, maintenance, and limited resources among rural the majority of rural population.
PART I: RESEARCH CONTEXT

CHAPTER 1: INTRODUCTION

The purpose of this chapter is to give an overview of the dissertation. It relates to the area of research, research context, the questions that the dissertation deals with, the importance of the research, assumptions, and the details on the structure of the contents of the draft dissertation.

A brief guide to the chapter is as follows. Section one deals with purpose of the research, in section two the research questions are surfaced, section three identifies the research context - that is the electricity sector in Botswana, section four indicates the significations of the research, section five reflects the operating assumptions associated with the research, and section six covers the main areas of the dissertation.

1.1 The Purpose of the Research

The purpose of this dissertation is to use systems approach to analyse / synthesis / diagnose general models of regulatory institutions for a liberalised electricity sector, as established in other countries, and through this research determine how it can be adapted to suit the peculiarities of the sector in Botswana when the sector becomes liberalised. This is critical for several reasons. First the objectives of liberalisation of the sector can only succeed if the regulatory institutions are effective, particularly in developing countries (Minogue, 2000), and secondly direct imports of models of regulatory institutions from one country to another where electricity reforms have been implemented is no guarantee for their effectiveness; and third the cause of many problems and failures in a liberalised sector is blamed on the inefficiency of regulatory institutions. The scope of this dissertation is to use systems approach, qualitative research and case study to analyse, and propose a suitable model of regulatory institutions for electricity sector in Botswana. This will be built upon the understanding of the nature and complexity of the electricity sector in Botswana
and under the assumption of the form of electricity market that consultants have recommended for Botswana. As of now the electricity market model recommended for Botswana is the wholesale. This is supposed to be the market model Botswana is recommended to adopt by Government by Consultants\(^1\) when the sector becomes liberalised. The objective of the dissertation is intended to fulfil two key stipulations: that the proposed models of regulatory institutions reflect the peculiarities of Botswana; and that the proposed model meet the prerequisites for an effective electricity sector regulatory institution reflecting improved ability to regulate competition and efficiency among market participants. The management theories developed during EMBA4 will be applied to give insights to the proposed models.

### 1.2 Research Question

The dissertation seeks to answer three sets of related questions. They are:

(i) How can systems approach be applied in analysing and diagnosing the generic model of electricity regulatory institutions (electricity regulator and governance body) in a deregulated electricity market?

(ii) What are the contextual characteristics of the environment of the electricity industry in Botswana?

(iii) How can the results of the analysis and diagnosis of a model of electricity regulatory institutions and the results of study of contextual characteristics of the environment of the electricity sector, in Botswana be integrated to design a model of governance and electricity regulator to suit Botswana?

### 1.3 The Research Context

The context of this research is based on the electricity sector in Botswana. To appreciate the research question it is important to understand the totality of the context. Briefly this may be explained as follows. The current electricity sector is

\(^1\) PPA consultants to the Government of Botswana recommended that wholesale market is suited to the power sector when it is deregulated.
owned and regulated by the government but it is operated on behalf of the government as a utility by a public corporation, the Botswana Power Corporation. In this form the structure of the utility is vertically integrated, meaning that generation, transmission and distribution segments are bundled and under one ownership, that is, the government.

The electricity sector, however, is on the verge of liberalisation. This will mean that generation, transmission, and distribution sectors will be unbundled and restructured and sold to investors. The electricity sector will therefore be privately owned and operated. Under this form the sector will be liberalised resulting in the formation of an electricity market. That is, the sector will undergo structural and ownership changes, a process known as electricity reform, which is currently taking place in several countries, both in the developed and developing countries. The Government will however maintain control of the liberalised electricity sector through the establishment of an Electricity Regulator, whose responsibility will be to promote competition and efficiency within the electricity market. The market will also establish a governance board to adjudicate over ethical issues arising from among market participants.

The context of this research is based on the future liberalised electricity sector in Botswana in which the electricity regulators and a governance board are key components. Nevertheless understanding both the situation of current form and proposed future form of electricity sector are necessary for this research. An overview of the issues relevant to both forms of the sector is given here in the introduction, but the details are contained in chapter 2.

In the current electricity sector, in Botswana, the key issues are associated with government ownership and regulation; excessive dependence on imported electricity, which now accounts for 70% of electricity supplied; the relatively high tariffs compared to regional levels; inefficiencies in the sector; the low level of investment in generation; rural electrification which is considered expensive and generating low returns on investments; the demand sector which is heavily dependent on the mining industry.
On the other hand the future proposed liberalised electricity sector for Botswana, the issues will contain existing problems such as: excessive electricity imports compared to local generation, high tariffs compared to regional levels, demand dependence on the mining industry will continue as challenges. However new developments and challenges will emerge- these include developing governance and effective electricity regulator for the liberalised electricity sector market; the tasks of establishing and sustaining competition among market participants; motivating efficiency among market participants; cultivating ethical values and subscribing to environmental protection. Such are the issues that the liberalised electricity sector must respond to but which to a large degree will depend on the effectiveness of the electricity regulator, yet to be established.

Ryan (in EMBA notes, 2003) advocates that the essence of systems thinking that are relevant to systemic management practice is best captured in four categories: multiple perspectives; bounding; process thinking and relationships. In chapter two the details of the electricity sector are presented with that insight at the fore.

1.4 The Significance of the Research

Literature surveyed in the process of this research reveals a gap in the use of systems approaches in liberalised electricity sector in developing electricity regulators and market governance. The gap embraces recognition of the development of the regulatory institutions as a complex process in which systems approaches is not explicitly harnessed to capture the full potential that reforms are intended to produce. The implication is that where reforms have taken place, and regulatory institutions established, the performance of such regulators have not measured up to expectations, particularly in developing countries. This leaves open the possibility of improving the performance of electricity regulators if models according to which they are designed are based on the applications of systems approach.
The importance of this research can be seen in the context of making incremental but novel ways of designing more effective regulatory institutions associated with liberalisation of electricity sector through the application of systems approach and integrating local conditions into account.

1.5 Key Assumptions

There are three key assumptions upon which this research is being undertaken:

(a) The structure of electricity sector in Botswana following reforms will be a wholesale market comprising of the following independent enterprises: independent Power Producers forming the supply / generating companies (possibly more than one), transmission and Distribution Company, customers (mining companies; manufacturing enterprises; government institutions (urban and local authorities); commercial enterprises; and domestic consumers), Market Operator, Electricity Regulator, Market Governance Board, Traders and brokers, Service providers e.g. reactive power.

The categories of enterprises listed above are representative of electricity markets in countries where power sector reforms have been implemented.

(b) The liberalised electricity sector market is not an organisation in construct but consists of many organisations and businesses working for a common good. However it satisfies the following attributes of a system:

(i) The system as a whole has one or more defining behaviours. For example a defining characteristic of the liberalised electricity sector market is competition.

(ii) The behaviour of each part has an effect on the behaviour of the whole. As an example when an Independent Power Producer Exercises market power, electricity market prices become distorted.

(iii) The system consists of essential and non-essential parts. For example service providers for reactive power may not be essential and the electricity sector can still function albeit under different conditions; similarly
the battery back-ups for control systems are not essential. The essential parts are the generators or lines and loads.

(iv) The behaviour of the parts and their effects on the whole are inter-dependent. System operators can for example in a liberalised electricity sector decide to provide discriminatory access for transmission services to Independent Power Producers and that can cause serious effect on the behaviour of the electricity market.

(v) A system may be open or closed. The electricity market is an open system and new developments in technology can be assimilated as appropriate.

Each business organisation / entity forming part of the electricity sector can be diagnosed using the Viable Systems Model. The VSM will be used for the design of the regulatory institution using cybernetic laws.

(vi) The development of Governance and the electricity regulator is for a future liberalised electricity sector in Botswana after the reforms.

1.6 The Structure of the Dissertation

A guide to the structure of the dissertation is as follows.

Part 1: Research Context
Chapter 1 - the introduction
Chapter 2 - Research context - being the electricity sector in Botswana
Chapter 3: Problem formulation that is concerned with the problems existing within the electricity sector in Botswana

Part II: Theoretical Elements
Chapter 4: Literature review, which covers two distinct strands: electricity sector governance and electricity market regulation; literature in management and systems thinking applicable to the research including theory developed from the EMBA programme.
Chapter 5: Discusses the research design covering the following: philosophical and systems approaches; methods of inquiry and data sources.
Part III: Application: Results Analysis & Synthesis
Chapter 6: Case studies of electricity regulators in S Africa and Namibia
Chapter 7: Qualitative and systems dynamics approach to understanding the electricity sector in Botswana
Chapter 8: Qualitative and systems dynamics approach to understanding the environment of the electricity sector in Botswana
Chapter 9: Building A Model of an Effective Governance and Electricity Sector Regulator for Botswana;

Part IV: Conclusion and personal reflections
Chapter 10: Conclusion
Chapter 11: Personal reflections
CHAPTER TWO: THE RESEARCH CONTEXT - THE ELECTRICITY SECTOR IN BOTSWANA

In this Chapter the situation pertaining in the electricity sector is discussed under two models; the present one in which the sector is government owned and operated by a public utility; and the proposed future model that will follow liberalisation and when the sector reverts to private ownership and becomes regulated by an electricity regulator. The details of the sector are captured using four categories: multiple perspectives; bounding; process thinking and relationships as suggested by Ryan (in EMBA notes, 2003) in his approach on systemic management practice.

A brief guide to the chapter is as follows. Section 2.1 deals with the details of the current electricity sector in Botswana such stakeholders, ownership, regulation, tariffs, efficiency, financial performance, rural electrification. Section 2.2 deals with issues related to the report and recommendations from Consultants to Government on the structure of the sector when it is liberalised. Section 2.3 deals with the arrangements related to requirements for the electricity regulator.

2.1 Key stakeholders and Ownership of the Electricity Sector

The main stakeholders of the industry are- the Government of Botswana (simply referred here as the Government); Botswana Power Corporation (the power utility); the Public Evaluation of Enterprises Agency (PEEPA); electricity customers; electricity importers (South African Power Pool, and Eskom); business and society. The Government owns the utility 100% and regulates its functions through policy. It has the power to liberalise the sector with the means at its disposal. PEEPA is responsible for the economic operation of the sector and was established by the Government to oversee the liberalisation of public utilities, the electricity sector included. PEEPA reports to the Ministry of Finance and Development Planning. The task of liberalising the sector is still at an early stage – the commercialisation stage of the process of liberalisation of the utility.
The Botswana Power Corporation is responsible for the generation, supply, transmission, and distribution of electricity in Botswana. It is a parastatal organisation, which is controlled and regulated through policy set by the Government.

Customers for the electric utility consist of the mining sector, Government (local, urban and central), households, business, Government, Water Utility Corporation. The main customers are the mining industry consuming 51% of electricity supplied; Government consuming 29%; households; business 13%; households 10% (BPC Annual Report, 2003). It is important to note that, the electricity requirements of the mining sector should be met at all times, as it is the nerve centre of the economy.

Society, which controls the industry through Parliament, expects all sections of the society to be electrified in both urban and rural areas, according to national development plans. At the moment access to electricity to rural areas is 20% while for urban areas stands at 40% (BEMB, 2002). Imports of electricity from Eskom and SAPP Short Term Energy Market (STEM) now constitute 70% of total electricity supplied in the country. Imports thus constitute a lifeline source of supply for the country.

2.2 Policies, Regulation and Management of the Electricity Sector

The Ministry of Minerals, Energy and Water Affairs is in charge of the electricity sector through the Department of Energy Affairs. The Energy Affairs makes policies through a consultative process with the stakeholder to regulate the sector through the Botswana Power Corporation. The policies for the sector are concerned with both the short term and long term strategy for sustainability of supply of electricity for the country. The regulatory regime on the other hand is concerned with ensuring that the sector performs within acceptable technical, economic and social norms subject to policy. It is the responsibility of the
electricity utility as an organisation to undertake normative, strategic and operational management.

PEEPA however has a special role, which is directed at economic and financial performance of the power utility. At the moment its task is focused on preparations for liberalising the sector through the reform process. That explains why PEEPA is accountable to the Ministry of Finance and Development Planning. Figure 2 shows the structure of policy, regulatory and management flows for the electricity sector in Botswana.

![Figure 1.1: Policy, management, and regulatory flows for the electricity sector in Botswana.](image)

2.3 Physical Systems Structure of the Electricity in Botswana

The physical structure of the electricity systems in Botswana is based on the "old" power system model, which is vertically integrated. The Botswana Power Corporation (BPC) is responsible for the generation, transmission and distribution of electricity in Botswana. The management of utility is entrusted to BPC management, which operates under the Department of Energy. The electricity
system is comprised of three functional areas, which are bundled: generation, transmission and distribution. It is important to note that many utilities the world over still maintain this structure, including the large French power utility, Electricité de France (EdF). The structure of the electricity supply and demand in Botswana is represented in Figure 1.2. The structure depicts generation, imports, transmission, distribution and demand.

![Diagram of electricity supply and demand in Botswana](image)

Figure 1.2: The Structure of Electricity Supply and demand in Botswana.

### 2.4 Electricity Supply and Demand

BPC has an installed thermal generating capacity of 132 MW. In 2002 the installed capacity was able to meet 42.8% of total energy demand with 57.2% being sourced through imports, sourced from SAPP Short Term Energy Market and Eskom Power Pool. As of 2003, local generation is able to supply 30% of national load demand compared to 70% that has to be imported.

The current import trend shows that BPC is increasingly relying on electricity imports to meet its increasing load demand and in the process is taking
advantage of low electricity prices in the region. However of greater concern is that the region will run out of excess generating capacity by 2007/2010, if not earlier than that time (BPC, Annual Report, 2002). With imports currently constituting over 70% of the country’s power requirements the issue of investing in the country’s generating capacity remains a major prerequisite. While considerable effort has been made in sourcing adequate electricity to meet national demand, there is a need to set criteria on the optimal percentage ratio between local generation and imports to ensure security of supply.

The main consumers of the power supplied by BPC are: mining companies: (Orapa and Jwaneng mines; Soda Ash (Botswana); BCL); industrial enterprises; commercial enterprises; urban areas; rural areas; households. The demand patterns for these consumers are depicted in pie chart of Figure 3. (BPC Annual Report for 2002).

![Pie chart of Figure 3: Demand Pattern of Power Supplied by BPC](image)

Figure 1.3: Demand Pattern of Power Supplied by BPC

Mining is an important economic activity for the country, with minerals making up 75% of exports and 35% of GDP. Because of the significant contribution of mining compared to other sectors of the economy, any disruptions in the supply of electricity to this sector are destined to have significant negative impact on the economy as a whole. BPC therefore is obliged to ensure that mining will continue to have access to all electricity it requires.
2.5 Regional Cooperation in electricity

Regional cooperation in the electricity sub sector is facilitated at three levels comprising: the SADC Energy Protocol that oversees the energy policy and strategy for the community; the Southern Africa Power Pool (SAPP) through which regional utilities can trade in electric energy; cross-border grid connections to border settlements, which are not connected to the BPC grid due to distance and economic considerations.

The electricity sector has demonstrated the mutual benefits of regional cooperation through electricity trade. In this regard, BPC is an active member of SAPP and in 2001/2002 imported 57.2% of its energy/power requirements from SAPP and Eskom. From December 2001 BPC started participating in SAPP's Short Term Energy Market (STEM). The result of regional cooperation in the power sector has led BPC to defer investments in the domestic power generation system because of availability of relatively cheap electricity from the SADC region. During 2000/2001 BPC was able to save P2.1 million through importing power from the Pool. Between 2007 and 2010 the excess power in the region is predicted to run out. As a result BPC, with the cooperation of Government, initiated a process that is to culminate in the appointment of a consultancy firm to undertake a feasibility study on generation expansion at Morupule Power Station.

Through regional cooperation Botswana can achieve part of its policy goal on security of supply through participation in future large-scale power transfers from the Democratic Republic of Congo and Angola. This is the project dubbed the Western Corridor Power Project.

The ongoing study on generation expansion commissioned by BPC has an important bearing on regional corporation particularly in electricity trade. The study needs to establish the extent of security of electricity supply in terms of a balance between local generation and imports in the short and long term.
2.6 Financial Performance of Electricity Sector

In the financial year 2001/2002 the corporation's turnover was P436.7 million compared to P411.9 million in the previous year, reflecting an increase of 6.0%. This increase was made possible by a concomitant load growth of 5.5%.

The operating expenses over the same period increased by 16% from P333.4 million to P388.9 million between 2001/2002 and 2000/2001. The main cost drivers were attributed to a rise in the salary bill, depreciation and increase in tariffs, increase in volume of imports, and increase in cost of imports as a result of annual import tariff adjustment. As a result the operating profit in 2001/2002 dropped to P56.1 million from a figure of P87.8m the previous year, precipitating a drop in the net profit from P165.3 million to P135.3 million over the same period. The key financial indicators for the year 2001/2002 are indicated in Table 1.2.

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on total assets</td>
<td>6.6%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Return on investments</td>
<td>11.5%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Return on revalued property, plant and equipment</td>
<td>6.0%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Cost of borrowing</td>
<td>7.9%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Return on equity</td>
<td>7.7%</td>
<td>7.1%</td>
</tr>
</tbody>
</table>

Table 1.2: Key financial Indicators for BPC


The financial performance indicators are a favourable reflection on the performance of the corporation in the context of the financial targets achieved. The good financial position the corporation currently enjoys reflects: an impressive gearing ratio of 0.1:10; an interest cover of over 12 times; ability to provide a stable tariff environment in which the economy can function with certainty; ability to support further expansion plans. It is important to note that this good financial position has been due to several factors, notably: increase in sales, increased returns on investments; financial gain made from cheaper imported power, as a result of regional cooperation; focus on improving the operational efficiency of the corporation and customer focus.
The negative impact on financial performance has been due to inflationary pressure on expenditure, reduction in electricity consumption at a copper mine (BCL) whose tariff is linked to prevailing nickel prices in London and tariff remaining constant over the last three years; and systems losses which constitute 9.8% of supply; and increased operating expenses.

2.7 Tariffs

BPC has six categories of tariffs – home, small business, medium business, large business, government, and water utility each designated as a Type of Use (TOU). Among these tariffs, government's inclination to subsidise this corporation for reasons relating to its strategic role in sustaining the country's economy.

Tariffs should be cost reflective. Efficient energy utilization and innovative tariff design can facilitate reduction of overhead costs to ensure that electricity is affordable by various categories of consumers. Over the last 5 years there have only been two tariff increases, each of 5%, in February 1999 and June 2002. The Corporations' internal target is that tariff increases should not be more that 50% of inflation. This is beneficial to consumer planning and serves as a self-regulatory mechanism for BPC to control costs and making electricity affordable to the public.

<table>
<thead>
<tr>
<th>Type of Use</th>
<th>Fixed Charge (Pula)</th>
<th>Energy charge (Pula)</th>
<th>Demand charge (pula)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>8.09</td>
<td>0.2914</td>
<td>-</td>
</tr>
<tr>
<td>Small business</td>
<td>19.64</td>
<td>0.3024</td>
<td>-</td>
</tr>
<tr>
<td>Medium Business</td>
<td>19.64</td>
<td>0.1550</td>
<td>37.11</td>
</tr>
<tr>
<td>Large Business</td>
<td>19.64</td>
<td>0.1398</td>
<td>34.93</td>
</tr>
<tr>
<td>Government</td>
<td>19.64</td>
<td>0.3918</td>
<td>-</td>
</tr>
<tr>
<td>Water pumping</td>
<td>19.64</td>
<td>0.3083</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1.3: BPC tariffs

Long Run Marginal Costs (LRMC) drive BPC tariffs. For the purpose of this report the current LRMC of supply is taken to be US$0.04 per KWh.
BPC policy on maximum tariff increases aims at keeping tariffs at affordable levels and reflects the utility's commitment in keeping tariffs low. However the utility's low tariff policy is likely to be compromised by increasing financial commitments occasioned by the need to expand generation potential amidst a competitive regional economic environment in which S Africa’s Eskom charges lower tariffs.

2.8 Rural Electrification

Successful rural electrification in other countries has shown that a more comprehensive approach involving pro-active promotion, financing, deployment of appropriate technology and support is required. Such an approach does not however mean that cost-recovery principles need to be compromised. In fact measures employed are similar to those that a supplier in a competitive market would need to take to guarantee success.

By 2002 the national access to electricity was 28% with 20% and 40% of this allocation going to rural and urban villages respectively. At present BPC has over 120 000 customers compared to over 50 000 customers five years back. The present scenarios show that in terms of access to electricity, rural villages lag behind urban areas. This disparity can be explained by higher transmission and installation costs in rural areas that stretch BPC's capacity.

However rural electrification remains at the core of government planning and through finance channelled through BPC the electrification of 72 villages was achieved by December 2002 at a cost of P183 million. Under the rural electrification scheme 237 villages have now been electrified with additional 411 villages on the waiting list. Government funding therefore constitutes a worthwhile financial interaction by the state in support of the entire rural electrification programme.

The central theme for access to electricity remains social equity and sustainable development through improved access to affordable electricity. Major benefits of
electrification in rural development include: promotion of productive service activities which can lead to self sustaining growth; allowing formal enterprises, such as banks to be established in rural areas; enhancement of renewable resources conservation (wood fuel in particular by providing a substitute to rural households; balancing regional development; raising standards of living.

There has been considerable progress in supplying grid electricity to rural areas. Though financial cost-benefit analysis suggests that rural electrification is an economic liability, the long-term benefits of this investment in terms of nature conservation and sustainable resource utilisation outweigh the perceived financial costs of rural electrification at present. The electricity sector faces the challenge of continuing to supply grid electricity to rural areas despite the economic constraints.

2.9 Concerns about the Electricity Sector in Botswana

The current electricity sector in Botswana is not deregulated. There are a number of concerns that the industry now faces from different stakeholders. The efficiency of the industry is a major concern. The relative inefficiency of the industry is manifested

In the increase operating expenses. For example in 2001/02 the operational expenses increased by 16% over the previous year. Over the same period profits dropped from P165.3 million to P135.3 million. Although the main cost drivers were attributed to a rise in the salary bill, depreciation and increase in tariffs, increase in volume of imports, and increase in cost of imports as a result of annual import tariff adjustment, it is important to note that tariffs also went up.

The government is dealing with the concerns of inefficiency through long-term policy approach. The Botswana Energy Master Plan of 2003/4 in one of the measures for policy goal on improving efficiency of operation in the electricity sector through improved performance, and cost reflective tariffs stipulates, "restructure the electricity sector" (BEMP, 2004; pp 45). This follows
recommendations to the Government in 2003 of consultants to look into the need to deregulate the electricity sector that the electricity sector should be deregulated. The implication is that the electricity sector in Botswana must be restructured.

The restructuring of the electricity sector is another concern that the Government has set its sights on. Although the Government has not set a date, it is evident that it is committed to restructuring the electricity sector. Evidence of this are contained in the privatisation policy, which is a blueprint of government programmes on restructuring and privatising public utilities such as the power utility, water utility, and the telecommunications sector. Further the electric utility, the Botswana Power Corporation, is already implementing a commercialisation strategy, a precondition for reforms in the power sector. The build up to what is going on in the industry was triggered by the recommendations from a study in 2003 that the Government should begin implementation of the restructuring in 2003. The implications of these activities are that the restructuring and the reforms in the electricity sector in Botswana can begin anytime. This has implications for new regulatory institutions and reform strategies to adopt.

The restructuring agenda is yet driven by another set of forces – the need to improve efficiency –, which I have already mentioned, from one perspective. The other perspective is the need to attract private investors into the industry. It is anticipated that private investors will invest in more efficient generation plants that will drive down cost and lead to reductions in tariff. So the other level of concern is then to attract private investors into the industry as a means of not only for improving industry efficiency but also to inject foreign direct investment.

A very critical aspect of concern with the industry involves the level of security of supply. With imports reaching 70% of supply, and local generation complementing the remaining requirement for supply, the Government is concerned about security of supply. This situation is definitely going to get worse before it gets better because the national load demand is continuing to grow due to developments and growth in the macro-economy and demographics, while current local generation remains constant, resulting in further increase in imports.
This concern is linked to investments to the industry. The government would like to develop private-public partnerships, and is in the process of doing that to attract private investments into the industry. The outcome of these concerns has resulted in Government decision to seek consider reforms through restructuring and privatisation of the power sector following in accord with international trends. For details on reforms on the power sector see-----. The Government as a result appointed consultants to undertake a study on the feasibility of restructuring the sector, dubbed the "Preliminary investigation on Electricity Supply industry (ESI) restructuring in Botswana".

2.10 Study on Options for Electricity Sector Liberalisation in Botswana

The final report of the study on "Preliminary investigation on Electricity Supply industry (ESI) restructuring in Botswana" recommended that the electricity sector in Botswana should be restructured. The study was commissioned by the Department of Energy in 2002 to investigate the possibility of restructuring the electricity sector in Botswana.

The final report from the study identified four reform strategies for restructuring the electricity sector in Botswana:

(1) Public governance: this involves the strengthening of the governance of BPC through a performance contract, monitored regulated initially by PEEPA and regulated later by the electricity regulator once established.

(2) Privatisation of BPC: under this strategy (a majority stake in) BPC would be sold in its current structure as integrated utility.

(3) Private generation: this would involve the privatisation of BPC's generation assets and involvement of private capital in the construction of Morupule extension. BPC Transmission and Distribution would remain in Government ownership as "a single buyer" but could be privatised later.

(4) Competition: this would involve the introduction of competition at the wholesale level, permitting large consumers to select their own supplier. BPC would not be broken up and could be privatised later.

The report went further and confirmed their recommended option for electricity sector restructuring as follows.

"Given our understanding of the principle drivers of reform, our recommended strategy is Strategy 3: Private Generation. The reason for this are that this option meets a range of Government's objectives for the sector, including private participation, generation expansion at Morupule, improved sector governance and increased focus on performance of BPC."


2.11 Proposals for Governance and Electricity Regulator

The final report of the study on "Preliminary investigation on Electricity Supply industry (ESI) restructuring in Botswana" also made recommendations on the arrangement for the set up of a regulator. In this regard the report said:

"Options for regulation of the electricity sector under the recommended restructuring strategy were considered. Our recommendation is that an electricity sector regulator should play a greater role in monitoring the performance compact between Government and BPC. Our preference is for a multi-sector network regulator rather than a separate electricity regulator in order to make best use of the synergy that exist and to make optimal use of skilled resources that are required for utility regulation." (EAD Report for Study on Restructuring ESI by Planning Associates, 2003, pp 9-10). The reports however did not commit itself on the form or nature of market governance that should be instituted.

On the issue of multi-sector network operator, my position is that a specific electricity regulator would be preferable. There are already too many complaints in many countries where electricity sector have been deregulated, about the ineffectiveness of specific electricity regulators, for example the National Electricity Regulator of South Africa (NER,2002). In Botswana there is no track record or history for the type of regulation envisaged. This is coupled with lack of skills capacity. It will therefore most certainly be more difficult to have a multi-
sector regulator in that context. On top of these the electricity sector in Botswana exhibits characteristics, which will pose special challenges for a regulator.

Figure 1.4: Model 4 - Wholesale electricity market proposed for Botswana

Considering the recommendations of the consultants to the Government on the future reform in the electricity sector together with factors that are considered essential to an electricity market, the overall wholesale market proposed for Botswana is as shown in Figure 1.4. Of concern to this research are the electricity regulator and market governance board. The key function of the electricity regulator is to ensure a fair competition among electricity market participants while the function of market governance board is to handle complains of unethical and uncompetitive practices by market participants as well as to promote ethical standards among market members.
CHAPTER THREE: PROBLEM DEFINITION – REGULATORY GOVERNANCE IN A LIBERALISED ELECTRICITY SECTOR

In this chapter the nature of the problems related to governance and electricity regulation for the electricity sector is discussed. The Chapter draws on International experience, which is then linked, to the Botswana context. In defining the problem cognisance has been taken of Mintroff's strategy, which aims at avoiding error of the third kind. It does so by defining the problems around socio-cultural, socio-economic and technical / scientific issues (EMBA Notes, 2002).

A brief guide to the Chapter is as follows. Section 3.1 defines the problems associated with the current and proposed new electricity sector paradigms for Botswana and supported with international experience and views where applicable. The behaviour over time of the key variables is shown in Figure 3.1. The classes of problems indicated relate to governance and regulation. Section 3.2 discusses the arguments for relevance of the problems within the context of the electricity sector in Botswana.

3.1 Problems with Electricity Sector Governance and Regulation

3.1.1 Capacity to Regulate

The regulation of the electricity sector by the Department of Energy is weak under the current structure. The form of regulation is through policy for which there is no sector specific mechanism for enforcement. For example if a certain policy is not being complied with, the Department of Energy has no mechanism to deal with the situation. The situation is aggravated by what reflects a shortage in staffing for professionals responsible for policy for the industry. There are only two officers in the Department of Energy who are responsible for the entire electricity sector (Annual Report, Department of Energy, 2003) for the country,
and yet the industry has a turnover of 452 Million Pula and a workforce of nearly 2500 employees. The scope and detail of work involved in regulating an industry of such magnitude poses a serious challenge for only two officers. This has two implications: first policy debates cannot be rich enough as there is inadequate variety in the Department; secondly the chances of manipulating the staff over policy by stakeholders is real because fewness of staff; thirdly the number of staff who are responsible for regulating the industry is simply not enough.

3.1.2 Current State of Poor Regulation

Rossouw (2002) reported that in assessing the performance of National Electricity Regulator (NER) of South Africa, using world-class standards the results on the performance of the Regulator were shown to be as follows:

- Poor in the areas of: (i) work practices (predictable and consistent, clear and understandable); (ii) being proactive; (iii) being responsive with fast work cycle times; (iv) having knowledge of future (needs, threats opportunities); (v) having clear and understandable (policies, rules, roles and responsibilities);

- Below par in the areas of: (i) knowledge of the current industry; (ii) observing timeliness; (iii) ability of having applied regulatory judgement in an orderly and responsible manner; (iv) being flexible, appropriate, fit for purpose and on time for every situation.

There were several reasons advanced for this unfavourable state of scorecard, the main reasons being that the NER was not able to play a constructive role in interpreting and influencing appropriate government policy; electricity distributors were not able to file in their returns to NER as the existing controls were too complicated; the way in which NER implemented their rules and procedures were not predictable or consistent. (Rossouw, ibid.).

3.1.3 Data and Information Inadequacy and Gaps

Cook (2001) argues that data needed for regulation continues to be lacking on basic information, particularly in poorer countries, concerning markets and their
structure and on the ability of competition agencies to effectively evaluate claims of market dominance and strategic behaviour. Given the lack of information and institutional weakness found in low-income countries, private monopolies are more likely to exploit their position by influencing the regulatory environment or by evading regulation. Weak regulation of competition is likely to undermine the potential gains to be made from privatisation and deregulation. The problem here may not only involve lack of information but extents to defining the type of information that is actually needed.

The electricity sector in Botswana is underegulated thus the purpose of all current information and data are intended to serve management and bureaucratic needs rather than to application for regulating competition. This creates two kinds of problems for a new regulatory institution: the format and adequacy of data and information available is unlikely to meet the needs of regulating competition; secondly it indicates lack of industry-specific data.

Market participants need information access since long run competition requires that information be available to participants about opportunities and constraints in the market. As an illustration: "The Electricity Act of 1992 in the USA accelerated this process in that market (FERC, 1994) but there is a long way to go before anything like transparency concerning network costs exists" (Kahn 1995).

The efficiency of electricity markets is increasingly relying on the Internet for trading. However the concerns are that congestion on the Internet and the overwhelming volume of information are two important issues to consider as energy markets move towards a common-real time information infrastructure that permits trading of electricity (Ramesh 1997). It is therefore important to get information infrastructure right the first time.

3.1.4 Gaps in policy and legal framework

The establishment of a regulatory institution requires a supporting and enabling policy and legal environment. Reforms in the industry are intended to introduce
competition and enhance efficiency, and regulatory institutions by design must promote both but a challenge that can only be through regulatory and competition policies. On a positive side for Botswana, policies measures and implementation strategies to support establishment of governance and regulatory bodies are in place as shown in Table 1 (BEMP, 2004).

<table>
<thead>
<tr>
<th>Policy Measure</th>
<th>Implementation plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish an Electricity Regulator</td>
<td>▪ Enact an Act for a New Regulator</td>
</tr>
<tr>
<td></td>
<td>▪ Establish a governance body for the electricity sector following restructuring the electricity sector and establishment of an electricity Regulator.</td>
</tr>
<tr>
<td></td>
<td>▪ Enhance electricity sector capacity to implement electricity sector restructuring</td>
</tr>
<tr>
<td></td>
<td>▪ Establish an Electricity Regulator</td>
</tr>
<tr>
<td>Maintain the current and new regulatory responsibilities of EAD in the energy sector and enhance its capacity to implement policies and plans</td>
<td>▪ Identify new and current regulatory responsibilities of EAD, plans and policies to implement</td>
</tr>
<tr>
<td></td>
<td>▪ Enhance EAD capacity to regulate the energy sector effectively</td>
</tr>
</tbody>
</table>

Table 3.1 Policy framework aimed at establishing electricity sector regulator

However, competition policy has not been developed. Similarly the legal framework remains to be designed and adopted. These gaps in policy and legal environment are needed for the process of effective regulation.

3.1.5 Resources and Capacity for Regulatory Institution

The introduction of effective competition policy may require new institutions and these may be costly to establish. Low-income countries lack financial resources and the human skills that make the implementation of competition policy easy. According to Cook (2001) resource allocation to regulation, and implementation of competition policy remains low. This problem is not only confined to competition laws but also apply to electricity regulatory institutions. In the case of Botswana there is currently no competition law and there is lack of skills and management capacity to implement regulation effectively both during and after reforms.
3.1.6 Differences in Country Developments of Electricity Sector

There are differences in the ways in which liberalised electricity sector enterprises have developed in industrialised countries and developing countries. The implication in terms of regulatory policy is that a simple transfer of the lessons of regulatory policy from industrialised countries to developing countries may be inappropriate. Although countries have begun to introduce new competition laws, these can only be assessed through their effective monitoring, implementation and enforcement provisions rather than on the basis of the introduction of legislation. Our knowledge of how these have developed, the models used and how they are working is incomplete. More importantly competition policy will need to be credible if foreign investments flows, associated with the removal of restrictions on foreign investment, are not to lead to substantial increases in electricity sector that results in more control in domestic markets in poorer countries.

3.1.7 Environmentalists and Social Rights Activists

Environmentalists are concerned that reforms in the electricity industry worldwide should not harm the environment. In the context of Botswana, the concerns are similar, particularly about fears of introduction of generation technologies, which will harm the environment.

Social rights activists are concerned about three issues: the loss of employment that the reforms in the ESI in Botswana entail and citizen economic empowerment. Empirical evidence suggests that the loss of employment, if any, that will results from the reforms will be tackled through regulatory policy. On a different but similar note social activists representing the interest of citizens will seek citizen empowerment within the liberalised industry. They will want the rights of citizens to be included in the reform agenda. Citizen participation in investment, business opportunities will be some of the opportunities they will seek for their members. They are concerned that these social issues are unlikely to be addressed within the regulatory agenda.
3.1.8 Problems of Importing Models of Electricity Regulator

Minogue (2004, pp1) argues that current public management reforms in developing countries closely links public services improvement, and public management reforms, including regulatory governance are closely linked, however the reform initiatives in these areas are developing countries are likely to be ineffective because they embody models that do not engage accurately with the real economic and political conditions of these countries. In the context of electricity sector restructuring this calls into question key debates about the regulatory models we seek to introduce for the industry in regard to their appropriateness, and whether appropriate methodology has been applied to adapt imported models for our own use. The case of Botswana is relevant here. When the restructuring of the electricity sector begins, the option being mooted is to import a model for a regulatory institution without serious consideration for adaptation. This is part of the reason for this dissertation.

Smith (2003) in his study on comparison of privatisation of electric power in Malaysia and Thailand found that in Malaysia there was a rapid implementation of the liberalisation process brought about through closed policy process which resulted in a reduction in competition, increase in charges, and consumer complaints.

Efforts have been made to improve regulatory performance from a number of perspectives. The approach proposed by Kirkpatrick (2003, 14) that can be used to assess and improve regulatory proposals and evaluate regulations in developing countries fall under three categories of principles (i) building an effective regulatory management systems; (ii) improving the quality of new regulations, and (iii) upgrading the quality of existing regulations, to reflect particular needs of developing countries.

Each of the above principles contains a list of requirements and methodologies that has to be implemented in order to establish an effective regulatory regime.
Detailed scrutiny of the list reveals that systems approach has not been intentionally targeted either directly or indirectly as a means and strategy that can be applied to establish effective regulation.

3.1.9 Market Power

As already indicated elsewhere in this dissertation, BPC imports nearly 70% of Botswana's power demand through imports of which 75% is imported from S Africa and 25% is imported from the Short Term Energy Market (STEM) of the SAPP. The liberalisation of electricity sector in Botswana will as a result have a ripple effect upon the electricity sector in S African and the region through the SAPP (BPC Annual Report, 2003).

It is important to note that the bulk of electricity supplied in Botswana is sourced externally. This has serious implications and concern on regulation of the future liberalised electricity sector in Botswana in terms of market electricity importer will have on the market. The market power that will be brought to bear from such sources of imported power on the local market will distort disproportionately competition in the sector. The liberalised sector thus will have two sources of market power, imported power companies (Eskom and SAPP), the monopoly elements of the market (transmission and distribution) to regulate, both of which has the potential to wreck havoc on competition an emerging market.

Another major source of market power will be information asymmetry among market participants, which is difficult to eliminate without innovation in regulation will be able to track and reduce such information asymmetry.

3.1.10 Key Challenges of Regulatory Governance

Minogue (*ibid.*) indicates that as in all public policy, we find an "implementation gap" or what he refers to as "a reality gap": that is, the bureaucratic, political, social and economic realities typical of developing bear little relationship to the conditions necessary for reform models proposed. Yet these realities cannot be wished away: if reform is to be more that a rhetorical flourish it must in some
sense be rooted in, and responsive to real processes and existing forms of behaviour. The elements of the reality gap according to Minogue (*ibid.*) are as follows:

- There are serious gaps in our knowledge and understanding of the governance process in developing economies; these governance structures appear to serve a range of objectives other than efficiency; correspondingly due attention to process, i.e. how things really work in practice, is essential to effective governance reform;
- Transferred "best practice" models demonstrate clear adaptive variations in different countries, and it is likely that "blind" importing of these models from developed economies will be counterproductive where no account is taken of differences in legal infrastructure, bureaucratic culture, market realities, and political values;
- Regulation inside government remains widespread and this will bring resistance to stereotypical regulatory reform;
- A key task is to design governance reforms so that opportunities for corruption are minimised rather than elevated;
- Political institutions and relationships constitute a primary operating context for economic reforms; but these political factors frequently neglected or inadequately understood by external economic policy actors; in this respect the rhetorical nature of political commitment to such reforms is consistently underestimated. Well organised and institutionally entrenched political interests will often succeed in controlling or subverting economic agencies; nonetheless, authoritative and stable political interests can be a driver for economic reforms;
- Market reforms of basic public services are likely to meet political and user resistance if they reduce access, affordability, and quality, and the impact of these on poor communities is inadequately understood.

These elements suggest the need for better understanding of the role and operation of legal institutions and actors in regulatory systems that are politically and behaviourally constrained (Ogus, 2003). A study by Knight-John and Peruma (2003) in a paper prepared on impact assessment in Sri Lanka demonstrated regulatory weaknesses in that country due to flawed institutional framework, the
absence of explicit regulatory policy and the unchecked poor governance that has saturated every strata of state.

These examples point towards the need for better methods for developing regulatory frameworks. The importance of the research can be seen in the context of generating new perspectives on the debates about the reform and restructuring of the ESI in Botswana.

3.1.11 Manifestation of the Problems and Behaviour Over Time

The problems discussed in the foregoing sections are manifested in two key issues: introducing sustaining competition and enhancing efficiency of the electricity sector after reform. The problems are the symptoms of these two issues, which are in turn caused by the current regime of government regulation. The behaviour over time of the variables are depicted shown in Figure 2. Note that effective regulatory functions only begin to operate after reforms (post-reform). The purpose of an effective regulatory institution in a post-electricity liberalisation for Botswana and indeed other countries where reform has already taken place are three-fold:

- Introduce and enhance competition in the electricity market;
- Enhance efficiency of the industry through better investment decisions and better utilisation of existing plants and infrastructure;
3.2 Relevance of Problems in Research Context

3.2.1 Overview
The overall objective of this dissertation is to use a systems approach to analyse a general model of regulatory institutions (Electricity Market Regulator and Governance) for a deregulated Electric Supply Industry (ESI), as established in other countries, so that it is adapted to suit the peculiarities of the power sector in Botswana when deregulation is achieved.

The arguments for relevance are drawn from the perspectives defined by systems thinking (Ryan in EMBA notes, 2003) using socio-cultural, socio-political and technical/theoretical perspectives which are linked directly or indirectly to: efficiency; financing needs and markets; environmental pressures; a number of countries specific needs; ethics policy shift at the World Bank; and technological change.
It is important to note that these perspectives are affected by or affect the stakeholders of the power utility, which include the Government; employees of the utility; customers; society, business, and external stakeholders such as financial institutions (regional and international).

3.2.1 Efficiency

Publicly owned infrastructure industries, such as electricity utilities, have historically played an important role in underpinning economic development - however, weak operational, financial and investment performance, and poor management accountability, have caused governments to embark on fundamental reform and restructuring exercises.

Many governments have aimed to lower costs and prices through forcing improved efficiencies through commercialization and exposure of the industry to greater competition and private ownership. There have been few incentives for the publicly owned utilities to improve efficiencies and even those that had previously been well-regarded (like the old Central Electricity Generating Board of England and Wales) have subsequently shown (in their successor companies) marked efficiency gains in a competitive market (Dubash, 2001). A commercial and competitive environment exposes investors and managers' performance to market scrutiny. Incentives to reduce operating costs are sharpened. Prices tend to move to their lowest economic level. Investment decisions are exposed to their associated risk and innovation is stimulated. Customers are also begin to demand the right to choose their electricity supplier - thus also forcing greater competition, lower prices and pressures on improved costs and efficiencies.

The efficiencies and competitions desired in a liberalised electricity sector can only be realised and enhanced fully through an effective electricity market regulator and market governance body. This logic is linked to the concern that the present ESI regime cannot deliver more economic benefits as reflected in the tariffs, which are generally high compared to regional tariffs.
3.2.2 Market Participants and Competition

The participants in a deregulated market categorised by (Willis et al 2003) to include: *generators; purchasers; traders; brokers* will need information access since long run competition requires that information be available to participants about opportunities and constraints in the market.

The efficiency of electricity markets is increasingly relying on the Internet for trading. However, the concerns are that congestion on the Internet and the overwhelming volume of information are two important issues to consider as energy markets move towards a common-real time information infrastructure that permits trading of electricity. (Ramesh 1997). It is therefore important to get information infrastructure right the first time, without the functioning of the electricity market in Botswana will not produce the expected results of deregulation. An effective regulatory institution is well positioned as an enabler of appropriate market conditions to prevail; information infrastructure is a case in point.

3.2.3 Technological change

Traditional sources of cost reduction, for example economies of scale in power plant construction by large integrated utilities, have largely been exhausted. New technologies, specifically combined-cycle gas turbines (CCGTs), do not have the same economies of scale and allow new, smaller entrants to come into the market. Further, new information and communication technologies now enable more sophisticated system control that could include many different participants, as well as short-term electricity trading, in a way that was simply not possible in the previous decades. The concern is that the present scenario and regulation in Botswana cannot promote changes in power generation technology that will result in competitive prices or will drive costs and tariffs to their lowest possible economic levels without competition. Private investment has both the incentives and innovation to seek and promote more cost effective power generation technologies while complying with environmental concerns.
Deregulation and effective regulation represent opportunity to renew and sustain new technology in the power sector in Botswana.

3.2.4 Finance

Changes in capital markets, sector finance and fiscal pressures has affected financial resources for capital intensive investments in the power sector, both in developing and developed countries. Less finance is now available for large public sector infrastructure projects, including loans from the multi-lateral lending agencies. Governments are also increasingly reluctant to provide public sector financing. Indeed the reverse has been true - there are growing pressures to reduce their fiscal borrowing requirements and to sell off public assets to meet other social and economic objectives. At the same time globalisation of international capital markets has created new financing opportunities, often linked to the participation of private equity partners. These conditions are to a great extent true for Botswana. The concern is therefore to seek reforms and regulations that will promote regulatory functions to create conditions in which private finance can be sourced for developments in the electricity sector, particularly from the private sector.

3.2.5 Environment

Concerns about global warming and climate change, as well as a general consensus on the need to move towards greater environmental sustainability, have meant a slowing of investments in the large nuclear and coal fired plants favoured by the old large utilities, and has placed greater emphasis on the introduction of gas, and renewable sources of energy, as well as institutional reform to allow new investors to promote these options. The local power is generated from thermal plants which at the present levels of operation is not so much a threat to environment. But since Botswana receives over 70% of its energy needs, environmental pressures may be imposed on countries supplying Botswana with power. Therefore the concern is to have sustainable and flexible way of sourcing power for Botswana, which are not subject to unnecessary risks.
of security of supply, for example from environmentalist or shortfall in power availability in the region.

3.2.6 Country specific Drivers

There are a number of country specific drivers for reform new and with it regulatory institutions. For example, in Chile and the UK (the first two countries to undertake radical restructuring of their Electricity Supply Industries ((ESIs)) there was a strong ideological commitment to privatisation. The UK government also wanted to undermine the power of coal mining trade unions, and institutional reform was bound to challenge the old coal contracts and lead to a reduced reliance on coal as new investments were made in turbine technologies. In the US, the disparity in the electricity prices between the different states has been a major driving force. Customer groups have seen the introduction of competition as a way of obtaining cheaper power. In some cases the reform process may be initiated by a crisis, or perceived crisis such as the droughts in New Zealand and in Columbia in the early 1990s that affected hydro generation and caused both governments to consider different ways of organising their power sectors. In South Africa, there is the specific requirement to widen economic ownership and to promote black economic empowerment.

In Botswana the country specific concerns are rural electrification, which need to be pursued as a matter of government policy, the security of supply, affordable tariffs (particularly for the poor), continued employment, and citizen economic empowerment. The performance of current electricity sector and regulation in these areas are not getting better under current form of regulation.

Political interference in decision-making, and corruption of public officers in regulating the current public utility are possible sources of low morale and low productivity in the electricity sector. It is assumed that when the sector is liberalised and privatised, the incentives to perform will be sharpened through effective regulation.
3.2.7 Policy Shift at the World Bank and Ethical Approach to Lending

By 1998 a study of 300 World Bank power projects financed between 1965 and 1983 found a severe deterioration of in the performance of developing country power utilities over time, and called into question the Bank's basic approach of promoting supply expansion. Instead the review suggested a shift to promotion of efficiency and restructuring in the sector in borrower countries. Accordingly in 1993 a new world bank policy paper made reform in the electric power sector an explicit condition of continued lending in the sector in the borrower countries. The new policy called for developing countries to: establish transparent regulatory processes, commercialise and corporatise the power sector, allow for importation of power services in some cases, and encourage private investment in the sector. The Bank's new direction identifies environmental sustainability as one of the four lines of business the other being poverty alleviation, macro/fiscal stabilisation, and private sector development and governance.

3.2.8 Systemic View and Market Power

Systemic perspective seeks to identify the concerns involving human or social actions and interactions in a smaller context being also true in the wider context. The desired characteristics of the electricity sector market co-produced by all participants will be competition and efficiency. For these characteristics to emerge market power and information asymmetry remain a big challenge for the regulatory regime of the market.

The current ESI in Botswana which operated under the electric utility BPC is linked to Eskom of South Africa, whose ESI is a deregulated, and the South African Power Pool (SAPP) through electricity imports. BPC imports nearly 70% of Botswana's power demand through imports of which 75% is imported from S Africa and 25% is imported from the Short Term Energy Market (STEM) of the SAPP. The restructuring of the ESI in Botswana will as a result have a ripple effect upon the ESI in S African and the region through the SAPP (BPC Annual Report, 2003).
It is important to note that the bulk of electricity supplied is sourced externally. This has serious implications and concern on regulation of the reformed electricity sector in Botswana to achieve competition within the market following reform. The market power that will be brought to bear from the sources of imported power on the local market will distort disproportionately competition in the generation sector of the industry.

3.2.9 Ethical Perspective

Ethical considerations of regulatory institutions involve social justice pertaining to loss of employment resulting from privatisation in power sector; rural electrification as a social service involving electrification of poor rural households, urban electrification of poor urban households. Generally electrification of rural areas associated with poor households, in financial parlance is unattractive to investors under private ownership of the power sector because of the low rate of return on capital. However the current government policy clearly targets rural electrification as well poor urban households on the basis of social justice for electrification. Under deregulation and new regulatory regime there is need for government policy to be implemented with respect to poor household electrification. It is the regulator who is positioned to ensure that government policies are implemented albeit without force, but through innovative regulatory measures.
CHAPTER FOUR: RELEVANT LITERATURE SURVEY

4.1 Overview

The purpose of this chapter is to explore what literature offers on the diverse range of concepts and theories forming the theoretical framework upon which this research is based. The literature review covers four distinct areas (i) governance and regulation (ii) framework for systems thinking and approach (iii) tools for interpreting, conceiving, and understanding management problem (iv) and arguments of utility for the literature surveyed including ethical considerations.

A brief guide to the chapter is as follows: Section 4.1 is about regulatory and governance theories, and processes. Section 4.2 deals with the principles and processes for systems thinking and cybernetics, particularly systems dynamics and viable systems model (VSM). Section 4.3 is about tools for understanding, and interpreting problem situations in management – and includes metaphors, mental models, and development of theory. Section 4.5 summarises the theory of how organisations create value for customers drawn from the EMBA programme. Section 4.6 is concerned with the utility of the literature surveyed in the context of the research; and the final section concludes with ethical considerations.

4.2 Regulation

There are different notions of what constitutes regulation; however a broad and yet a practical and global definition that contains essential elements that are visible in the practice of regulation include control, source of authority, protection of public interest; safeguards against political interference is:
"the use of public authority to set and apply rules and standards" (Hood et al, 1999). In applying this definition it is essential to make a distinction between the following categories of regulation: regulation of business in which controls are exerted over private, non-state activities; regulation inside government where controls are exerted within and between government agencies, and between levels of national government. Yet other types of regulation include: international regulation which involves regulation of national governments by supranational mechanisms; self-regulation which is constituted by less formal alternatives that legislative or administrative rulemaking; and metaregulation, which implies an overarching systems for reviewing regulatory mechanisms within government policymaking processes (Minogue, 2001).

The concept of deregulation is linked to regulation and therefore both fall under the same field of analysis. When regulation is applied to competition, it provides a framework of objectives for regulatory system. According to Berg (2001) the Australian Competition and Consumer Commission (1999) has created the most comprehensive listing of functional aspects of regulation, and examined how these features contribute to the development of policies that balance the interests of various stakeholders. The list is reproduced below.

Communication: Information should be made available to all stakeholders on a timely and accessible basis.

Consultation: Participation of stakeholders in meetings promotes the exchange of information and the education of those affected by regulatory decisions.

Consistency: the logic data sources, legal basis for decisions should be consistent across market participants and over time.

Predictability: A reputation for predictable decisions facilitates planning by suppliers and customers, and reduces risk as perceived by investment community.

Flexibility. The agency should use appropriate instruments in response to changing conditions, balancing this regulatory discretion against the costs associated with uncertainty.

Independence: Autonomy implies freedom from undue stakeholder influence, which promotes confidence in the regulatory system.
Effectiveness and efficiency: Cost effectiveness should be emphasised in data collection and in the policies implemented by the regulator.

Accountability: Regulators should provide clearly defined processes and rationales for decisions. In addition, appeals procedures need to be specified to provide appropriate checks and balances.

Transparency: The openness of the process to stakeholders promotes legitimacy.

Berg (2001) identifies the following as the key regulatory functions in an electric power sector, from experiences around the world:

- Issuing licences,
- Setting performance standards,
- Monitoring the performance of regulate firms,
- Establishing / approving the level and structure of tariffs,
- Establishing a uniform accounting systems,
- Arbitrating disputes among stakeholders,
- Performing (often via independent consultancy) management audits on regulated firms,
- Developing human resource for the IRC,
- Reporting sector and IRC to the appropriate government authority.

For each of the above functions, the regulatory institutions need sufficient authority to carry out its responsibilities. There is a degree of consistency among these different studies about the areas of regulatory functions and suggesting a consensus regarding desired features of a regulatory process.

4.2.1 Theories on Regulation

Theories in regulation attempt to explain how regulation arises, develops, and declines. Most theories of regulatory origin and development can be seen as types of interest theory. Among the interest theories a broad distinction can be drawn between public, group and private versions as explicated by Baldwin et al (1999).
4.2.2 Public Interest Theories

Public interest theories centre on the idea that those seeking to institute or develop regulation do so in pursuit of public interest related objectives (rather than group, sector, or individual self-interest) (Baldwin, ibid.). Proponents of regulation thus act as agents for the public interest. The purpose of regulation from this perspective is to achieve certain publicly desired results in circumstances where, for instance, the market would fail to yield these. Implicit in this theory is assumption that expert regulator, who pursue the public interest are trustworthy, efficient, endowed with public values in and whom the public can have confidence. The public interest theory is still defended by commentators who argue for their development rather than abandonment.

Some analysts have pointed to the weakness of this theory from other angles. First the concept of public interest is not clear in the application of the theory. Secondly there are doubts about the efficiency and skills of regulators entrusted with enforcing regulatory rules and standards. Thirdly it is urged that theory understates the degree to which economic and political power influences regulation.

4.2.3 Interest Group Theory

Interest group theorist sees regulatory developments as the products of relationships between different groups and between such groups and the state. These theorists generally differ from proponents of public interest accounts in not seeing regulatory behaviour as imbued with public zeal but as a competitive power. Some accounts do however offer explanations of the public interest that take on board competitions between different versions of that interest. Some analysts points to the role of regulators in carrying out missions that legislators have negotiated between interest groups, consumers, businesses, and other affected parties – missions that affect compromises but are seen by participants, nevertheless to be attempts in pursuit of public interest. Such visions bridge public interest and group interest approaches.
There are versions of group theories, which range from open-ended pluralism to corporation. Pluralists see competing groups as struggling for power and elections as won by coalitions of groups who use their power to shape regulatory regimes. In contrast corporatists emphasize the extent to which successful groups are taken into partnership with the state and produce regulatory regimes that exclude non-participating interests.

4.2.4 Private Interest Theories

Private interest theories approach to regulatory developments are driven by pursuit not of public or group but private interest. This general approach encompasses theories going under a number of names, notably economic, Chicago, private interest, public choice, special interest, and capture. Some economists hover between group and private interest approaches. The Chicago approach as seen in the writings of George Stigler and Sam Peltzman suggest that where there was a failure of competition, or the existence of monopoly, there would be monopoly profit which the legislature would give the regulator the power to dispose of. The regulated industry thus would have an incentive to influence the regulator so as to benefit from a regulatory rent and there would be a market for regulation. This meant that the regulator would have to be captured by the industry since industry would have more to lose or gain than the regulator and more generally that in political contest compact organised interest would usually win at the expense of a diffused group. Regulation would thus go to those who valued it most and producers would thus tend to be better served by regulation than the masses of consumers.

4.2.5 Force of Ideas

The liberalisation programmes under Reagan and Thatcher in the 1980s, it is argued, did not stem so much from the pressing of private interests as from the force of ideas. Although ideas might be distorted by political considerations when being applied; they provide the essential basis of assumed social realities whereby political leaders explain and justify realistic options within narrow limits. It argued that liberalisation was driven not by interest group pressure but by
intellectually guided process of economic rationalism that managed to benefit
dispersed consumer groups at the expense of concentrated producer interests.
This argument might itself have difficulty in explaining why certain ideas take
root, how ideas can be separated conceptually from interests, or in accounting
for the patchiness of deregulation, but in so far as it conceded that ideas posses
a force of their own, the force of ideas approach does usefully qualify economists
emphasis on the market as the key factor in understanding regulatory
progression.

4.2.6 Institutional Theories

Sceptics of economic approach developed an institutional theories alternative
approach for explaining regulation. The core of institutional theory hold the notion
that institutional structure and arrangements, as well as social processes,
significantly shape regulation – that there is more driving regulatory
developments than mere aggregations of individual's preferences. Individual
actors are seen by institutionalists as influenced by institutional procedures,
principles, expectations, and norms that are encountered in cultural and historical
frameworks. Regulation is thus seen as shaped not so much by notions of the
public interest or competitive bargaining between different private interests but by
institutional arrangements and rules emphasised more strongly within
institutionalism than in, say, interest theories.

Organisational theorists have tended to focus on the role of organisational
structures and processes that are of industry wide, national, or international
scope and the extent to which individual choices are guided by shared
organisational experiences, expectations and understandings.

4.3 Governance

'Governance has several meanings to be useful, but the concept can be rescued
by stipulating one meaning and showing how it contributes to the analysis of
change' (Minogue, 2001). Here, however we shall consider the governance of
regulation and competition. Governance of regulation and competition is an essential ingredient in regulating competition. Minogue (2001) conceptualises that governance of regulation must be taken to cover the following:

- The whole range of government institutions involved in rule making and implementation;
- The public policy processes which involve this set of institutions;
- The interactions of public organisations and actors with private organisations and actors;
- The significance of political factors: political will and leadership; the interactions of political and economic elites; political interventions in rule adjudication (especially in the actions of the judicial or other regulatory actors); and the use of political relations either to achieve regulatory capture or to build trust relationships which underpin effective informal regulation;
- The system of public values, which provides the setting for regulation and competition.

It is at once evident then that a governance approach implies examination and analysis not only of the institutions and policies, but of the politics of regulation and competition.

Minogue (2001) argues that regulatory capture and political capture constitute serious threats and challenges in detracting regulatory objectives and processes meeting desired goals. Both regulatory design and implementation may be seriously weakened by regulatory capture in which in developed countries is usually taken to refer to a situation where regulatory bodies are independent of government, but through lack of expertise, or resources, or information come to depend too much on the regulated interests in the process of rulemaking and application. This might be considered undesirable where regulators effectively exercise policy-making powers. Political factors can also be significant in their effects on regulation, when regulation becomes a focus of political control, and a locus of political conflict, rather than a politically neutral instrument of efficient economic organisation.
4.3.1 Corporate Governance and Self-regulation

Punitive enforcement of regulatory rules may be less productive than a process in which rules are regarded as legitimate, and regulators are subject to transparent accountability regimes. Forms of self-regulation, private market governance, relations of trust are now seen as attractive regulatory options. It is now common to propose self-regulation as a more flexible alternative to regulation by public authorities. A key expectation of these approaches is the ability to internalise regulatory norms rather than impose them from outside. However it should be noted that self-regulation, co-regulation, and voluntary regulation are regarded as techniques of regulation rather than an alternative to it.

The benefits of corporate governance are clear: flexibility, capacity to utilise appropriate expertise, responsiveness to changing conditions, and lower institutional complexity. Equally clear are the costs: potential for abuse and bias, lack of transparency, and an orientation private rather than public interest. At the level of regulatory institutions, trust is at the heart of regulation. Regulators must be seen as competent, reasonable, and credible while at the same time trusting regulatory targets to exercise self-restraint and to accept public interest values.

4.3.2 Governance and the Electricity Sector

Barker et al (1997) defines governance as how decisions are made and implemented within an organisation. He identifies the four key questions that should be addressed in designing any systems of governance as: What decisions are made? Who makes them? How are decisions enforced? How are disputes resolved?

The effectiveness of any governance system can be judged only against set goals that relate to both outcome and process. According to Barker (ibid.) Some goals that governance would seek in managing electricity sector are:

- Electricity sector are not controlled by any single participant or stakeholder;
- The electricity sector market is fair;
- Reliability of energy supply to the sector is achieved;
- Decision making process is transparent;
- Operating rules can be changed in a reasonable period of time;
- The cost of governance is minimised.

According to McGowan (1991, pp 5) the relationship between government and utilities can be characterised as one of governance, which can be interpreted as a 'cluster of control relationships between public authorities and utilities'. The electricity sector in various countries, whether publicly or privately owned are subject to significant public governance, because they are a strategic industry in a country's economic infrastructure; and because transmission and distribution networks are viewed as natural monopolies.

Governance can take various forms: direct control through government ownership, more formal control through regulation, and the general control exercised through legislation pertaining to areas such as safety, environmental protection, investment, macroeconomic management and monopoly control (anti-trust legislation). Governance expresses the notion that, as part of the national political process, governments determine the forms of ownership and specific forms of control over the energy sector on the basis of their social and economic policies and ideological leanings. Governments control the electricity sector primarily in two ways. As the executive of the state, it controls publicly owned enterprises in terms of property rights; and if it enjoys the support of the legislature, it controls the electricity sector (private or public) through legislation (Steyn, 1994). Governments often choose to relinquish ownership of the electricity sector while maintaining legislative control and formalising the regulatory mechanism. The ownership and regulation of enterprises are thus always part of the wider governance equation, and must be evaluated in this context.

The four basic governance models are: multi-class stakeholder board; non-stakeholder board; single class board; and single for-profit corporation not affiliated with market participants (World Bank Technical Papers, 1997)
The details of these models are according to Barker as applies to electricity sector markets are provided below. These four basic decision making models dominate discussions of power pool governance.

(i) Model 1: A Multi-Class Stakeholder Board

A Multi-class stakeholder board is the club or legislative approach to governance. In its governance structure, most or all classes of users and owners are represented on the board. All who participate in the market designs it for a collective, self-governance. Collective governance tries to achieve independence through voting allocations and rules that attempt to balance the often-conflicting interests of different classes. It has been described as "independence by diffusion," but will fail to achieve independence if one company or one class has the voting power to block actions that everyone else supports.

(ii) Model 2: A Non-Stakeholder Board

A non-stakeholder Board tries to achieve independence directly. The Board is not meant to be a representative board. Board members are explicitly prohibited from having current or future financial interests in any market participants. The goal is to create a board that will represent the broader "public interest", not the commercial interests of any particular market participant. Board members are usually required to have professional qualifications and experience that are relevant to the activities of the pool. The principal danger of a non-stakeholder board is that it can become isolated and politicised.

(iii) Model 3: Single Class Board

In a single class board, one class controls decision-making. This has been the historic model for most of the old style tight pools that have operated in the USA. It is also the current approach in Chile where the largest club is effectively a club of large generators. Single class domination can be achieved directly by simply limiting voting membership to a one class. It can also be achieved indirectly by giving independent decision-making authority to committees dominated by one
class or by allowing the favoured class to select "independent" board members who are not really independent.

(iv) Model 4: Single-For Profit Corporation Not Affiliated With Market Participation

Most power pools around the world are organised as non-profit associations or corporations owned or controlled by some or market participants. An alternative is to create a single for-profit corporation not affiliated with any market participants. If this approach is adopted, governance becomes an internal corporate matter for the profit-making corporation. The Nord Pool electricity power pool in Scandinavia comes closest to this approach. It is a for-profit corporation that is indirectly owned by the governments of Norway and Sweden. Thus, it is probably not a good example of the for-profit governance model because government policies are likely to affect corporate decision directly.

4.4 Transaction Cost Theory – Market Governance Mechanism

The debates of why organisations exist have been at the centre of contest between organisational economists. Alchian-Demset approach explains the existence of managerial hierarchies and the existence of stockholders as a firm's residual claimants. Their approach, which focuses exclusively on team production, tends to obscure the nature of the firms (Clegg et al, 1996). The work of Williamson on why organisations exist now forms the core of transaction cost economics (TCT).

In Williamson's theory of TCT, "hierarchies and markets are instruments for completing a set of transactions" (Williamson, 1975 pp 8). As instruments for completing a set of transactions, markets and hierarchies are often called "governance mechanisms". Market forms of governance rely on prices, competition, and contracts to keep all parties to an exchange informed of their rights and responsibilities (Clegg et al, 1996, pp 117). Hierarchical forms of
governance, on the other hand, bring parties to an exchange under direct control of a third party. This authoritative third party then attempts to keep all parties to an exchange informed of their rights and responsibilities. In addition the third party has the right to directly resolve any conflicts that might emerge in an exchange. The TCT is based on the assumption that the economic actors engaged in transactions have bounded rationality and opportunism.

In an electricity market there are several lapses in this market form of governance. Market power, hazards of bilateral dependency on agreements; information asymmetry represent a sample of the problems associated with TCT (Carroll et al, 1999). It is important to note that market governance is less costly and has the benefit of capturing extant economic benefits. Market governance through hierarchical form, though not problem free is commonly associated with electricity market governance. An obvious disadvantage is that it is more costly to implement.

**4.5 Systems Thinking**

A system consists of two or more interacting parts, which co-produce the behaviours of interest to the observer and inquirer and satisfy the following conditions: system as a whole has one or more defining behaviours; the behaviour of each part has an effect on the behaviour of the whole; a system consists of essential and non-essential parts; the behaviour of the parts and their effects on the whole are inter-dependent; and a system may be closed or open. (EMBA4 notes, 2003). The parts of a system and the system as a whole may or may not be purposeful. Using these criteria, four types of systems can be identified: deterministic; animated, social or ecological (EMBA4 notes, 2003).

Senge (1994) interprets systems thinking "to encompass a large and fairly amorphous body of methods, tools, and principles, all oriented to looking at the interrelatedness of forces, and seeing them as part of a common process". The field of systems thinking, according to Senge includes cybernetics and chaos theory; gestalt therapy; and the dozen or so practical techniques for process
mapping flows of activity at work. The common thread linking all diverse approaches using systems thinking is that all system behaviour follows certain principles, the nature of which are being discovered and articulated.

Traditional Western Thinking is largely based on two major ideas. The first is reductionist – the belief that everything can be reduced, broken down or disassembled into ultimately simple indivisible parts. The second idea is that all phenomena, events and activities are explained by cause and effect relationships, where effects become the cause of other effects, ends become the means for other ends. (Daellenbach et al. 2002).

Therefore reductionist and cause-and-effect thinking need to be complemented with a third type of thinking, systems thinking. It explains the behaviour of components or groups of components in terms of their systemic role in the transformation process. (Daellenbach et al. *ibid*.). An important aspect of systems thinking is the search for appropriate boundaries to the system, that is, what is considered part of the system, what is considered part of the environment, and what is seen as irrelevant. Boundary choices always involve some degree of arbitrariness and need to be challenged and justified by way of boundary critique.

When evaluating system performance, rather than putting the main emphasis on efficiency of system activities ie how well resources are used for each activity, its main focus is on the effectiveness of the activities, i.e. how well the activities achieve the system's overall mission, objectives or goals. Part of systems thinking deals with setting these objectives and goals, such that they are congruent with the objectives of the wider system of interest.

According to Flood (1991) a system is able to sustain an identity by maintaining itself in a dynamic steady state in the face of and using its changeable environment, a process referred to as homeostasis. A system that maintains an identity and stable transformation processes over time, in changing circumstances is said to be exhibiting some form of control. Essential to this is the communication of information between the elements (Flood *ibid*.). A system stabilised by its control mechanisms, and possessing an identity can be further
understood through its emergent properties. These are properties relating to the whole system but not necessarily present in any of its part.

The implications of systems thinking are enormous. Systems thinking has enabled us to think about managing organisations at a higher level of abstraction than was previously possible. Instead of thinking about particular organisations and similarities between particular organisations; systems thinking requires that we think in terms of the general characteristics of the organisation itself such as cohesion, interdependencies, stability (Cummings, 1980). Systems thinking are a conceptualisation of higher order configuration than traditional science has previously considered (Cummings, ibid.). Systems thinking offer us a real prospect in understanding change.

4.6 Cybernetics

Cybernetics is the science of effective organisation, that is, the science that describes the general principles of growth, learning, and adaptation in complex dynamic systems (EMBA class notes, 2003). Cybernetics is concerned with all forms of behaviour as far as they are regular or determinate or reproducible as opposed to asking to know what a thing is or is not. The main perspectives or models of cybernetics are: management cybernetics and organisational cybernetics (Jackson, 2000). Management cybernetics model is the input-transformation-output schema and used to describe the operational activities of the enterprise that are required to meet the goals of that business / enterprise. Managers have to regulate, usually by feedback processes, the operations to achieve the objectives of the enterprise.

The second type, organisational cybernetics is encapsulated in Stafford Beer's Viable Systems Model. The model typifies the most important features of organisational cybernetics. Clemson (1984) distinguishes organisational cybernetics as second order, because it is capable of dealing with the complexity being observed as well as the observer. This contrasts with first order cybernetics appropriate for studying matter, energy and transformation.
According to Beer for a system to be viable it should have these key characteristics: capable of responding to environmental changes; the system has to achieve requisite variety; it must be able to respond to various threats and opportunities presented by its environment. These characteristics may be summed as: adaptability; requisite variety; feedback. In practice, if managers are to be effective, they should reduce external variety confronting them and amplify their own variety.

Cummings (1980) identifies cybernetics as a strategy for intervention in Organisational development. He argues that a cybernetic definition of intervention in organisational development involves organisational change, which may be seen as the management of an appropriate combination of both negative and positive feedback loops.

4.6.1 The Viable Systems Model (VSM)

The VSM, as the name suggests is a model of the organisational features of any viable systems (Jackson, 2000). According to Jackson, Stafford Beer constructs the model using as an example of any viable systems the workings of the human body and nervous system. His principle is based on the known viable system – the human body, which is the richest and most flexible viable system from his work in the *Brian of the Firm*. From this Beer builds up a model – consisting of 5 sub-systems of any viable system. In Beer's work in the *Heart of the Enterprise* (1979), he built up the same model from first principles of cybernetics. For applying the model to organisations, Beer sets out the same ideas in the form of a handbook or manager's guide in *Diagnosing the system for Organisations* (1985).

Returning to VSM, the model specifies five broad functions that must be carried out in any organisation that manages to both maintain internal stability and adapt to a changing environment. These functions are labelled system 1 – operations; system 2 – coordination; system 3- management; system 4- intelligence; system 5- policy (Clement, 1984). The viable system model also specifies the information
flows (i.e. the interactions) among the parts of the model. The various channels for information flow need to be functional, balanced relative to each other, and adequately large to handle the variety present at each point in the network.

According to Jackson, System 1 of any organisation is concerned with carrying out tasks that the organisation is supposed to be doing. Systems 2 are a coordination function, and under normal circumstances instructions from higher management should ensure that various parts of system 1 of an organisation is in harmony. In an emergency, however, each part of system 1 will try to act on its own best interest. This may lead to oscillations, and it is the job of System 2 to bring such oscillations under control. System three is a control function. It does not initiate policy but interprets it in light of internal data from system 2 and external data from system 4. System three implements policies from system 4 and supplies resources to system 1 to implement policies. It has to report information from systems 1 upwards to system 4 needed for policy. System 4 has two main tasks - it acts as a switch and switches instructions from lower systems to system 5 and to lower systems; it captures for the whole organisation all information from the external environment, which are relevant to the organisation. System 4 represents a point in the organisation where information both external and internal are brought together. System 5 is responsible for the direction of the whole enterprise. It represents all the qualities of the whole system to any wider system of which it is apart.

Espejo (1989) indicates that VSM offers a paradigm for problem solving. Its understanding offers a mental tool to approach the creation and design of effective contexts for the participation of people in human activities. Beer (1989) sets out a number of options that can be used by managers to balance the variety equations for an organisation satisfactorily. He suggest that managers can reduce external variety confronting them using these approaches: structural changes (e.g. by delegation, functionalism); planning (e.g. using priority); operational (e.g. management). In the same vein managers can amplify their variety through: structural changes (integrated team work); augmentation (e.g. use consultants); information (e.g. management information). The design described is intended to achieve three objectives: the organisation must have the
best possible model of environment relevant to its purposes; the organisation's structure and information flows should reflect the nature of that environment so that the organisation can be responsive; the variety balance achieved between the organisation and environment must be matched by an appropriate variety balance between managers and operations within the organisation.

Some of the major criticisms labelled against VSM according to Flood et al (1989) are: that it is an impoverished picture of the organisation because it neglects human actions at the expense of communications and control; that it emphasises stability at the expense of change; that it emphasises viability which may not necessarily be congruent to organisational goals.

4.7 System Dynamics

A system dynamic view is one that places emphasis on structure, and processes within that structure, assuming that this is how dynamic behaviour in the real world can be best characterised. System dynamics considers behaviour as being principally caused by structure; it is a theory of systems and dynamic behaviour (Flood et al, 1991 pp 62). System dynamics assumes that analysis of a situation can be undertaken from an external objective viewpoint and that the structure and dynamic processes of the real world can be re-created in both systems diagrams and mathematical models.

System dynamics in its broadest sense sees systems as "feedback processes" that demonstrate specific and orderly structure (Jackson, 2000). It is this causal structure that gives rise to the system's dynamic behaviour. In complex systems problems arise because of the number of variables and their inter-relationship through interacting feedback loops. According to Jackson (2000), Forrestor observed "The structure of a complex system is not a simple feedback loop where one system dominates the behaviour. The complex system has a multiplicity of interacting feedback loops. Its internal rates of flow are controlled by non-linear relationships. The complex system is of high order, meaning that
there are many system states or levels. It usually contains positive feedback loops describing growth processes as well as negative, goal seeking loops”. This suggests that cause and effect are often not closely related in either time or space. In a complex system therefore the cause of a difficulty may lie far back in time from the symptoms, or in a completely different and remote system. Causes are usually found not in prior events, but in the structure and policies of the system (Forrester, 1969)

System dynamics provides a suitable methodology for system inquiry because it supplies managers with "a tool set" they can use in systems design and problem solving. Qualitative systems dynamics cause and effect diagram provide a qualitative assessment of the relationship between system processes, information, organisational boundaries and strategy (Jackson, 2000). The diagram aids in estimating system behaviour and suggesting strategy design changes to improve the behaviour. The qualitative diagrams themselves might allow the managers and analysts to explore alternative structures and strategies both within the system and its environment, which might benefit the system.

The use of system dynamics is limited to simple-unitary thought. Flood et al (1991) point out that critics of different persuasions criticise system dynamics for failure to fully embrace subjectivity of any analysis of social systems.

4.8 Mental Models

"Mental models are the images, assumptions, and stories which we carry in our minds of ourselves, other people, institutions, and every aspect of the world" (Senge, 1994, pp 235). Mental models plays a key role in enabling people to understand what they think about the world. The way we order our thoughts, construct our mental representations of reality around us is the way we build our mental models. Mental models are deeply held, often subconscious sets of assumptions about how the world works. They affect our perception and evaluation of the situations we encounter. Balle (Ryan in EMBA notes, 2002) indicates that mental models tend to follow three general rules: consistency,
stability and simplification. The consistency of mental models means that many people find it difficult to maintain contrary beliefs. A person may experience intense stress when and anxiety created by cognitive dissonance when a person's experience is contrary to his beliefs. Mental models are stable and tend to resist change. Under the circumstances people tend to hold on to their beliefs, attitudes, opinions and even prejudices. Usually this leads to situations where people become dismissive in the event of cognitive dissonance. Mental models are simplifications of the real world and in that interpretation they work as maps of reality and as such they are often oversimplified.

Lissack (2000) describe mental models as "toolsets" for understanding the world. Mental provides a means for individuals and ultimately organisations to create and share understanding. He also sees mental models in other roles, such being a source of action; enabler of creativity and obstructionism. A creative mental model allows us to see what we haven't seen before; it gives context for creativity and action to happen. An obstructionist mental model is one that fails to reflect dependence on a context. It is the role of mental models as "toolset" that will be applied in this research in making sense of answers that will come out of the inquiry process.

Kelly's construct theory analyses a personal construct psychology focusing on the complete purposeful person as an active agent in his/her own right, not simply as a personal stimuli. Kelly's epistemological assumptions are that there is no objective knowledge of reality, but that reality can only be known through our constructions, which are subjects to constant revision; we do not have direct access to an interpretation free reality. Mental models provide us with a perspective of understanding Kelly's construct theory.

Part of this dissertation is involved with qualitative (action) research in which Kelly's construct theory will be used to make interpretations within the research inquiry process.
4.9 Metaphors

The purpose of metaphors is to help in clarifying issues and ideas in a situation so that we are better placed to deal with the problem in the given context. The study of organisations through systems thinking is vastly enhanced through the use of appropriate metaphors referred to as systemic metaphors. EMBA class notes, 2002) Balle identifies five metaphors at a general level, which capture insights of almost all management and organisational theory.

- Machine metaphor, or "closed system" view,
- Organic metaphor, or "open system" view,
- Neurocybernetic metaphor or "viable system" view,
- Cultural metaphor, and
- Political metaphor.

In the current research the organic metaphor and neurocybernetic metaphor are relevant and are discussed further.

Morgan (1998 pp3) points out that using multiple metaphors to understand organisation and management gives us capacity to tap different dimensions of a situation, showing how different qualities of the organisation can co-exist, supporting, reinforcing, or contradicting one another. For example it can extend insights into situations and can suggest actions, which may not have been possible before. Thus insights generated by metaphors are not just theory but are practical. Metaphors lead to new metaphors creating several interlocking competing and complementary insights.

Morgan however cautions us about the limitation of metaphors. He argues that when metaphors' insights are taken to the extreme they constrain our ability to gain an overall view of a situation. Most of what management theorists say about the insights metaphors offer are positive. However the reality is that metaphors have limitations and create distortions of a given situation.
4.9.1 Neurocybernetic metaphor

The view of Balle is that neurocybernetic metaphor emphasises active learning and control rather than the passive adaptability that characterises the "open system" view. The focus of neurocybernetic metaphor is on information processing and viability within the theory of management and organisation. Morgan suggests that by thinking of organisations as brains we can begin to understand how to intervene in organisations through four fundamental ways:

- We focus on learning abilities and processes that can either stunt or enhance organisational intelligence.
- We discover how the findings of modern brain research can be translated into design principles for creating learning organisations.
- We learn how intelligence can be distributed throughout the enterprise.
- We see how the power of information technology can be used to develop decentralised modes of organisation that are simultaneously global and local.

The strengths of these interventions seen through the metaphor suggest actions that can be taken to improve the organisation in a number of ways. The metaphor gives clear guidelines for creating learning organisations; it indicates how information technology can support intelligent evolution; it gives a new theory of management based on the principle of self-organisation; and leads to the recognition of the importance of dealing with paradox.

Balle indicates that the metaphor has two limitations: that there may be conflict between the requirements of organisational learning and the realities of power and control; and that learning for the sake of learning can become just another ideology.

Jackson (2000) suggests that neurocybernetic metaphor emphasises active learning rather than passive adaptability, which characterises organismic view. When we think of organisations in this context we should see them as embracing active learning so that they are able to adapt continuously with the changes in environment. According to Jackson, Galbraith (1997) developed his view of organisations as information processing systems. He argued that the best design of an organisation was seen as contingent upon the uncertainty and diversity
surrounding the basic task undertaken by that organisation – since this determined the amount of information that would have to be processed. In practice if the task of uncertainty was low, then organisational structures with their low information processing capacities were enough. However if the task uncertainty was high, alternative organisational structures would be required based on strategies either to reduce the need for information processing or to increase the capacity for it. This is consistent with Ackoff’s law of requisite variety. Clearly information processing capacity is dependent on structure of the organisation. From this argument it is evident that structure is fundamental in the design for organisational fitness.

In his more recent work Morgan (1997) in his treatment of organisations as brains, more attention is given to learning organisations and how they can be created. He suggests that if organisations are to learn, they must scan the environments, relate relevant information to their operating norms, detect deviations from goals and objectives, and take corrective action if necessary. They must also possess the capacity for "double loop" as well as "single loop" learning. Single loop learning allows the correction of deviations from goals and objectives established on the basis of existing norms. In double loop learning there is questioning of the norms themselves. Organisations then become capable of "learning to learn", questioning the actual appropriateness of what they are doing.

This aspect of the metaphor is critical for regulatory institutions associated with electricity sector regulation. Note that the electricity market is relatively new compared to other network industries. There is plenty of learning and understanding to be done if the regulatory institution is to be effective.

4.9.2 Organic Metaphor

Organic metaphor is associated with open systems as observed from organisms or organisations. Flood and Jackson (1991) conceives organism as a system of complex network of elements and relationships that interact forming highly organised feedback loops, existing in an environment from which it draws inputs
and to which it dispenses outputs. They describe an open as homeostasis in that it exercised self-regulation and exhibits characteristics of survival and adaptability. Morgan (1998) identifies an organisation with the organism metaphor in three ways:
  - The metaphor helps us understand organisations as clusters of interconnected human, business, and technical needs.
  - It encourages us to learn about the art of corporate survival.
  - It urges us to develop vibrant organic systems that remain open to new challenges.

Morgan points to the strengths of the metaphor as serving organisational understanding in two ways: it suggests the organisations must always pay close attention to their external environments; and that the managerial tasks should aim at achieving congruence with the environment. He also alludes to the following as the key limitations of the metaphor in relation to organisations: organisations are not organisms, and their environments are far less concrete than the metaphor, the metaphors overstates the degree of functional unity and internal cohesion.

Jackson (2000) points out that both formal and informal aspects of organisations are granted attention in the organismic model. If organisations are like organisms, it is clear what must be done to correct any malfunctions. The sub-systems must be examined to ensure that they are meeting the needs of the organisation, and the organisation examined to ensure that they are adjusted to its environment. A managerial subsystem is charged with this task.

In the context of this research, the regulatory institution must be adaptable to new development within the market. The organismic view helps to visualise the electricity sector market as continuously adapting against threat from market participants who hold market power.
4.10 Theory

Karl E Weick has suggested that there may types of claims that are often confused with theory. Bodies of text often contain one or more of these, claiming theory. He explains that these claims are not theory as they do not constitute logic, or relationships or explanations on their own. Clegg et al. (1996) notes that the overall process of theory development is a continuous cyclic process in which the combination of the developing theory from the research and implicit pre-understanding informs action, and reflection upon the action informs the theory development.

Weick (1995, pp386) suggests that researchers tend to be generous with the label of theory. He illustrates this when he says theory belongs to the same family of words such as "guess", "speculation", "suppositions", "conjecture", "proposition", "hypothesis", "explanation" and "model" do. He suggests that the word theory should not be too rigorously implemented but should be taken to mean "a system of assumptions, accepted principles and rules of procedure devised to analyse, predicts, or otherwise explain the nature of behaviour of a specified phenomena".

Theory may be viewed as a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses and the whole system is bounded by the theorist's assumptions as indicated in Figure 3 (Bacharach, 1989, pp498-499)

Figure 3: Elements of theory
The notion of boundary in theory is based on assumptions which include the implicit values of the theorists and often explicit restrictions regarding space and time.

To the extent that the theory is not long-range the goal of organisational theoretical systems and statements can be empirically tested, and provide some source of explanation and prediction. The use of criteria should improve theory building and evaluation by ensuring the delineation of theoretical boundaries while at the same time explicating the assumptions on the boundaries; ensuring a common language of constructs and variables across levels; specifying distinctions between propositions and hypothesis; improving the parsimony of our theories (Bacharach, 1989).

Whetten (1989) characterise what and how of a research as providing frameworks for interpreting patterns, or discrepancies, in our empirical observations. This is an important distinction because data, whether qualitative or quantitative, characterise theory and on the other hand provide explanations for the characteristics. Therefore we must make sure that what is passing as good theory includes a plausible, cogent explanation for why we should expect certain relationships in our data. Together these three elements provide the essential ingredients of a simple theory, description and explanation of relationships.

In the case of qualitative research search, such as the one I propose to undertake, this suggests that there will be a close interconnection between what may emerge from the data and what will emerge from the implicit, and explicit use of theory for driving intervention. The theory to be developed in my research will reflect Whettens's interpretation of theory. It will aim at diminishing the complexity of the empirical world on the basis of explanations and predictions.

### 4.11 Utility of Literature Surveyed

The implications of the literature point to several dimensions that are required in focusing on the research questions; namely:
(i) How can systems approach be applied in analysing and diagnosing the generic model of electricity regulatory institutions (electricity regulator and governance body) in a deregulated electricity market?

(ii) What are the contextual characteristics of the environment of the electricity industry in Botswana?

(iii) How can the results of the analysis and diagnosis of a model of electricity regulatory institutions and the results of study of contextual characteristics of the environment of the electricity industry in Botswana be integrated to design a model of regulatory institution adapted to suit Botswana but more effective than its erstwhile models?

The categories of issues that emerge from the literature are: generic model of electricity regulatory institutions which forms the unit of analysis and diagnosis; this captures theories on regulation, governance; systems approaches that will be used as tools for analysis and diagnosis of the model and the help of metaphors in that approach; mental models needed for interpreting and understanding the contextual environment of the sector; theory building to use in creating and conceiving new insights resulting from the analysis and diagnosis, as well as the contextual environmental scan of the ESI in Botswana.

We now discuss the utility key areas of the dimensions of utility of the literature.

4.11.1 The Generic Structural Model of an Electricity Regulator

Berg (2001) identifies the following as the key regulatory functions in an electric power sector, from experiences around the world: issuing licences, setting performance standards; monitoring the performance of regulate firms; establishing / approving the level and structure of tariffs; establishing a uniform accounting systems; arbitrating disputes among stakeholders; performing (often via independent consultancy) management audits on regulated firms; developing human resource for the IRC; reporting sector and IRC to the appropriate government authority.
The use of Berg’s regulatory functions can be the basis of a generic functional model of an effective electricity regulator with a form of functional structure depicted in Figure 4 below.

Figure 4 Generic functional model of an electricity market regulator

The above generic model can be analysed / diagnosed using systems approach to determine its fitness in terms of functional and effective regulation.

The model ignores human interactions and only reflects what the functional characteristics of the electricity regulator should be, that is, but does not indicate the human or individual interactions and relations. In addition it does not show what type of skills are needed for the functions nor does it explain fully what their roles should be. This is the weakness of the model.

Another weakness of the model is that there are several functions, which are not represented: information flows and control; and the links with the external
environment. As a result is not easy to apply this model in practice for diagnosis or analysis for viability.

The strength of the model however can be seen from the VSM perspective – and it is in that light the model has value in this research. From that perspective, the above generic model can be analysed / diagnosed using systems approach to determine its fit in terms of effective regulation. The views of Government, Public Enterprises Evaluation Agency (PEEPA), Botswana Power Corporation, major consumers (the mining companies), and investors will be solicited during the course of the research as inputs for analysis. Officials from deregulated power sector in the regions will be another source of data and information on the analysis of this model.

4.11.2 Market Governance Body

Four types of models of market governance board (World Bank Technical Papers, 1997) have been indicated in the literature, each has advantages and disadvantages in the Botswana context. The Electricity market in Botswana will not be markedly different from other similar markets in developed or developing countries in respect of categories of participants. The market will consist of the following types of participants: electricity generators, transmission and distribution system operators, market operators, brokers, and traders. The Market Governance Board will preside over issues of fair competition in the market and its composition will take any of the four forms indicated.

The form of governance Board is usually a function of history of the electricity sector in a particular country. For example in the USA a single class board is preferred; and in many parts of the world model four (single-for profit corporation not affiliated with market participation) is preferred. The non-stakeholder model is best suited in situations where the Board is intended to be representative. In the multi-class stakeholder board all classes of market participants are represented.
4.11.3 Cybernetics

In the context of electricity market in Botswana, cybernetics will be applied to analyse and diagnose the generic model of electricity regulator using the VSM in the first phase, and in the second phase will be used to redesign an electricity regulator organisation for Botswana’s electricity market.

The analysis and diagnosis of generic model will be based on systems identification according to the organisation of the VSM and systems diagnosis based on cybernetic principles.

The second phase will take a broader view of the electricity sector and assume as follows shown in Figure 4:

- That the electricity market is the supra-systems-level of recursion 0 (R0) – the electricity market for Botswana comprising Generation Companies, Transmission and Distribution System Operator, Market operator
- Electricity regulator is the system of interest – level of recursion 1 (R1); - the electricity regulator for Botswana
- Units within the electricity regulator – level of recursion 2 (R2) – viable units within the Botswana electricity regulator.

Figure 4-1: The organisation of the liberalised electricity sector in Botswana as supra-system.
In the second phase of the redesign, the key issues that will be addressed are communication between the three levels of hierarchy and regulation.

This approach may be seen in the context of what Clement (1984, pp 125) says about large organisations that reflect ways that support of the model used above to harness the laws of cybernetics as follows:

(i) Large organisations are treated as relatively autonomous organisations systems nested within autonomous larger systems. This characteristic reflects the following laws:

- System holism; each autonomous system is treated holistically;
- Recursive systems: each level within the overall structure has the same internal structure of systems one-two-three-four-five.

(ii) Attention is focussed on communication flows within the market and the following laws are important:

- The law of Requisite variety;
- Feedback laws;

(iii) Each system one is treated as self-organising (ie autonomous) systems by its system two-three-four-five

The problem with the above approach is that the liberalised electricity sector in Botswana is not an organisation but an electricity market. The sector is an electricity market, which has significant differences with, what an organisation is. The difference is manifested in leadership and management. This makes the application of cybernetic principles to break down, particularly the VSM.

In terms of control and communications, however the market has striking similarity to an organisation and from a systems point of view and the use of cybernetic laws to regulate the market as exercised by the electricity regulator seems adequately justified.

The command and control strategy in the context of the market using cybernetic approach for the market is not possible. This is the result of the market not being an organisation.
4.11.4 Systems thinking

Systems thinking will be applied to deal with the following systemic intervention in through identification of issues and elements that can be applied to managing electricity market by the regulator more effectively. It will be used to gain insight into the following, associated with the electricity sector in Botswana which are a reflection of systemic management practice as argued by Ryan (EMBA notes, 2003).

- Multiple perspectives from stakeholder: politicians, society, and industry stakeholders, and technical scientific.
- Bounding the industry – to include or exclude systems of interest to the electricity market in Botswana;
- Process thinking that provides insight to the current state of the electricity sector, the problems embedded in it as a historical product. The interaction of the industry with the environment in Botswana will be part of the process thinking;
- Relationships will involve both vertical relationships and horizontal relationship within the electricity sector. The vertical relations involve the industry and regulators and policy organs, notably Government and PEEPA while horizontal relations involve the industry and its suppliers and customers.

In the research context, systems thinking will be constrained by the nature of the research problem, in which the problem being solved is for a future situation. That is the governance and electricity regulator for which this research is being undertaken has yet to be established. This extends to the liberalised electricity sector. The use of process thinking as proposed above will be predictive rather than actual. However problems of the industry embedded in the historical past will be relevant.
4.11.5 Metaphors and Mental Models

As argued in literature, metaphors and mental models are essentially tools that will be applied to help us make sense of the evolving needs of management research and other similar situations. The organic and neurocybernetic metaphors depicted in literature are relevant for articulating and enabling intervention of cybernetics in the current research of regulation of electricity market in Botswana – essentially because it deals with control and communications.

Mental models are applied for interpreting what we see in the industry by enabling us makes sense of them.

The limitations of metaphors chosen, namely neurocybernetic and organismic metaphors are that they will severely distort the context. For example, the response to uncompetitive behaviour in a market by an electricity regulator is not as swift as in humans systems when a sickness strikes or occurs in an individual.

Mental models represent barrier in our understanding of operation of a liberalised electricity sector when one has been used to a government regulated, owned and controlled electricity sector. For example, thinking about differences in quality of electricity. In Botswana the electricity service is good, with no significant flickers or brownouts under the current government regulated industry. This is likely to be the same when the sector is liberalised. So what will be the difference in the quality of electricity supply?

4.11.6 The Ethics of the Utility of Literature Survey

The ethical dimension of the utility may be captured in this question:
What are the utility of ethical considerations and issues contained in the literature reviewed if any?

The fundamentals of the electricity sector is that it is divorced from ordinary people, whether one is considering policy issues, participation in decision
making, social justice regarding electrification for both rural and urban poor, the environment – particularly with regard to introduction of generation technology, technology issues. Professionals, politicians, government officials and bureaucracy, and sector specific specialists deal with most of these matters. The constraint prohibiting the participation of the majority of ordinary people in debates on the management of the electricity sector and its benefits or burdens to society is embedded in the lack of knowledge exhibited about the sector. The literature surveyed indicates that the utility of the literature is not associated with ordinary people.
Chapter 5: Research Methodology

5.1 Overview
This chapter deals with the strategy for methodology – and covers research philosophy, social theory, systems approach, problem contexts, and methodological processes and techniques. The selected frames in each category of research methodology has been indicated and justified. The detailed research strategy is captured in Table 5.2, which also doubles as a guide to the chapter.

5.2 Research philosophy

The debate of research philosophy in management research is important for several reasons (Smith et al 1991):

- Clarifies research designs and by which data is collected and analysed;
- Helps the researcher to recognise which designs will work and which will not;
- Helps the researcher identify, even create, designs that may be outside his past experience.

In what follows an attempt has been made to discern the research design strategy applied in this research in terms of research philosophy, and systems approach.

5.2.1 Positivist and Phenomenology Philosophies

The debate among social science philosophers on the philosophy of research philosophy is based on two extreme positions: the phenomenology and positivism and between these two is pragmatism. The positivist position is that the social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through sensation, reflection or intuition (Smith, ibid.). According to Comte (in Smith et al) all good intellects have repeated that there can be no real knowledge but that which is based on observed facts. The assumptions underlying this claim are
two fold: reality is external and objective; secondly that knowledge is only of significance if it is based on observations of this external reality.

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Table 5.1: Research design strategy elements used & their sections in the Chapter.
Phenomenology, which originated around the middle of the last century and later than positivist, is the notion that reality is socially constructed rather than objectively determined (Smith et al, ibid). Hence the task of the social scientist should not be to gather facts and measure how often patterns occur, but to appreciate the different constructions and meanings that people place upon their experience. One should therefore try to understand and explain why people have different experiences, rather than search for external causes and fundamental laws to explain their behaviour. Human actions therefore arise from the sense that people make of different situations, rather than as a direct response from external stimuli.

5.2.2 Epistemological and Ontological Philosophies

Epistemology and ontology assumes research philosophies, which are akin to phenomenology and positivist respectively. My interpretation of epistemology is that it is a form of knowledge – based on empiricism at one end and rationalism at the other extreme end. Epistemology holds a similar philosophical position as phenomenology reflecting a system of interpretation that helps us perceive and conceive ourselves, our contacts and interchanges with others, and everything else in our experiences in a variety of ways. It is both a method of research as well as a philosophy.

As indicated, one extreme end of epistemology is rationalism and the other is empiricism. Rationalism considers reason and not our sense as the primary source of knowledge and truth and logic, analysis and rationality as based on innate concepts. In contrast, empiricism proclaims that all knowledge as arising from sensory real world experience and not from innate concepts (EMBA class notes, 2003)

Ontology as a research philosophy, according to my interpretation, is positivist and refers to metaphysics of reality. It refers to the object of knowledge. It considers reality to fall between a continuum of two extremes: idealism and realism. Idealism takes the view that there is no reality independent of the mind
and mental states and that reality is mental not material. In contrast realism refers to real objects which exist in the real world independently of the mind and that their meaning exists within them and can only be explored quantitatively. Some aspects of my research will be positivist. Many aspects of the electricity sector are based on physical and functional laws. For example the technologies available for generation, transmission and distribution are all real systems that have to function as designed.

5.2.3 Pragmatism

Pragmatism occupies a compromise position between epistemology and ontology and combines both philosophies as a research philosophy: on the one hand there is epistemological position of pragmatism and on the other hand there is the ontological positioning of pragmatism.

The underlying philosophy of epistemological position of pragmatism is that it involves the construction of maps or images of a particular territory or real world being studied and the testing of these maps and images through exacting scrutiny of the real world. The inquiry process seeks maps and images that can successfully handle and accommodate the resistance offered by the obdurate real world. We come to know the obdurate character of the real world through a careful and honest study not by forcing some outside conceptual and theoretical model on it.

The underpinning philosophy of ontological position of pragmatism is that the real world out there, which I can know to the degree that I can indicate and refer to the objects, exists in the form of my pictures or maps and conceptions of it. The map and pictures change as to resolve a particular resistance that the object offers (EMBA class notes, 2003). My understanding of ontological pragmatism is that its a qualified positivist philosophy. The nature of reality of objects as interpreted through the philosophy of ontology is based on my maps and conceptions, which has to change to overcome dynamic problems that prevent me from determining to the extent possible the reality of the object.
5.3 Philosophical Approach to the Research

Having reviewed the main research philosophies and considered the research questions in relation to these philosophies; Burrell et al (1979) proposed a structure, shown in Table 5.1, based on positivist and phenomenological paradigms that could assist researches to determine the most appropriate choice of philosophy to use.

<table>
<thead>
<tr>
<th>Basic beliefs:</th>
<th>Positivist paradigm</th>
<th>Phenomenological paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>The world is external and objective</td>
<td>The world is socially constructed and subject to change</td>
<td></td>
</tr>
<tr>
<td>Observer is independent</td>
<td>Observer is part of what is observed</td>
<td></td>
</tr>
<tr>
<td>Science is value-free</td>
<td>Science is drive by human interest</td>
<td></td>
</tr>
<tr>
<td>Research should:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focus on facts</td>
<td>Focus on meanings</td>
<td></td>
</tr>
<tr>
<td>Look for causality and fundamental laws</td>
<td>Try to understand what is happening</td>
<td></td>
</tr>
<tr>
<td>Reduce phenomena to simplest elements</td>
<td>Look at the totality of each situation</td>
<td></td>
</tr>
<tr>
<td>Formulate hypothesis and then test them</td>
<td>Develop ideas through induction from data</td>
<td></td>
</tr>
<tr>
<td>Preferred methods include:</td>
<td>Operationalising concepts so that they can be measured</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using multiple methods to establish different views of phenomena</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.1: Philosophical positioning chosen for this research as shown in the shaded area.

The choice for elements of philosophy adopted for my research is shaded in the Figure above. The approach embodies features combining positivist paradigm phenomenological paradigm as a means of research inquiry.

5.3.1 Justification for Philosophical Approach

The regulation of the electricity sector in Botswana following reforms and deregulation will be concerned with enforcing control through rules, standards and quality in order to cultivate and sustain competition and efficiency within the industry entities and enterprises. Governance on the other hand will be concerned with ethics, value and other normative management issues. The justification for philosophical approach may be considered along systems thinking as proposed in EMBA4 notes (2003).
(a) Scientific / Technical issues

The technical aspects of the industry involving operations of generators, transmission and distribution systems associated with regulation of acquisition, commissioning, operation, and decommissioning are based on hard facts regarding operations. The operational standards and codes of practice should be followed. For issues relating to planning and management of regulation and governance of these technical and scientific resources I propose to use systems methods, cybernetics and systems dynamics. For example Piaget, according to Jackson (2000) is complementary about the achievement of cybernetics in synthesizing information and communication theories with guiding regulatory theories.

(b) Social

One of the challenges of regulation and governance following electricity sector liberalisation reforms will be concerned with the social obligation to implement electrification particularly rural electrification, where investors will be discouraged with poor returns on investments and as a result are unlikely to invest in that area. The government however will be concerned that rural electrification should be pursued in compliance with government policy. There are several ethical and social issues that require multiple perspectives. The use of qualitative research to elicit views from rural community, government policy makers, the utility management for perspectives on ways and means that regulation and governance in a liberalised electricity sector in Botswana will sustain rural electrification. Thus phenomenological philosophy applies in this case. Struebert (in EMBA4 notes on qualitative research, 2003) states that qualitative research offers the opportunity to focus on finding answers to questions centred on social experience, how it is created, and how it gives meaning to human life.

(c) Stakeholders / Individuals

Employees within the electricity sector will be affected by the liberalisation in the sector. Other stakeholders (such as industries; commercial sector and the mining
sector) and individuals (such as investors, businessmen) may hold insights and perspectives, which can enrich the design of the management of regulation and governance of the electricity sector before liberalisation. A phenomenological approach through qualitative research will be appropriate.

5.4 Sociological Paradigms

Sociological paradigms capture the main categories of relationships between people and society and their interactions. The understanding of sociological paradigms helps us to understand, explain and interpret what organisations are about and their interaction. The paradigms guide us on the most effective ways in which we can intervene to deal with organisational problems and issues.

Jackson (2000) reviews the work of Burrell and Morgan on their perspectives of sociological paradigms, which relate to people and society and their interactions. The paradigms are broadly classified under four categories: Functionalist, interpretive, emancipatory and postmodern. The four categories paradigms are constructed around the different assumptions that social scientists make about the nature of social science and about the nature of society. These paradigms are.

5.4.1 Functionalist paradigm

As the name implies, it refers to a state of a systems functioning well to promote efficiency and effectiveness to ensure survival and adaptation. The use of scientific methods by managers and technocrats to understand parts of the systems and interrelationships between them are critical tools of intervention and troubleshooting intended to deal with system problems. The understanding of this paradigm is enhanced by the use of metaphors – such as "machine", "organism", and "brain".
5.4.2 Interpretive paradigm

The relations between people, social systems and their interactions create objects. Interpretive paradigm is about how people understand, interpret and get meaning of the real world of objects created by relations and interactions between people, social systems. The relations and interactions of people in organisations need to be interpreted appropriately by managers to enable and appropriate mode of intervention that promotes the development of the organisation. The "political" metaphor and "culture" metaphor are useful tools for understanding the interpretive paradigm.

5.4.3 Emancipatory Paradigm:

This paradigm refers to situations and conditions, which characterises people, individuals, groups of people in society or organisation who are aware of forms of domination or oppression that are a result of abuse of power or authority in organisation. As a result of that awareness people who are victims of domination encourage means and ways of transformation of "status quo". Examples domination of related to this paradigm are: sex, race, disability. Example of metaphors which are associated with this paradigm are: "instruments of domination" and psychic prison.

5.4.4 Postmodern paradigm

This paradigm takes the view that organisations are too complex to understand using as paradigm and as such they do not take the organisation seriously. People who hold this view prefer conflict and discontinuity as a means of surfacing problems in organisations. It is a process through which organisations can bring the surface conflicts, claiming space for lost opinions. They prefer fun and carnival mode of approach to organisational issues.

The meta-system of social theory, which allows society and social interactions to be described, requires exploration of all perspectives in the categories of functional,
interpretative, emancipative, and postmodern. The social perspectives and categories are as defined in Table 5.2. The categorisations of systems approaches along sociological paradigms are reflected in the same table.

<table>
<thead>
<tr>
<th>Features</th>
<th>Functionalist</th>
<th>Interpretive</th>
<th>Emancipative</th>
<th>Postmodern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic goal</td>
<td>Demonstrates law-like relations among objects</td>
<td>Display unified culture</td>
<td>Unmask domination</td>
<td>Reclaim conflict</td>
</tr>
<tr>
<td>Method</td>
<td>Nomothetic science</td>
<td>Hermeneutics, ethnography</td>
<td>Cultural and ideological critique</td>
<td>Deconstructing genealogy</td>
</tr>
<tr>
<td>Hope</td>
<td>Efficiency, effectiveness, survival and adaptation</td>
<td>Recovery of integrative values</td>
<td>Reformation of social order</td>
<td>Claim space for lost voices</td>
</tr>
<tr>
<td>Organisational metaphor</td>
<td>Machine, organism, brain flux and transformation</td>
<td>Culture, political system</td>
<td>Psychic prison, instruments of domination</td>
<td>Carnival</td>
</tr>
<tr>
<td>Problems addressed</td>
<td>Inefficiency, disorder</td>
<td>Meaninglessness, illegitimacy</td>
<td>Domination, consent</td>
<td>Marginalisation, conflict, suppression</td>
</tr>
<tr>
<td>Narrative style</td>
<td>Scientific / technical, strategic</td>
<td>Romantic, embracing</td>
<td>Therapeutic, consent</td>
<td>Ironic, ambivalent</td>
</tr>
<tr>
<td>Time identify</td>
<td>Modern</td>
<td>Premodern</td>
<td>Late modern</td>
<td>Postmodern</td>
</tr>
<tr>
<td>Organisational benefits</td>
<td>Control, expertise</td>
<td>Commitment, quality of work, life</td>
<td>Participation, expanded knowledge</td>
<td>Diversity, creativity</td>
</tr>
<tr>
<td>Mood</td>
<td>Optimistic</td>
<td>Friendly</td>
<td>Suspicious</td>
<td>Playful</td>
</tr>
<tr>
<td>Social fear</td>
<td>Disorder</td>
<td>Depersonalisation</td>
<td>Authority</td>
<td>Totalisation, normalisation</td>
</tr>
</tbody>
</table>

Table 5.2: Social paradigms and relation to systems methods

5.5 Social Theory and Systems Methodologies Approach

Systems methodologies have been identified with categories of sociological paradigms in Table 5.2. This identification serves two key points:

(i) To help in explaining the development of organisations as social constructs;

(ii) To guide systems practice of optimal ways in which to intervene in dealing with organisational problems and issues;
The implications to organisation for the foregoing is that: functionalist approach serves to increase efficiency and effectiveness; interpretive approach is important in promoting organisational values and cultures; emancipatory approach is important in promoting diversity and tolerance in organisations; while postmodern approach would be important in enhancing democratic values in organisations.

5.5.1 System Methodologies and Problem Contexts

Jackson et al (2000) uses a table of classification of problem context to guide systems researchers on the appropriate systems methodology to apply in a given problem situation. Further the classification of problem context is used to guide the process of structuring and grouping different system methodologies. The table of problem contexts have two dimensions: systems, which can be simple or complex; and participants, which can be unitary, pluralist, or coercive (Flood et al, 1991). The systems dimension captures the relative complexity of the system or systems that constitute the problem situation containing unitary, pluralistic, or coercive participants. The participants dimension is associated with relationships between individuals or parties who stand to gain or lose from system intervention.

A useful table, for managers interested in using systems methods in their problem situation, developed by Flood et al (1991:42) shows a menu of system methods, which are applicable to specific problem contexts, is indicated in Table 5.3.
Table 5.3: Problem contexts associated with systems approaches

<table>
<thead>
<tr>
<th>Features</th>
<th>Dimensions of systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of elements</td>
<td>small</td>
</tr>
<tr>
<td>Interactions between elements</td>
<td>few and organised</td>
</tr>
<tr>
<td>Laws governing behaviour</td>
<td>well defined</td>
</tr>
<tr>
<td>Time for system to evolve</td>
<td>take short time</td>
</tr>
<tr>
<td>Subsystems pursuing their goals</td>
<td>do not pursue their own goals</td>
</tr>
<tr>
<td>Effect on system of behavioral influences</td>
<td>not affected</td>
</tr>
<tr>
<td>Extent of system openness to environment</td>
<td>largely closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions of participants</th>
<th>Unitary</th>
<th>Pluralist</th>
<th>Coercive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common interest</td>
<td>shared</td>
<td>have compatible interest</td>
<td>Do not share common interest</td>
</tr>
<tr>
<td>Values and beliefs</td>
<td>compatible</td>
<td>diverge to some extent</td>
<td>likely to conflict</td>
</tr>
<tr>
<td>Level of agreement upon ends and means</td>
<td>largely agreeable</td>
<td>not necessarily agreeable but compromise</td>
<td>not agreeable and do not co</td>
</tr>
<tr>
<td>Participation in decision making</td>
<td>all participate</td>
<td>all participate</td>
<td>Coerce others to accept dec</td>
</tr>
<tr>
<td>Agreed objectives</td>
<td>all act according to objectives</td>
<td>all act according to objectives</td>
<td>no agreement is possible.</td>
</tr>
</tbody>
</table>

Table 5.4: Characteristics of problem context with positioning of my problem context shaded

The dimensions and characteristics of typical problem context as described by (Flood et al, 2002) are indicated in Table 5.4. The nature of my research question involves a range of problem contexts:

- Simple – unitary; (Systems Dynamics)
- Simple pluralist; (SAST)
- Complex unitary; (Cybernetics / VSM)
- Complex pluralist;
However most of the systems methodologies applicable in the problem context with regard to my research question fall within the first three problem contexts indicated. The darkened areas shown in Table 5.4 under unitarist / pluralist participants and simple / complex systems meet to a large extent the requirements of my research. The reformed and deregulated electricity sector is complex in terms of the technical, scientific and physical structure and organisational terms based on functionalist principles. The supply sector with several generators, the transmission lines for high voltage spanning large territories, and distribution systems networked to various consumers all operated through tightly controlled laws of communication and control to allow electricity to be provided to various categories of consumers. These are being operated and managed by different organisations and being regulated by an industry regulator. The number of participants involved is small, and all are governed by electricity sector market rules. These are the attributes that make the electricity sector simple systems. Such scenarios as described above make the electricity sector simple and complex systems at the same time.

From the organisational point of view there are several enterprises – the power producers, the transmission and distribution system operator; the market operator, the regulator, the governance authority, brokers and traders all serving and operating within the market have compatible mission, namely to co-produce efficient and competitive electricity market. In that respect the participants are unitary in mission but pluralist in organisational structures. Based on the foregoing discussion I have opted to use system methodologies to apply for the research namely, cybernetics (VSM) and system dynamics.

### 5.5.2 Justification for Systems Methodology

When the electricity sector is liberalised through deregulation, from the single organisation, which is the electric power utility, the Botswana Power Corporation, several new privately owned organisations will take its place- namely Independent Power Producers (IPPs); the Transmission and Distribution System Operator, the Market Operator, Traders, Brokers. A new institution for regulation, the Electricity Regulator will be established to enforce competition and efficiency
in the restructured industry. The entire network of organisations supporting the electricity market has to be functional can be modelled at three levels of recursion: (i) the supra-system (0)- being the environment; (ii) the system under focus (1) – the Electricity Regulator and Governance System; (iii) the subsystems (2) – the industries within the electricity sector.

From the technical scientific perspective – the entire network of organisations within the electricity sector can only function properly if the following conditions are met:

- Regulator function must incorporate control and communications capacity;
- Design of the regulator functions must be compliant with cybernetic principles of feedback; self-organisation and having possession of adequate variety to deal with the several organisations within the electricity sector;
- Organisations and enterprises must comply with rules, policies and standards of the market to promote competition and efficiency;

These functions and tasks call for intervention of systems methodology as tools of analysis and design to establish functional fitness of the organisations of the electricity market.

On the socio-economic terrain, private-public partnership which are a driver for the reforms sometimes have conflicting agendas among the key stakeholders of the industry in Botswana, and indeed in other regions of the world. Within the electricity sector, government policy is concerned with increased access to electrification, high efficiency in the industry, low tariffs, and security of supply; social equity; and the environment. Private investors on the other hand place priority on high rates of return, higher tariffs, cheap but functional technology – particularly in generation; less emphasis on environment and social equity among other things. Employees of the utility will be affected by the reforms; rural households, which have no access to electricity demand access. These perspectives represent disparate views on the most effective policies in a liberalised electricity sector.
5.6. Philosophical Basis of Qualitative Research Methodology

The underlying basis of qualitative methodology is centred on the debates about what constitutes reality as perceived by social scientists or individuals and the assumptions, which govern how they interpret reality. Knowing how social experiences construct an individual's reality is an important assumption. Based on this assumption, an exploration of ways of knowing is appropriate.

The debates about positivist or phenomenological philosophical research approaches point to doubts about ability of individuals to fully apprehend reality. In the views of Denzig and Lincoln (in Carpenter et al, 1998), post-positivist believe there is a reality to be known but have conceded that this reality will be "imperfectly or probabilistically apprehensible". Critical theorists and constructivists see reality from a dynamic standpoint. Critical theorists perspective is that reality is "shaped by social, political, cultural, economic, ethnic, gender values" (Denzin et al, 1994, p.109). The constructivist, however sees reality as "relativism-local and specific" Denzig et al, p109). Therefore, "reality is actually realities" Lincoln, 1992 pp 370).

These debates have generated a rich perspective on what qualitative research is about.

Van Maanen (in Smith et al., 1991:70) defines qualitative methods as "an array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more less naturally occurring phenomena in the social world ". This view reflected early debates about science and reality, which established the foundations of quantitative paradigm. According to Struebert et al (in Denzin et al, 1994) quantitative research "offers the opportunity to focus on finding answers to questions centred on social experience, how it is created, and how it gives meaning to human life". (EMBA notes, 2003). Cheek (1996) states, "qualitative research enterprise is about allowing multiple readings of the same reality to surface".

In carrying out my research on the electricity sector, regulation and governance, it is important to recognise from the onset that, little available objectively derived
measurements exist that is meaningful when one studies human phenomena within social context. The concepts of objectivity, reduction, manipulation, which are fundamental to empirical science, defy the authentic fibre of humans and their social interaction. With the belief that science should inform the lives people who interact and function in society, my research need to examine all parts of the reality—subjective reality as well as its objective reality.

In the context of my research the subjective dimension of the research will deal with reality shaped by social, political, cultural, ethnic, gender values within the context of policy while the objective reality will deal with economic and technical issues within the context of functionality. As a consequence I have chosen qualitative research as one of the methodologies that I will use to explore the research question.

5.6.1 Justification for Using Qualitative Method

The electricity sector in its current form or the restructured form in Botswana or other countries is an industry that has multi-perspective stakeholders. The sector in Botswana, which is the focus of my research, associated with regulation and governance subsumes these key stakeholders: the government, strategic consumers (mining and industry), rural and urban consumers, the power utility (Botswana Power Corporation), and prospective investors.

I need to know the views of these key stakeholders on what their understanding of the implications regulating a liberalised electricity sector will mean in their areas of work or life including their interactions and relations. A broad range of issues can be explored but I will limit my area of research through qualitative method to understanding issue related to keeping a clean environment, expectations on means and ways of sustainability of rural electrification, future security of supply of electricity, implications for regulation and governance of electricity sector associated with social and community interests, and affordable prices of electricity. Each stakeholder interpretation is based on what that stakeholder perceives the reality to be in relation to regulation and governance of electricity sector.
The purpose of the inputs will serve policy imperatives needed to for preparing a regulatory and governance system that is transparent, well informed, and inclusive.

5.7 Case Study Research Methodology

The case study is a research strategy, which focuses on understanding the dynamics present in a single setting. Yin (1994) defines case study as "an empirical investigation into contemporary phenomenon operating in a real life context". It is particularly valuable where the kind of control present in a laboratory is not feasible and not even ethically justifiable (Yin 1994).

A case study may be characterised as a detailed examination of an event or a series of related events, which the analyst believes, exhibits the operation of some identified general principle (Mitchell, 1983). A very important advantage of the case material lies in the richness of its detailed understanding of reality. This means it can work as an effective mnemonic device. According to Zonabend (1992) case study research is done by giving special attention to complexities in observation, reconstruction, and analysis of the cases under study and is done in such a way that it incorporates the views of the actors in the case under study.

According to Maxwell, case studies require three ingredients. First is the capability to deal with a diversity of evidence. The second is the ability to articulate research questions and theoretical propositions. The third is the production of research design. It is important to note that doing case study research truly involves continued interactions among design, data collection, and analysis.

Tellis (1997) identifies three categories of methodologies associated with case study approach: exploratory- fieldwork and data collection are required; explanatory – pattern matching between case study and theory; descriptive – begins with a descriptive theory and proceeds by pattern matching. Yin (1994)
recommends that each category of research should be packaged and presented as a protocol comprising of the following sections: overview of the project; field procedures; questions; and guide to the report.

The evidences commonly used for case studies are indicated in Figure 5.5, indicating their strengths and weaknesses.

<table>
<thead>
<tr>
<th>Source of evidence</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Documentation</strong></td>
<td>Stable-can be reviewed repeatedly; Unobstrusive - not created as a result of case study; Exact- contains exact names, reference, and details of an event; Broad coverage - long span of time, many events, and many settings</td>
<td>Retrievalability - can be low; Access - may be deliberately blocked; Biased selectivity, if collection is incomplete; Reporting bias-reflects bias of author</td>
</tr>
<tr>
<td><strong>Archival records</strong></td>
<td>Same as above for documentation; Precise and quantitative</td>
<td>Same as above for documentation; Accessibility due to privacy reasons</td>
</tr>
<tr>
<td><strong>Interviews</strong></td>
<td>Targeted-focuses directly on case study topic; Insightful-provides perceived causal reference</td>
<td>Bias due to poorly constructed questions; Response bias; Inaccurate due to poor recall; Reflexivity-interviewee given what interviewer wants</td>
</tr>
<tr>
<td><strong>Direct observations</strong></td>
<td>Reality - covers events in real time; Contextual - covers context of event</td>
<td>Time-consuming; Selectivity-unless broad coverage; Reflexivity-event may procure differently because it is being observed; Cost - hours needed by human observer</td>
</tr>
<tr>
<td><strong>Participant observations</strong></td>
<td>Same as above for direct observations; Insightful into interpersonal behaviour and motives</td>
<td>Same as above for direct observations; Bias due to investigator's manipulation of events</td>
</tr>
<tr>
<td><strong>Physical artifacts</strong></td>
<td>Insightful into cultural features; Insightful into technical operations</td>
<td>Selectivity; Availability</td>
</tr>
</tbody>
</table>

Table 5.5: Case study approach adopted, shaded in the table.

In the research I propose to use the sources of evidence shaded in Table 5.5.

The case study approach will be applied to the current electricity sectors in S Africa and Namibia, two examples of regional countries that have liberalised their electricity sectors. Documentation to use in the case study will include reports from the national electricity regulators in S Africa and Namibia, namely: the National Electricity Regulator of South Africa, and the Electricity Control Board of Namibia. Interviews with key stakeholders of these organisational are also planned. Direct observations of current functional aspects and structure of the regulators have been proposed.

### 5.7.1 Justification for Using Case Study

The positivist and phenomenological research philosophies presented earlier support the need for a case study research. From philosophical viewpoint case
studies hold the promise of being applied from a positivist or a phenomenological paradigm stance depending on the sources of data available for the case study. Narratives of subjective cases allude to phenomenology while objective reports of cases fall under positivist paradigm. Case studies proceed from multiple perspectives, considering not only the voice of actors but interaction between them. It is considered a triangulated research strategy, using data, investigators, theories and methodologies to ensure accuracy and to explore alternative explanations.

The regulation and governance issues of a liberalised electricity sector in Botswana, which form the basis of this research, can only be built upon a solid understanding of the situation of the sector at present as well as through understanding the functional and structural aspects of example regulators such as those selected from Namibia and S Africa. It is thus appropriate to get as much information as possible as inputs for strategies that can be used for developing robust future electricity sector regulator for Botswana.

5.8 Methodological Processes

The following methodologies have been selected for this research, namely: cybernetics - systems dynamics (functional) and VSM (functionalist); case study (interpretive and functionalist), qualitative research (interpretive). In the previous chapters their philosophical fundamentals were discussed and articulated. In this section some of those attributes have been recasted and reframed for application to the electricity sector in Botswana, under two systems approaches: functional and interpretive. Under functional sociological paradigm are systems dynamics and the VSM and under interpretive sociological paradigms are qualitative research (interpretive) and case study (interpretive) have been selected.
5.8.1 Functional Systems Approach

(a) System Dynamics

There are two phases of application of system dynamics – quantitative and qualitative system dynamics phase (Jackson, 2000 pp 144). Qualitative systems dynamics is found relevant to the research question and hence is being applied to deal with aspects of design of policy strategies involved. The qualitative system dynamics is concerned with creating cause and effect diagrams. These are the causal loop diagrams, which are deemed essential if any exploration or analysis is to be made of systems under consideration (Jackson, 2000).

The primary rationale behind system dynamics remains gaining knowledge about systems, which as seen as existing in reality, by studying the interactions between their variables. Understanding the system under study enables better prediction and control of the system to be realised. The process of system dynamics consists of defining the problem, identifying the factors, which have bearing on the problem, and recognising the feedback loops which relate materials, information and decisions. The final stage involves deciding on actions to be taken to improve behaviour of the system.

The proposed research involves effective regulation and governance of the electricity sector in Botswana. Regulation in particular will involve elements of control while governance will provide the framework for overseeing fair competition. Understanding the variables and issues affecting the behaviour of participants in the electricity sector market as well as how to change their behaviour will be important through application of systems dynamics.

The key issues for market governance will be the selection of suitable models of governance – attributed to literature survey from four options:

- Model 1: A Multi-Class Stakeholder Board;
- Model 2: A Non-Stakeholder Board;
- Model 3: Single Class Board;
- Model 4: Single-For Profit Corporation Not Affiliated With Market Participation
For the electricity regulator, the key issues will be about structure and functional issues discussed in section 4.4.5.

(i) Deductive Method of Inquiry

The method of inquiry is based on a deductive process, concerned with analytic problem solving, in terms of electricity sector regulation, in which the output should be an improved or a new regulatory structure incorporating those changes that will produce the result most satisfactorily for Botswana. As the observer I will be independent. The focus is on facts and the search is for causality and feedback among variables.

(ii) Participants

The participants for the inquiry will be key stakeholders of the electricity sector in Botswana representative of the following organisations. The participants will be treated equally.

<table>
<thead>
<tr>
<th>Organisation / Stakeholder</th>
<th>Reason for choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Botswana Power Corporation</td>
<td>Public Organisation and current electricity utility, monopoly supplier of electricity throughout Botswana</td>
</tr>
<tr>
<td>2 Department of Energy (Botswana Government)</td>
<td>Current regulator of the ESI through policy</td>
</tr>
<tr>
<td>3 PEEPA</td>
<td>Government public privatisation agency, responsible for the restructuring and privatisation of the power utility</td>
</tr>
<tr>
<td>4 Mining sector</td>
<td>Main electricity consumer, consuming 51% of electricity supplied by BPC</td>
</tr>
<tr>
<td>5 Manufacturing Industry</td>
<td>Main electricity consumer, consuming 29% of electricity supplied by BPC</td>
</tr>
<tr>
<td>6 DBES</td>
<td>Government Department responsible for electrical design and construction for government and public buildings</td>
</tr>
<tr>
<td>7 BTA</td>
<td>Regulator for the Telecommunications industry</td>
</tr>
</tbody>
</table>

Table 5.6: Data sources for system dynamics

The selection of participants are based on the following criteria:

- Their knowledge and skills of the industry associated with operation, management, or technical issues.
- Their understanding of regulation and governance of electricity sector;
- Their understanding of reforms and privatisation of state owned enterprises (SOE);
- Their understanding of social interactions

(iii) Data for System Dynamics

For the research question on regulation and governance of the liberalised electricity sector in Botswana data will be generated from the following process:

- Qualitative research involving interviews and consultation with stakeholders within the electricity sector in Botswana;
- Documentation on qualitative and quantitative aspects of the electricity sector in Botswana;
- Personal understanding of the industry.

The content of interviews will reflect both current thinking and reforms taking place within the electricity sector locally and internationally, with care taken to absorb as much information as possible from the interviewee.

The case study on electricity sector in Botswana will include documents (policy, strategic or working papers), consultancy reports, and interviews.

(iv) Data Analysis

Data analysis will be based on systems approach. A story forming a rich picture from the results will be prepared; the data will be organised using key themes leading to the development of AD, ID and the development CLD, followed by a reflection and then redesign intervention.

(b) Cybernetic (VSM)

Cybernetics is the science of effective organisation, meaning the science that describes the general principles of growth, learning, and adaptation in complex dynamic systems (Clemson, 1984). This is to do with the way complex, dynamic systems work. By this definition Beer is thinking of a system with the following characteristics:
- Complex - they have more relevant detail than the given observer can possibly cope with;
- Dynamic – they are changing in their behaviour or structure or both;
- Probabilistic – there are important elements whose behaviour is at least partly random;
- Open- they are embedded in an environment which affects them and which they affect.
(Clement, ibid)

Cybernetics is concerned with general patterns, laws and principles of behaviour that characterize complex, dynamic, probabilistic, integral, and open systems. In some literature cybernetics is referred to as the science of control- and communications.

The three laws, which govern cybernetics, are:
- Self-organising systems laws. Complex systems organise themselves; the characteristic structural and behavioural patterns in a complex system are primarily a result of the interactions among system parts.
- Feedback law: The output of a complex system is dominated by feedback and, within wide limits, the input is irrelevant;
- The law of requisite variety: Given a system and some regulator of that system, the amount of regulation attainable is absolutely limited by the variety of the regulator.

When these laws are used as a lens for a liberalised electricity sector, the sector may be viewed as a complex system satisfying the above laws.

Beer's Viable Systems Model contains all the most important features of organisational cybernetics. The VSM is an attempt to embody many of those laws of cybernetics in an effective way. There are many uses of VSM but two are significant:
- It provides a way of structuring an organisation and;
- Provides a language for discussing viability;

In this research the purpose of VSM is to facilitate the design of an effective Electricity Regulator for the liberalised electricity sector in Botswana. The utility of
the VSM in this respect is grounded on the ways in which the model uses the various laws of cybernetics; namely:

- Large organisations are treated as relatively autonomous system nested within larger autonomous systems. This characteristics reflects the following laws:
  - System holism: each autonomous system is treated holistically;
  - Recursive systems: each level within the overall structure has the same internal structure of systems one – two – three – four – five.
  - Darkness: it is not possible to know a system fully. Fortunately, there is no need to examine the details of a unit's operation so long as it produces the desired outputs.

- Attention is focussed on the communication flows within the organisation. The following laws are important in this respect:
  - The law of requisite variety: all of the many double arrow loops in the model are governed by the law of requisite variety. This means that, in effect, the amount of useful information in each of the two arrows making up a loop, will become more or less equal. Thus, if managers are to have any real insight into the systems they are supposedly managing, the filters and amplifiers on these loops had better be designed carefully.
  - The feedback laws: any of these loops can be treated as a feedback situation and can, therefore, be set up to more or less run automatically if proper feedbacks are implemented.

- Each system one is treated as a self-organising (autonomous) system by its two- three – four – five meat –system.
- System two is necessary primarily because feedback loops (particularly when they are multiple and inter-laced one with another) show complex oscillatory patterns based on the time lags around the various loops.
- System three is the monitor for internal homeostasis. It also provides a meta-language for discussing synergy among one units.
- System four embodies the Conant Ashby Theorem "Every good regulator must be a model of the system regulated". In addition, system four provides a meta-language for discussing change and adaptation.
From the foregoing it is evident that the VSM embodies the laws of cybernetics.

(i) **Assumptions.**

In order to use VSM for designing an effective electricity regulator for Botswana, some simplifying assumptions need to be made regarding the linkage between the organisations of a liberalised electricity sector and the Regulator. These assumptions are:

- The liberalised electricity sector is a complex systems (system of interest-R1);
- The Electricity Regulator is an organisation of the electricity sector of which is part of the environment (electricity sector – is supra-system –R0);
- The organisations within the ESI is part of the total environment;

(ii) **Deductive Method of Inquiry**

The method of inquiry is based on a deductive process, concerned with design of an effective Electricity Regulator for Botswana. The output of the process is a VSM model for Electricity Regulator Organisation based on cybernetic principles. As a researcher who has knowledge in the area I will be involved but will not impose my views on the information or data made available to me. The focus in on facts and the search is for finding the data and information most appropriate for the design of the proposed electricity regulator agency.

(iii) **Participants**

The participants for the inquiry will be people who are working with Electricity Regulators in Namibia and three key stakeholders of the electricity sector in Botswana indicated in the Table 5.7. The participants will be treated equally.
<table>
<thead>
<tr>
<th>Organisation / Stakeholder</th>
<th>Reason for choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Electricity Control Board, Namibia</td>
<td>Their deregulated electricity sector has similarities to Botswana’s electricity sector in terms of capacity, customer base and industry structure prior to deregulation. They have experience of regulation.</td>
</tr>
<tr>
<td>2 National Electricity Regulator of S Africa.</td>
<td>It exhibits the relevant core features that are critical and necessary in the structuring and establishment of a new electricity regulator such as that mooted for Botswana.</td>
</tr>
<tr>
<td>3 Botswana Power Corporation</td>
<td>Public Organisation and current electricity utility, monopoly supplier of electricity throughout Botswana</td>
</tr>
<tr>
<td>4 Department of Energy (Botswana Government)</td>
<td>Current regulator of the electricity sector through policy</td>
</tr>
<tr>
<td>5 PEEPA</td>
<td>Government public privatisation agency, responsible for the restructuring and privatisation of the power utility</td>
</tr>
<tr>
<td>6 BTA</td>
<td>Regulator for the Telecommunications industry. They have experience in regulation.</td>
</tr>
</tbody>
</table>

Table 5.7 Data sources for the VSM

(iv) Data for VSM Design for Electricity Regulator Organisation

The data for the VSM design of Regulators for that will address the research question on regulation and governance of the liberalised electricity sector in Botswana will be generated from the following process:

- Interviews and consultation with stakeholders listed in the above table
- Data and information on selected Electricity of Regulators – Electricity Control Board of Namibia;
- Understanding of Regulatory needs drawn from literature survey.

(v) Data Analysis

The process of inquiry, data analysis and use will be simultaneous for the design of an Electricity Regulator Institution will be based on the Figure 5 shown below due to Espajo (1991). There are two loops:

- The learning outer loop (1-6-7-8), which involves discovering issues of concern for the design through eliciting views and collecting information; naming relevant organisations and producing models. These activities are done while using information from participants;
- Finding out about the situation and managing the design process takes place in the operational domain. In this way the design process is offered
as an interplay between the fully fledged complexity of the participants; interactions and the much simplified, but also useful, world of models and abstraction.

- The cybernetic loop the inner loop (2 – 3 – 4 – 5). Studying the cybernetics of the situation – that is control and communications mechanisms constituting the situation implies studying the situation of the organisations brought forward as the relevant to the design problem situation.

Figure 5: Using cybernetics for design of electricity regulator

(vi) Data for VSM Required for Research on Policy for the Electricity Sector Regulation and Governance

The normal process in which a regulatory institution, such as the proposed electricity regulator for Botswana, is established is based upon appropriate government policy and followed by an enabling legal framework. For the
purposes of examining the adequacy of policies related to establishing the electricity sector regulations and market governance it will appropriate to obtain data from these sources:

The regulation of the electricity sector in Botswana is vested with the government under the Department of Energy.

(i) Primary Data: Interviews with policy makers relating to the current policies, regulation, governance, and operations of the sector from the following ministries or organisations:

- The Ministry of Minerals, Energy and Water Resources (MMEWR): Energy Affairs Division (the Department of Energy) which has overall responsibility for co-ordination and policy formulation of the country's energy sector;
- Ministry of Transport and Works- The Department of Building and Engineering Services, which is concerned with professional practice in electrical engineering nationally.
- The Botswana Power Corporation, the electric utility currently responsible for the generation, transmission and distribution of electricity nationally;
- The Public Enterprise Evaluation and Privatisation Agency (PEEPA), currently responsible for privatisation of public enterprises;

(ii) Secondary Data
Sources of policy documents used include the following:

- Energy Master Plan, 2004 which contains the medium and long term planning for the electricity sector for Botswana;
- Electricity Act of Botswana, 1973;
- Electricity (Supply) Regulations, 1988
(vii) Policy Analysis

Data on policies related to the electricity sector, solicited from the sources identified in section (vi) are analysed through the VSM. The analysis of policies using this approach is based on the recursion of the electricity sector as explained in chapter 8.

5.8.2 Interpretive Systems Approach

(a) Qualitative Research Methods

Qualitative researchers have emphasised six significant characteristics of the research (Struebert, et al, 1998): A belief in multiple realities; (ii) a commitment to identifying an approach to understanding that supports the phenomena studied; (iii) a commitment to the participant's viewpoint; (iv) the conduct of inquiry in a way that limits disruption of the natural context of the phenomena of interest; (v) Acknowledge participation of the researcher in the research, and (vi) the conveyance of an understanding of phenomena by reporting in a literary style rich with participation.

Qualitative research is committed to the idea that multiple realities exist and create meaning for the individuals studied. As a result it is important when undertaking qualitative research to allow the process or discovery to lead the method applied rather than the method to lead the process. Key aspects that qualitative research emphasises include: dependence on context; discovery, description, understanding, organismic, whole is greater than the parts; rich narrative report; researcher is part of the process; involves participants; subjectively valued; and multiple realities.(Struebert, et al, 1998 in EMBA class notes, 2003):

(ii) Qualitative Research and Inductive Method of Inquiry
This research involves change in which deregulation and reform in electricity sector will trigger changes that will involve current employees in the power sector in terms of social change, structural and ownership changes in business. These issues will be approached from governance and regulation. It is thus appropriate to conduct this research as qualitative research, which can be categorised as action research. As such it is important to learn of what the stakeholders of the electricity sector expect as well as their current view of the sector. The research process is interpretive and as a researcher I will be involved in enriching the output of the research that emerges. One advantage of this research is that it serves two purposes – the emergence of theory and enables practice of the ESI reform process.

(iii) Participants

The participants for this research will be drawn from stakeholders of the electricity sector in Botswana who will be affected by the reforms in the electricity sector. The participants will be categorized into three groups depending on their area of work – Government representing policy makers (Ministry of Minerals Energy and Water Resources), the electricity supply industry represented by the Botswana Power Corporation; Consumers both small and large – mining, water pumping, domestic consumers, industrial, and government.

(iii) Data Collection

For the action research qualitative research on regulation and governance of the reformed electricity sector in Botswana data will be generated from the following process:

- Interviews and focus group discussions with policy makers;
- Interviews with the Electricity Supply Industry; personnel; management and professional cadre;
- Interviews with electricity consumers – small and large;
- Questionnaire were used for professionals in all categories of respondents;
- Using field notes;
- Personal understanding of the industry;
The content of interviews will reflect both current thinking and reforms taking place within the electricity sector locally and internationally, with care taken to absorb as much information as possible from the interviewee.

(iii) Data Analysis

Data requires what Struempf refers to as "dwelling" with data. The process will involve clustering similar data – the process of forming affinity diagram. Once the themes have been formed then a rich narrative will be developed based on the themes. The process of forming the themes will be facilitated through affinity diagram. The development of theory will be achieved through interrelationship diagram and causal loop diagram.

(b) Case Study

The research design for case study subsumes of five key elements which must be tackled are: (i) questions of how and why which need to be defined; (ii) the proposition or research questions that must precede the case study; (iii) the unit of analysis which should define the boundary of research; (iv) the logic and rationale binding the data to the research question reflecting pattern matching; and (v) the criteria for interpreting the findings. (Yin, 1994). The case study research incorporates a number of methodologies-

- Exploratory – Fieldwork and data collection;
- Explanatory – pattern matching between case and theory;
- Descriptive – Begins with a descriptive theory and proceeds by pattern recognition.

This particular research will be limited to exploratory case study intended to collect data and information needed for building a theory that will be used in establishing an effective regulatory and governance for a reformed electricity sector in Botswana. The case study will involve electricity regulators in South Africa and Namibia, namely the National Electricity Regulators and Electricity Control Board of Namibia respectively; both of which has relevant perspectives of a deregulated electricity sector regulation. The unit of analysis will be functions,
structure and practices intended to guide the design of an effective electricity regular agency in Botswana.

(i) Inductive method of inquiry -Case Study

Case study represents a strategy for exploring alternative explanations of a situation under focus using data, theories, and investigators to ensure accuracy. The case study methodology should be used to give a holistic picture of the areas under focus.

The case study for this research should provide a holistic picture of the electricity sector regulation with attention to effective and efficient structure, functions and practice. To achieve this I have adopted the inductive method of inquiry based on interpretive approach. The design of the case study involves two units based on themes indicated above for electricity regulators in S Africa and Namibia.

(ii) Data Sources

Data sources for the case study evidence will be varied but all must meet the criteria of relevance to the research question on electricity regulatory agency for S Africa and Namibia that can be applicable for a similar agency in Botswana. The data sources identified include:

- Organisational documents and reports: eg annual reports, journal; market codes; operational manuals; economic regulation; technical regulation.
- Documentation on planning, and operation;
- Documentation on policy for regulation;
- Archival records;
- Interviews focusing on case study topics with relevant officials (management and professional staff);

During interviews for other segments of the research field notes will be developed, including personal observations and issues relevant to the research.
(iii) Data Analysis

The analysis of case study will be conducted when data has been collected. The core of the analysis will consist of inspecting, categorising, tabulating, recombining and manipulating the evidence to deal with the research question.

5.8.3 Validity of Research Methodology

The process of finding a valid answer to research question(s) will consist of the following processes:

(i) Deciding on the research inquiry, problem solving or systems thinking process followed;
(ii) Gathering the necessary data and evidence needed to construct the situation, concern and an answer to the question;
(iii) Selection of the relevant theories needed in the construction process;
(iv) Applying the process selected in (i), (ii), and (iii) to construct the situation, concern and answer.

(EMBA4 notes, 2003)

These processes lead to arguments that need to be tendered to establish validity of the process and this consists of four parts:

- Dependability – which refers to acceptability of research inquiry including how well the research process is understood and defended as well applied to construct the situation, concern, and answer;
- Credibility – which concerns the data and evidence collected as well as the theories needed in the construction phase; the burden of establishing credibility can be effectively achieved through triangulation;
- Conformability - which is concerned with the degree to which the process followed in constructing the process can be followed; this can be achieved largely by through audit trail;
- Transferability – which is about how lessons derived from the research process can be applied to another situation.

(EMBA4 notes, 2003)
Strategies built in the research methodology are intended to focus on the arguments for validity. The design of strategies intended for achieving validity are indicated in Table 5.8

<table>
<thead>
<tr>
<th>Arguments for validity</th>
<th>Research methodology strategy</th>
<th>Phase of research where strategy is applied/will be applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependability</td>
<td>Area of research: developing a more effective governance and electricity regulator for Botswana</td>
<td>Research design</td>
</tr>
<tr>
<td></td>
<td>Use of multiple methodologies: Mixed approach: positivist and phenomenology</td>
<td>Research design</td>
</tr>
<tr>
<td></td>
<td>Mixed functional and interpretive systems approaches</td>
<td>Research design</td>
</tr>
<tr>
<td></td>
<td>Functional -Systems dynamics and org cybernetics approaches</td>
<td>Data collection, analysis/diagnosis and intervention</td>
</tr>
<tr>
<td></td>
<td>Interpretive - Qualitative &amp; case study</td>
<td>Data collection, analysis and theory construction</td>
</tr>
<tr>
<td>Credibility</td>
<td>Triangulation of data sources: Questionnaire; interviews; workshop; documented evidence; reports;</td>
<td>Data collection; analysis; and theory construction</td>
</tr>
<tr>
<td>Confirmability</td>
<td>Literature survey, and data sources</td>
<td>Research design</td>
</tr>
<tr>
<td>Transferrability</td>
<td>Publish results</td>
<td>Output</td>
</tr>
</tbody>
</table>

Table 5.8: Validity of the research methodology.

5.8.4 Utility of Methodology

The overall purpose of the research is to develop effective governance and electricity regulator agency for a liberalised electricity sector in Botswana. The output of the research is part of the search for a model of an effective regulation of the electricity sector when the sector becomes liberalised in the near future. This comes against the background of concerns and problems that have been associated with the ineffectiveness of regulatory institutions in other countries where the electricity sector has been liberalised. The main problems have been identified as: importation from countries where the electricity sectors have been liberalised earlier to countries which have newly liberalised their sector, without adequate adaptation of institutions of electricity regulation; inadequate understanding of the regulatory process for electricity markets since they only emerged in the 1980s; failure of electricity regulators to achieve minimal objectives of electricity liberalisation – such as decline in tariffs or enhancement of efficiency of operations or promotion of competition.

The wider objective of the research is thus to bring benefits of electricity sector liberalisation to Botswana when that status is achieved by the sector through development of an effective sector regulation.
Relevant literature has been surveyed from several sources to support the research: (i) governance and electricity sector regulation; (ii) areas of management – including the; and (iii) systems thinking and approach. Mixed philosophical research approaches, positivist and phenomenological have been contrived to achieve the objectives through functional and interpretive systems approaches. In particular organisational cybernetics, systems dynamics have been identified as appropriate functional research methods suited to the research area. Similarly case study and qualitative research methods have been selected as interpretive methods, which are suitable for achieving the research objectives.

The design of the research is encapsulated in pragmatism – drawing from the strengths of positivist and phenomenological philosophical positions. In practice this has been realised by choice of functional two functional methods – organisational cybernetics and system dynamics; and two interpretive methods – qualitative and case study research. Functional methods have been adopted because "the process of intervention is systemic and is aimed at discovering the best way to achieve a goal" and because the "solutions are tested primarily in terms of their efficiency and efficacy" (Jackson, 2000, pp 203). The interpretive approach on the other hand has been adopted because its use entails "the conscious thought about how to adopt it to a particular circumstance" (Jackson, 2000, pp 282). The suitability of these approaches are justifiable in the context of the research, that is, the development of governance and electricity sector regulator agency in Botswana needs to be adapted to the peculiarities of Botswana.

The methodological processes involve – both inductive and deductive methods of inquiry. Data sources selected include: questionnaire, interviews, workshop and documents. The problem solving approach chosen is based on systems thinking.

The general weaknesses and strengths of functional and interpretive research methodologies are well documented (Jackson, 2000) but similar evaluation of the methodology within the context may not be clear. The weakness of these methods within the research context takes the following forms: adequate knowledge and skills in the field by people who will be interviewed; the use of
models for regulatory institutions instead of actual institutions. These weaknesses are driven by issues: the relative newness of regulation of electricity markets and the lack of history in this area in Botswana.

The ethical dimensions of the research may be looked at from two perspectives: if electricity sector liberalisation is the best option from utilitarian approach for the sector – which calls into question the need for liberalisation of the sector; is social justice a factor that will drive the development of the electricity sector regulation and to what extent. These will be explored within the research question.
PART III: APPLICATION: RESULTS ANALYSIS & SYNTHESIS

Chapter 6: Case Studies of Electricity Regulators in S Africa and Namibia

6.1 Introduction

The purpose of this chapter is intended to present the institutional set up of an electricity sector regulator. In particular, an understanding of the functions, structure and operation of such organisation was the drive for the case study approach. Such information is necessary as additional lenses for designing a more robust and effective electricity regulator for Botswana. The two electricity regulators selected for the case study are the National Electricity Regulator (NER) of South Africa and The Electricity Control Board of Namibia. Incidentally these are the only two electricity regulators in the SADC region. Indeed South Africa and Namibia are the only two countries that have undertaken the electricity reform agenda in the region. The case studies were intended to address the question:

What are the key structural and operational features of an electricity regulator?

The answers to these questions are used in the design of an effective electricity sector for Botswana in Chapter 8.

6.2 Data Sources and Quality

6.2.1 Primary Data Sources: Interviews

Structured, semi-structured and open interviews were carried with the following categories of participants who are involved in diverse areas of professional work as detailed below.

Regulators of Electricity Sector In S. Africa and Namibia
• One official in the National Electricity Regulator of S Africa whose area of work involves economic regulation
• One Official in the Electricity Control Board of Namibia whose area of work involves licensing and compliance

The NER of S Africa is responsible for regulating the restructured electricity sector in S Africa and the regulator has been in operation for the past five years. The electricity sector in S Africa is one of the largest in the world. For Namibia, the electricity sector was liberalised in 2002 and the sector regulator has been in operation since then.

The information and data collected from these participants reflect current trends in operational and functional terms for electricity sector regulators. They understand the mechanisms and problems of regulating the sector first hand. The range of data collected involves the design and implementation of institutions of electricity regulation and governance, and problems they have encountered since they started operating.

There were certainly limitations associated with the interview approach. First, the drawback on information obtained from the interviews was that they tended to reflect individual perspectives on the nature of regulating the industry. The second drawback is that the scope and scale of information obtained was limited to the skills, knowledge and expertise of those interviewed, although their contributions significantly added value in making one understand the practical difficulty of regulating an electricity sector.

However, on the positive side, most of the information I got through the interview could be weighed against similar information that was available in the relevant documents that I reviewed.

Questionnaire Survey

A questionnaire survey was administered to selected employees of National Electricity Regulator (NER) and Electricity Control Board (ECB) respectively to
solicit their opinions regarding the performance of their agencies. Four questionnaire from NER and three questionnaires were duly completed and returned. Though the number of questionnaires returned was low, the information collected was nevertheless valuable, as they painted a general picture of how these organisations are performing. The major weakness of this survey is that the number of respondents is statistically insignificant. Despite that weakness, it important to note that these agencies employ relatively few people and as a result it is highly probable that the opinions collected may well be representative of how these organisations are performing.

Another factor, which tended to corroborate to the opinions the respondents, in spite of their statistical insignificance of number, was the information gathered through interviews.

6.2.2 Secondary Data Sources: Documentation

(i) Electricity Act of Namibia, 2000;
(ii) Vision, mission, and responsibilities of the Electricity Control Board of Namibia;
(iii) Electricity Act of S Africa, 1994
(iv) South African Energy Policy, 1996

The range of secondary data emanate from the government and the regulator organisations. Although the documents used in the study were not as comprehensive as one would have liked, they were, however, adequate in giving overall factual and objective views on the organisations in focus, though they tended to give official versions and understandably had less critical perspectives. To some extent, the articles in the Quarterly Journals, referred to in (vi) and (vii) above were critical in the way they viewed the regulatory institutions.
6.3 Data Analysis and Reporting

Data analysis was based on inspection, and categorising the information in suitable tranches. The end results are the key themes upon which the electricity regulator organisation is built – namely functions, structure, operation and challenges. The analysis also reflects the weaknesses of the regulator agencies studied, which are placed in the section on discussions and recommendations. The findings have been reported in terms of the main themes indicated.

6.4 National Electricity Regulator: S Africa

In the liberalised electricity sector, the art of regulation involves establishing rules that allocate value to consumers and suppliers in such a way as to maintain incentives for the firm to create value, while promoting political legitimacy in the eyes of consumers and other stakeholders (Berg, 2000). The achievement of tasks related to such a requirement, by a regulatory authority suggests that the authority must be well designed to undertake its functions effectively.

6.4.1 Legal Framework for Regulatory Authority and Funding

The electricity regulator for South Africa – the National Electricity Regulator was created following the restructuring and privatisation of the electricity sector. The National Electricity Regulator (NER), a regulatory authority over the Electricity Supply Industry was established in terms of the Electricity Act No. 41 of 1987, as since amended by the Electricity Act of 1994 and 1995. The NER was thus established on 1st April 1995 as a successor to the Electricity Control Board (ECB). The Minister of Minerals and Energy appoints board members of the NER. Once the Board is appointed the NER acts independently and reports to Parliament through the Department of Minerals and Energy.

The NER is funded from a levy imposed on the generators of electricity, and then passed onto all customers of electricity through tariffs. Customers, therefore, pay
for the protection that they receive from NER and the general body of taxpayers is relieved of this obligation.

6.4.2 New S African Electricity Industry Structure and Debates on Its Economic Regulation Based

The new structure of the industry is as depicted in Figure 6.1. The proposed regime for regulating the industry will involve a clear separation between and ring fencing of the different types of operating businesses in electricity production and supply. Regulation at the generation level will only last until full competition has been introduced. However, the regulator will be faced with the challenge of ensuring that prices give appropriate signals for optimal investments in the sector. At the transmission level, prices, and/or revenues will always be regulated, as this sector of the industry is a natural monopoly. The challenge to the regulator is to ensure that transmission prices encourage open and non-discriminatory access to the networks. The wires component of distribution, as a natural monopoly, will also always be subject to regulation and, therefore, poses the same challenges to the regulator. The retail or supply business will be regulated and be subject to competitive market forces when retail competition is eventually introduced. This, however, is not foreseen in the medium to long-term.

The development and implementation of the Regulatory Framework takes into consideration the following structure and associated challenges.
Regulatory methods should always try to mimic competition, as one of the key reasons for regulation is to control potential abuse of monopoly power. In a competitive environment, customers have a choice. It is this choice that forces producers and suppliers to be efficient and to produce high quality goods and services at the least cost possible. Any producer or supplier who does not meet this requirement will lose market share as customers will move to those producers and suppliers who provide goods and services of high quality, at the lowest possible price. The challenge to the Regulator is to ensure that there are adequate incentives for producers and suppliers to maintain sustainable low prices, without compromising the quality of supply.

It is, therefore, important to develop a regulatory framework that can achieve all the benefits of competition.

Various methodologies are available as options for regulating monopolistic industries: (1) the rate of return or cost of service regulation; (2) incentive-based regulation and all of its variations; and (3) benchmarking or yardstick regulation. Each of the above options has its peculiar advantages and disadvantages.
However, international practice is more and more to migrate to one or other form of incentive based regulation, with benchmarking used as a check.

As asserted earlier, the NER is using the rate of return regulation, at the moment, but as a pre-cursor to eventually migrating to incentive-based regulation and benchmarking. Incentive based regulation needs to be carefully introduced since it is premised on an agreed methodology and non-interference in the running of the methodology for a period of anything between three and ten years with five being the most frequently chosen period. The determination of the index linked formula and the first year's allowed revenue is critical for successful regulation in subsequent years. Wrong choices can either cripple the regulated utility regarding insufficient revenue to cover its costs. Alternatively, there absolutely be no regulation resulting in excessive utility revenues and profits. Current considerations are that incentive based regulation could probably be introduced within one or two years of the establishment of national transmission company and also within two years of the establishment of the Regional Electricity Distributors (REDs).

6.4.3 Functions of the NER

The role of the NER is to license the generation, transmission and distribution of electricity, to approve the prices at which electricity is sold and to set minimum standards for quality of supply and service. The NER also resolves disputes between suppliers of electricity and their customers, as well as between suppliers.

The NER operates under the mandate given by the Minister of Minerals and Energy to be the custodian and enforcer of a regulatory framework to monitor and ensure that the interests and needs of present and future customers of electricity respectively, are safeguarded regarding efficiency, effectiveness and long term sustainability of the ESI in S Africa. These functions involve different businesses and enterprises operating in the market as follows.

6.4.4 Core Regulatory Activities of the NER

Pricing and Tariffs
According to its mandate, the NER is required in terms of the 1987 Act as amended in 1994 and 1995 to "determine prices and conditions on which electricity is supplied by a licensee". Sections of the Act go further on to specify the information requirements of the regulator in as far as the amendment of prices is concerned. The order of annual consideration of price increases of electricity follows the following pattern and hierarchy, from a supplier at the apex to related pricing and tariffs: (1) Eskom Generation (Gx), transmission (Tx) and distribution (Dx); (2) Municipal distributors; (3) Retails tariff structural adjustments; (4) Other activities related to pricing and tariffs.

Pricing is sensitive and represents a serious business for NER, for several reasons. Pricing must be transparent and generally acceptable to stakeholders; it critically impacts on the development of the sector – for example investments; performance; and competition. NER is, therefore, guided by a number of considerations in developing its pricing structures. These include: the objectives which such methodology need to achieve; international best practice; and developments within the South African Electricity Supply Industry, especially the restructuring of the industry; current and future structure of the industry.

NER's approach is guided by the current industry structure and by the fragmentation of the Electricity Distribution Industry.

There are currently approximately 235 licensed municipal distributors in South Africa (Rossouw, 2003). Their tariff structures and levels vary significantly from each other. This has posed a challenge to the regulator, who over the years, since the establishment of NER has striven to rationalise. Municipal tariffs have been regulated using benchmarks. Until 2000, Eskom had in place a RDP compact with Government to decrease real price of electricity by 15%. After 2000, Eskom's revenues and tariffs have had to be regulated (Rossouw, 2003).

The Eskom tariffs are based on rate of return methodology. It is important to note that the NER is continuously investigating methodologies for tariff structures. Among these are: the Wholesale Electricity Pricing System (WEPS);
the Rate of Return regulatory methodology; the incentive based regulation methodology; and the framework for managing tariffs.

In the proposed industry structure, Eskom will own 70% of generation capacity while the remaining 30% or more will be owned by Black Economic Empowerment Companies (BEEs) and Independent Power Producers (IPPs). Transmission will be fully independent from generation and 100% owned by the state. Eskom distribution will be merged with municipal distributors to form six Regional Electricity Distributors, registered in terms of the Companies Act.

6.4.5 Licensing

The objective of licensing electricity generators, transmitters, and distributors is to ensure the efficient functioning of the ESI in terms of the Electricity Act of 1987. The licensing function is carried out by NER in such a way that the interests and needs of the present and future electricity needs are safeguarded and met with regard to the efficiency, effectiveness and long-term sustainability of the ESI.

6.4.6 Customer Services

Customer services fall under the Department of Customer Services, which is part of the Value Enhancement Division. The Division is responsible for resolving complaints received from consumers of electricity suppliers. NER mandate is derived from section 4 of the Electricity Act 1987 which stipulates that:

"At the request of any licensee or its consumer settle disputes between licensee themselves or between licensees and their consumers or prospective consumers."

The task of customer services is to form a cornerstone as one of the core functions of NER. As a result, the regulator has paid particular attention to this task and has developed stakeholder management mechanisms through which
the relationship between the customers and suppliers are enhanced on a continuous basis. One such approach is based on the Customer Communications Forum – which is a platform created by the NER to serve as a direct communications channel between the suppliers and their customers. It is intended to foster good working relationship between suppliers and their customers. A complementary approach used by NER to empower customers to understand their rights and obligations in the demand-supply relationship has been through Customer Education. For example, customers are taught how to lodge complaints with the regulator. To achieve its Customer Education programme has published a number of pamphlets that customers can download from NER's website. The range of pamphlets include: rights and responsibilities of both suppliers and customers; efficient use of electricity; theft of electricity; electricity cut-offs; resale of electricity; quality of service standard (NRS 047).

6.4.7 The Structure of NER

The structure of the NER depicts the NER Board at the apex. Below that is the CEO. The CEO's office is supported by three functions Stakeholder Liaison, Programme Development and Management, and Special Advisors. Below the CEO's office there are three key divisions:

- General Counsel;
- Value Enhancement;
- Regulations.

The details of the organisational structure are as depicted in Figure 6.2.
This structure was adopted from 1\textsuperscript{st} January 2003. Prior to this, the previous structure of NER consisted of five divisions: research and development; market operation and monitoring; licensing; compliance and customer services; Corporate services and general counsel.

6.4.8 The Structure and Elements of NER Control Systems

To be effective as a regulator, the NER has a system of control to apply in regulation. The system of control is based on answers to questions about: Why regulate? What do they regulate? And how do they regulate? The answer to why provides the NER with the rationale for regulation; the answer to what provides the NER with the factors it has to regulate and the how gives the answer on the procedure and codes NER uses for regulation. The system of control is depicted in Figure 6.3.
6.4.9 Information and Funds Flows and Regulation

The NER regulates an industry and market that comprise many enterprises: generation; transmission system operator; market operator; electricity distributors; electricity traders and brokers. Regulating the electricity market requires sufficient knowledge involving costs and revenue, prices, tariffs, levies, subsidies, taxes and volumes that constitute the funds flow stream. This is not an easy task. It involves skills capacity in a diverse range of technical, economic and financial knowledge of the industries involved. Closely related to funds flow stream is the information flow stream. Here the information flow is not only for management information but trade and technical related data. Two types of problems can be identified here: the diversity of data and the structure as well as
formats of data. It is important for the regulator to have adequate knowledge and skills associated with the market information flow stream. The information flow is linked to the physical flow of electricity as commodity being traded. The funds flow, information flow and physical flow are captured in Figure 6.4 below (Rossouw, 2003).

The electricity distribution industry is of particular significance to the market in relation to funds flow. This is, therefore, captured separately in Figure 6.5 (Rossouw, 2003) to illustrate the type of information that NER need to have in order to regulate that segment of the industry effectively.

Figure 6.4: Electricity flow and funds flow for the electricity sector in S Africa (Source: Rossouw, 2003)
6.5 The Electricity Control Board - Namibia

6.5.1 Legal Framework

The Electricity Act of 2000 in Namibia was enacted to establish the Electricity Control Board as an electricity regulator following the liberalisation of the electricity sector. The Act contains three principal items in order to and to facilitate the operational and functional responsibilities of the Board. These are the Electricity Control Board itself; financial provisions for the Board; licensing of market institutions and operators; and obligations of licensees. In addition the Act
also details the general provisions for the operation of the Electricity Control Board. Further insight to the Act is presented below.

6.5.2 Functions and Objectives of the Electricity Control Board

The Electricity Control Board of Namibia was established through the Electricity Act of 2000. The functions of the Board as outlined in Act include:

- Promote and efficient, reliable and economic system of electricity generation, transmission, supply and distribution within and importation into and export from Namibia;
- Regulate licenses in a manner that maintains and improves efficiency, economy and reliability on the part of licenses so as to enable all reasonable demands for electricity to be met, in accordance with prevailing Government policy;
- Have regard to the need of licenses to be able to finance the carrying out of their licensed activities;
- Encourage efficiency, economy and safety in the use of electricity;
- Regulate the quality of service and the tariffs, fees and charges payable for electricity keeping in view both the interests of consumers and of licensees;
- Act in a manner that is transparent and fair;
- Have regard to promotion of health, safety and the environment;
- Oversee the effectiveness of the mechanisms, processes and forces prevalent in the electricity sector to ensure that there is a reasonable balance between the demand for electricity and the supply; and
- Act in a manner consistent with the objects of the Act and any regulations made there under.

To carry out the above functions – the Electricity Control Board is constituted into a formal organisation consisting of: the Board for the organisation consisting of five members, and the Chief Executive Officer. Under the Chief Executive Officer are: the management team; technical and professional staff; and support staff.
6.5.3 The Hierarchy and Structure of Electricity Control Board of Namibia

Based on policy considerations and regulation of the electricity sector in Namibia, and according to Systems Thinking, the recursion levels between the Ministry of Mines and Energy; the Electricity Control Board; and the Electricity Sector is as depicted in Figure 6.6. The Ministry of Mines and Energy is at recursion level R0;

![Levels of recursion of the electricity sector in Namibia](image)

Figure 6.6: Levels of recursion of the electricity sector in Namibia.

The Electricity Control Board is at level R1 and the electricity sector is at level R2.

The policies, which guide the electricity sector, are formulated by the Ministry of Mines and Energy in consultation with stakeholders, and are implemented by the Electricity Control Board within the electricity sector.

The reporting structure of the Electricity Control Board of Namibia is shown in Figure 6.7. The CEO is responsible for the day to day management of the affairs of the ECB and the provision of sound technical advice to the Board on matters relating to the statutory functions of the ECB.

Due to the specific nature of the institution as the electricity sector regulator the bias of the staff is towards engineers and other professional cadres. The Senior Management of the Board is divided between three functional areas all grouped
into one Technical Services Secretariat headed by the CEO. The three functional areas are:

(i) Economic regulation; - responsible for tariffs and licensing that must reflect economic viability of the enterprises of the electricity market.
(ii) Finance and administration-responsible for administration; human resource management; and financial administration.
(iii) Technical services-responsible for quality of supply and performance of the system;

A General Manager who doubles as a member of the Technical Secretariat heads each functional area.

Figure 6.7: The Organisational structure of the Electricity Control Board of Namibia

Other functions of the ECB not directly listed under one of the functional areas automatically fall under the watch of the Technical Secretariat. Industry
Restructuring and dispute resolution are examples of functional areas that come under the supervision of the Technical Services Secretariat.

### 6.5.4 The Key Operations of the ECB and Challenges

The key areas of operation of the ECB as stipulated in its reports include: licensing of service providers; quality control, dispute mediations; data capture and processing; continued market changes and innovations aimed at establishing an electricity retail market. These are described briefly below.

**Licensing**

Licensing, according to the electricity Act of 2000, applies to authorisation by the Board to undertake any of the following business in the electricity sector: generation of electricity; transmission of electricity; supply of electricity; and export of electricity. The licensing process incorporates several critical elements – such as criteria for considering applications; duration and renewal of licences; transfer of licenses; offences; ministerial regulations and amendments of licenses.

The license offered to undertake business within the electricity market attracts obligations on the part of licensees to commit to the terms of the license. In regard to the supply of electricity, the licensee has a duty to supply electricity, subject to availability of capacity, within its licensed area to every person who applies thereof. The obligations of the licensee are counterbalanced by the licensee's rights to refuse or reduce supply of electricity to a customer as appropriate.

The challenge that ECB faces is developing a clear benchmarking system according to which a distribution licensee's performance, as supply will be measured. Similar benchmarks also need to be developed for generation and transmission.
Technical Standards and Performance

Monitoring technical standards is one of the key functions of the ECB. The technical standards cover network operation, maintenance standards, operational standards. ECB needs to coordinate efforts in preparation of standards that have to be used in enhancing the operational standards of the electricity industry. The overall need for standards covers Low Voltage, Medium Voltage and High Voltage Networks. At the moment these standards are scattered among different sectors of the industry. Some are not available at all and have to be developed. Effective regulatory work depends on availability of reliable comprehensives and recognised standards. The need for standards does not end with regulatory work by ECB but extends to contractors and consultants.

Separation of Distribution and Retails

The Electricity Act does not make specific distinction between distributions of electricity (the wires business involving network operation and maintenance) from the market business (selling electricity, metering and billing, interaction with customers). The international trend is to separate the distribution and retail functions. The ECB has not got sufficient information on how to regulate the relationship between the two functions. The ECB needs to undertake a study of its own to determine how effectively to deal with the need for separation between the two.

Off-Grid Electricity Supply Regulation

The off-grid electricity supply is primarily a distribution function and not a generation function although small generation scale is involved. In the case of customer owned systems, there is no need for regulation. The challenge for regulation will depend on the future large scale electrification through off-grid electricity. Possible approaches may involve fee for service model with a responsible co-coordinated off-grid electricity supply authority and customers who are charged for the service on a regular basis. Such approach is an option in regulating off-grid electricity.
Another possibility that needs to be analysed relates to the off-grid electricity supply services of a distributor whose area includes rural areas, and to leave it up to the licensee, in respect of how to supply prospective customers. Such license must include a very strong obligation to supply so that rural customers are not disadvantaged.

6.6 Survey on Performance of Current Electricity Regulators in S Africa and Namibia

So far insights on electricity regulatory institutions have been gained from results of case studies on electricity sector regulators in S Africa and Namibia based on literature review and interviews. In what follows the results of a questionnaire survey of sample employees of these organisations were made to indicate their opinions about how they thought their organisations were performing. This survey was based on benchmarks of best practice in electricity regulation as drawn from reputable literature sources (Chapter 3).

From these sources a working benchmark of practice of an effective electricity regulatory institution have been deduced. Such benchmark constitutes a model of an effective electricity regulatory practice. The elements of practice of an effective regulation are as obtained from the sources indicated.

Communication: Information should be made available to all stakeholders on a timely and accessible basis.

Consultation: Participation of stakeholders in meetings promotes the exchange of information and the education of those affected by regulatory decisions.

Consistency: the logic data sources, legal basis for decisions should be consistent across market participants and over time.

Predictability: A reputation for predictable decisions facilitates planning by suppliers and customers, and reduces risk, as perceived by the investment community.

Flexibility. The agency should use appropriate instruments in response to changing conditions, balancing this regulatory discretion against the costs associated with uncertainty.
Independence: Autonomy implies freedom from undue stakeholder influence, which promotes confidence in the regulatory system.

Effectiveness and efficiency: Cost effectiveness should be emphasised in data collection and in the policies implemented by the regulator.

Accountability: Regulators should provide clearly defined processes and good rationale for decisions. In addition, appeals procedures need to be specified to provide appropriate checks and balances.

Transparency: The openness of the process to stakeholders promotes legitimacy.

Timely: Decisions and actions must be timely, without short cuts and compromises; to avoid undue costs or the introduction of unnecessary inefficiencies. Rules, policies, roles and responsibilities must be clear for stakeholders. So should a responsive approach with fast-work cycles applied in an orderly and responsible manner.

Professional and management skills: capacity needed for practice

6.6.1 Results and Analysis of Survey on Opinion of Performance of NER of S Africa and ECB of Namibia

Table 9.1 shows the results of opinion of sample employees of the two regulators on their perception of performance of their organizations in areas of regulatory functions of the organisations.
<table>
<thead>
<tr>
<th>Results Area</th>
<th>National Electricity Regulator</th>
<th>Electricity Control Board</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall rating</td>
<td>Overall rating</td>
</tr>
<tr>
<td>Communication:</td>
<td>Adequate</td>
<td>Fair</td>
</tr>
<tr>
<td>Consultation:</td>
<td>Adequate</td>
<td>Adequate</td>
</tr>
<tr>
<td>Consistency:</td>
<td>Satisfactory</td>
<td>X</td>
</tr>
<tr>
<td>Predictability:</td>
<td>Poor</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Flexibility.</td>
<td>x</td>
<td>X</td>
</tr>
<tr>
<td>Independence:</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Effectiveness and efficiency:</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Accountability:</td>
<td>Satisfactory</td>
<td>X</td>
</tr>
<tr>
<td>Transparency:</td>
<td>Satisfactory</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Timely:</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Rules, Policies, Roles and</td>
<td>Unsatisfactory</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsive approach</td>
<td>Unsatisfactory</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td>Professional and management</td>
<td>Inadequate</td>
<td>Inadequate</td>
</tr>
<tr>
<td>skills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: "X" – implies not possible to rate

Table 6.1: Opinion on performance of electricity regulators in SA and Namibia

The results obtained above from this survey are part corroborated by Rossouw (2003, pp1-14) for the NER. From the snapshot of performance of these two regulators, some general conclusions can be inferred that the areas of regulation showing clear signs of weak regulation are: professional and skills capacity; responsive approach; timeliness; understanding the rules, policies, and roles; predictability.

There are a number of reasons for these problems occurring in the practice of regulation between NER and ECB. At the root of the problems is the relative lack of experience gained in the practice of electricity regulation. The ECB has been in operation for slightly over three years and the NER has been in practice for slightly over five years. The second point is that there is a shortage of professional and management skills in these two organisations. These shortages are particularly apparent among technical cadres of staff. Again these shortages may be due to a number of factors: general national skills shortages in technical fields; skills shortages due to the late appearance of electricity regulation as a practice and, by default, a lack of experience in the same; plus the slow strategic approach in dealing with problem.
The complexity of regulating the electricity sector is another reason for the poor ratings in the practice of regulation. The rules, policies and roles do not lend themselves to easy interpretation, particularly where government policies are conflicting. This is another factor that creates delays in responding to stakeholders.

Information asymmetry and regulatory capture are other factors, which impede the practice of regulation. The information asymmetry is a result of monopoly and older elements of the new electricity market players, while regulatory capture tends to emanate from political interference in the due process of regulation.

6.6.2 Implications of the Analysis

The purpose of the analysis is to identify hotspots in the practice of and behaviour of newly formed regulators. By determining the causes of such problem areas, it is expected that the results can be used to perfect the design of the regulator for Botswana to deliver superior performance. The main cause of poor performance in the categories of functions specified in Table 9.1 for the two organisations appears to be skills shortage. It is a factor that has to be picked and considered in the functional capacity of the electricity regulator for Botswana.

6.7 Discussions

At the onset it is important to recognize that the regulatory agencies for Namibia and S Africa are operational albeit their relatively short period of operation-between two to five years. Broadly the two agencies have a marked degree of similarity, but there are also significant differences. For example, each of the two agencies have core functional similarities relating to economic and technical regulation such as pricing and tariffs; licensing; customer services; technical standards and performance.

In terms of structure, the NER of S Africa is bigger than that of Namibia in
relation to staffing and functional areas. Possible reasons for can be seen in the relatively big size of electricity sector that is operational in S Africa in comparison to the size of the sector in Namibia. Size here refers to the electricity market - size of demand and capacity of supply business; infrastructure such as transmission and distribution systems and plant; extent of ancillary service market for reactive power, spinning reserve and cold start.

The electricity market in the two countries differs. The S African market is a retail type while the Namibian one is a wholesale type. In the retail market some customers and / or distributors can buy electricity from generators, in addition to the transmission systems operator. On the other hand in the wholesale market only the transmission system operators can purchase electricity from the generation entities and sell it to customers and / or distributors.

Relevance of Case Study Results
The relevance of the case study in the functional areas indicated for the two electricity regulatory agencies in South Africa and Namibia can be judged in the context of understanding how existing operational liberalised electricity sector regulators are organised in relation to structure, functions, key activities, and operation. The studies identify areas of concern within such organisations as they go about fulfilling their mission. The case studies show that there are clearly concerns with economic and technical regulations among stakeholders of the respective electricity sector as indicated in Table 6.1. These concerns are mainly due to skills and management capacity shortage in regulation. In practice, the study shows that performances in the areas related to transparency, timeliness, consistency, and responsiveness in the two organisations indicate underachievement. The relevance of the case study for these two regulatory agencies can be seen in terms of the insights and lessons learned that could be used to improve the set up of an electricity regulatory agency in Botswana. In particular the lessons learned should aim to constrain and neutralise the transfer of weaknesses in the performance of the regulatory agencies used in the case studies to Botswana one.
Utility of Case Study Results

The case study results contribute to the design of other electricity regulatory agencies in many ways: (i) core functions of regulation; (ii) generic organisation structure of a regulatory agency; (iii) avoiding replication of weaknesses embedded in their performance. Under the circumstances, the case study results establish example models of regulatory agencies that can be emulated when setting up new regulators such as the proposed one for Botswana.

The main problem associated with the utility of results of the case studies is that it "is not a fit all size" result rather there is a need to adapt the results so that it

6.8 Recommendations from Case Study of Regulatory Agencies (National Electricity Regulator -NER and Electricity Control Board- ECB) Relevant to Botswana

The case studies offer substantial insights and practical means of establishing a new regulatory agency, such as the one being mooted for Botswana. The areas in which these case studies are of significant values fall under the following categories:

(v) Generic organisational structure of an electricity regulatory agency;
(vi) The core functions and regulatory practice of the electricity regulatory agency;
(vii) Areas of key skills needed to operate an agency effectively;
(viii) Likely areas where the regulatory performance is likely to suffer.

The recommendations considered are drawn from considerations of these factors.
Organisational Structure

A robust structure for a regulatory agency requires a minimum of four business areas: legal services (dispute regulation and interpretation of regulations); value adding services (finance and administration); regulation (technical and economic); stakeholder consultation. Additional requirement for structure need to be considered in terms of developments in the electricity market – in particular the market structure and research, which can offer new and better techniques for effective regulation. The idiosyncrasies of the electricity market being regulated as well as the priorities of national energy policies need to be taken into account. These are the additional elements of structures, which need to be considered in the establishment of new regulatory agencies.

Core Functions and Practice For a Regulatory Agency

The results of the case studies confirm the core functions that a regulatory agency should perform: setting electricity prices and tariffs; licensing market operators and participants; monitoring customer services and concerns. These core functions are undertaken within the broader objective of increasing competition within the market. The core regulatory functions have to be achieved through broader operational practices involving: transparency, accountability, transferability, flexibility, and consistency. The practices marshalled here constitute factors, which increase efficiency of operation of the market and indeed the electricity sector.

Skill Capacity for Effective Regulation

The results from the case studies highlight the link between performance and skills capacity for electricity regulation. Poor regulatory performance is attributed to lack of understanding the skills underpinning regulatory process. The incidence of lack of regulatory skills can understandably be more acute in a country where the regulatory agency is yet to be established in comparison to countries where such agencies already exist. Botswana is such an example. Consequently it is important and imperative for Botswana to initiate the process
of training of relevant cadres of regulators prior to the beginning of establishing the institution of an electricity regulatory agency. This is particularly important for critical areas where effective regulation is needed: namely economic and technical areas of regulation.
Chapter 7: Conceptual Framework of Contextual Characteristics of the Electricity Sector in Botswana Based on Qualitative and Systems Dynamics Approach

7.1 Overview

In this chapter, the findings of qualitative system dynamic approach to understanding the contextual characteristics of the electricity sector in Botswana are reported. The findings essentially address the question:

What are the contextual characteristics of the environment of the electricity sector in Botswana?

The data collected and analysis (refer to methodology section). Have been used to provide insights of the sector in Botswana through a Causal Loop Diagram. The theory generated is used in Chapter 9, in designing a robust and effective future electricity regulator for Botswana. The nature of the problem being explored, as based on the question above was approached from qualitative system dynamics. The quality of data results and analysis of data collected are presented in the sections, which follows.

7.2 Data Sources and Quality

7.2.1 Primary data collection: Interviews

Structured, semi-structured and open interviews were carried with the following categories of participants:

Policy, Regulation and Quality of Public Electricity Sector Services

- A Deputy Director, one Senior Energy Officer and an Energy Officer in the Department of Energy, Government of Botswana. The functional areas of officials interviewed comprise of electricity (and energy) sector policy formulation, electricity sector regulation.
The Department of Building and Engineering Services – two Directors and three Principal, Senior Engineers, one Engineer whose functional areas include the Management and Supervision of Government Projects in Electrical Engineering Services.

The range of data and information collected through interviews from the Department of Energy reflect current and past policies used for guiding the electricity sector. Each of the policies encountered incorporated policy measures and implementation strategies. The policies discussed during the interviews or obtained through questionnaires were elaborated in two government documents: The Botswana Energy Master Plan (BEMP) of 1996/97 and the Botswana Energy Master Plan (BEMP) of 2003/04.

The strength of data collected from these sources represented perspectives on electricity sector policy, policy measures and their implementation strategies. Most of the information and data collected were based on reports from consultants engaged by the government in the immediate past.

Officers at the Department of energy are skilled in government bureaucracies and methods of government regulation of the electricity sector. Their backgrounds are technical fields particularly electrical engineering. The strengths of their information is therefore largely based on technical issues and policy issues.

Information collected from participants from the Department of Building and Engineering services was based on supervision of Government building, mechanical and electrical engineering services undertaken by consultants and contractors. The issues surfaced related to the quality of work in these areas and were technical in nature.

**Supply of Electricity**

- The CEO, and five Managers from the electricity utility, the Botswana Power Corporation. The managers interviewed consisted of those working in the
following areas: corporate planning, finance and accounting, operations and transmission; distribution operation; and commercial activities; and human resources.

The categories of data obtained consisted of the following perspectives: technical; financial; commercial; business and planning. The people interviewed do not have formal background in electricity sector regulation although they are aware of some of the factors associated with regulation. The deficiency in their knowledge of the sector regulation is reflected in the data collected.

**Deregulation and Privatisation of Public Enterprises**

- The Deputy CEO, a Director and three Managers from the Public Enterprise Evaluation and Privatisation Agency (PEEPA). The functional areas of the director and managers and officers interviewed consists of economic and financial affairs, human resources; legal and statutory affairs, privatisation planners, and deregulation of public enterprises.

Their perspectives were based on economic and financial issues, in relation to public sector and private enterprises, reflecting their education and experience as well as relevance to the organisation for which they are working. The skills in regulation, particularly with regard to electricity sector regulation are derived from either informal interactions or through regulation of other industries such as the telecommunications sector. The data collected from PEEPA, therefore, reflects these shades of high points and weak points.

**Telecommunications Regulation**

- Two Directors and three managers from the Botswana Telecommunications Authority whose functional areas include: the telecommunications market; quality of services; telecommunications engineering; legal and statutory affairs;

The data collected from these participants show depth of practical and theoretical understanding of regulation of the telecommunications sector and by extension
have appreciation of the key issues that are involved in the electricity sector regulation and governance.

**Major Electricity Consumers**

- Four managers and three officials from the Diamond Mining Industry whose functional areas include: electrical engineering services; mining operations; and technical services. Two managers from the BCL Copper mine who work in the areas of electrical engineering services and finance departments.
- Five managers in manufacturing processing industry. The industries include – Botswana Meat Commission; the Northern Textile Industries;
- Ten household consumers in urban areas;
- Two managers and two officials from the Botswana Confederation of Commerce Industries and Manufacturers (BOCCIM)-an organisation representing Private Sector Employers. The areas of work of the interviewees involve employers concerns – such as factors of production including labour productivity and costs, costs of electricity services and skills capacity.

The participants come from a broad range of social and professional backgrounds – in terms of professional and management skills. However the information and data collected from this group of participants is diverse and reflects concerns over electricity access, and affordability in such a way as to promote industrial development and social equity.

**7.2.2 Workshop Participants and Process**

A workshop comprising a mix of people from the public sector, private sector and academia were selected and took part in a three-hour workshop to discuss the findings and to provide further insight into the research question. In all twelve participants took part in the workshop. The participants for the workshop were drawn from the Department of Energy, the Public Enterprises Evaluation and Privatisation Agency, the Botswana Power Corporation, the Debswana Diamond Mining Company, Botswana Confederation of Commerce Industries and Manufacturers (BOCCIM), the Botswana Telecommunications Authority (which is a regulator of the telecommunications sector). The combined group was selected
to represent the key stakeholders and players in the electricity sector in its current form and future reformed structure. The group included stakeholders who have the power to influence the design of the electricity sector regulator and governance, stakeholders who will be affected by the sector regulator, and stakeholders who understand some perspectives of an electricity sector regulatory institution. The number of participants to the workshop was 12. I was the facilitator to the workshop and was assisted by a Research Assistant. The number was limited to 12 to ensure all participants were adequately engaged during the workshop.

I had interviewed six of the workshop participants during the interview stage and they were familiar with the theme of the workshop. The other six were new but were familiar with the subject of the workshop based on their experiences and knowledge.

The process of problem solving approach was adopted for the workshop. It involves four steps: planning; doing, checking and acting. Only the first step (planning) of the four-step process was relevant for the workshop. There are four stages of the planning step, namely:

- Addressing the research questions;
- Reviewing the current and proposed electricity sector institutional framework, features, characteristics, and behaviour and problems;
- Identifying all the possible causes of current and future problems in the electricity sector as it relates to electricity sector regulation and governance;
- Using the systems thinking tools to develop appropriate CLD theory and working models of electricity sector regulator and governance based organisational cybernetics and systems dynamics.

7.2.3 Secondary Sources of Data: Documentation

The sources of secondary data include a variety of reports and documents, which among other comprise:

- Consultancy reports to the government on the "Preliminary Investigation on Electricity Supply Industry Restructuring in Botswana, 2003";
7.3 Data Analysis

Data analysis will be based on a systems approach. A story forming a rich picture from the results will be prepared; the data will be organised using key themes leading to the development of Affinity Diagram (AD), Interrelationship Diagram (ID) and the development Causal Loop Diagram (CLD), followed by a reflection and then redesign intervention.

7.4 Overview of Qualitative System Dynamic Approach

First we remind ourselves of the role of system dynamics in a problem situation. A summary of approach deploying systems dynamic involves the following categories: purpose; beneficiary, transformation, measures of success, owners and constraints. The details on these are captured in the table below.
### Table 7.1: Defining categories for qualitative systems dynamics

<table>
<thead>
<tr>
<th>Category</th>
<th>System dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Establish relationships between key variables in the electricity sector in Botswana</td>
</tr>
<tr>
<td>Beneficiary</td>
<td>Stakeholders in the electricity sector: electricity suppliers; electricity customers; Government; Public Enterprises Evaluation Privatisation Agency (PEEPA); Botswana Power Corporation; Department of Energy.</td>
</tr>
<tr>
<td>Transformation</td>
<td>To inform the formation governance mechanism and the design of electricity sector regulator in Botswana in the future so that they are effective and efficient.</td>
</tr>
<tr>
<td>Measures of success</td>
<td>Operational Efficiency of an electricity regulator</td>
</tr>
<tr>
<td>Owners</td>
<td>Government, PEEPA, Department of Energy, Botswana Power Corporation</td>
</tr>
</tbody>
</table>
| Constraints | - Skills capacity;  
  - Stakeholder relationships;  
  - Decision capacity;  
  - Effective leadership |

#### 7.5 Literature on The Key Results and Analysis

The preamble to the results and analysis is a relevant literature survey presented below and serves a dual purpose: it acts as a reference position against which the results and analysis of the research can be bounced, and it fulfils the key requirement for inductive logic in the process of theory generation. In this section, we present the literature alluded to.

##### 7.5.1 Security of supply

Security of supply is an important regulatory factor for an electricity sector whether liberalised or not. It is a measure of the adequacy of electricity generation capacity to meet demand. The installed generation capacity can be considered to be adequate when peak demand for electricity is covered by an adequate margin, taking into account the availability of generation plant and the availability of primary energy. Assuming that the planned maintenance of generation plant must allow for forced (unplanned) outages of the generating plant and sufficient operating reserves to withstand the loss of the largest in-feed to the power system (Vundule et al; 2003). As a performance measure, security of supply shows the degree of the country's self sufficiency with respect to its electricity needs and excludes imports. On a more serious aspect, on the short
term basis the security of supply from the system can be affected by insufficient generation being available to meet demand or the transmission system being unable to sustain delivery of the power (Murray, 1998). Total reserve margin is an important aspect of security of supply and it shows the adequacy of available installed capacity and contracted supply in relation to the system maximum demand. A projection of the expected reserve margin into the future should be available from the forecast. This is to reduce violation of security of supply. Such forecasts of reserve margin must take into account-planned maintenance of the system.

When security of supply is violated; due to scarcity, the demand for electricity may exceed supply, and relatively high cost of supplies are called into market and the market clearing prices may rise (Wilson, 2000). The implications of scarcity on security of supply does not only affect prices in the electricity market but has important implications for market design; market power; economics of scarcity. All these require regulatory intervention to deal with, rather than being left to the market.

7.5.2 Financial Performance

Financial performance is a very important element in any business enterprise. In the electricity sector typical financial indicators include: debt to equity ratio (which shows the relationship between external and own funding); and return on assets. This shows the profit that is earned from assets. It represents profits that the electricity business makes. The debt equity ratio indicates how the business is funded and is commonly used as a financial leverage of the business (Vundule, 2003). Evidence from developed and developing countries show that financial performance has been unsatisfactory particularly prior to deregulation (Turkson, 2000). Therefore, there has been a need to improve the financial performance of the power sector to attract private sector capital to finance investments in power plants, transmission and distribution lines to meet the growing and unsatisfied electricity demand (Turkson, ibid). Many countries in developing countries still experience levels of country risk that prevent them from attracting the amount of financing they need to grow their electricity sector. Such risks include currency
devaluation, political risks, and currency convertibility. To succeed in meeting their electricity requirements, countries will need to solve the problem of putting their electricity sector on a sound financial footing.

A study of four electric utilities in Africa, indicates that financial performance is not an indicator of good overall performance or efficiency (Redeby, 1998). The Study shows that the Botswana Power Corporation and the Lesotho Electricity Corporation turned in good financial performances, but their high prices – in spite of cheap power from Zambia and South Africa point to organisational inefficiencies. A more holistic approach is, therefore, needed if adequate level of financial performance is to be achieved.

There is a general recognition that future prospects for a well functioning electricity market depends on our ability to design regulatory and market institutions that can provide efficient levels of transmission investment (Cameron, 2001). There are two debates to the problem. On one side there are those who advocate for market rules to make private investors to undertake a significant investments in the transmission systems. The other side of the debate proposes that transmission investment should be highly centralised and through a regulator. The issues are hence based on financial performance and the market, which, in turn, is based on regulatory fitness.

7.5.3 Sustainability of the industry (Efficiency; Safety; Affordability; and the Environment)

Sustainability of the industry is about meeting the needs of the present without compromising the ability of future generations to meet their own needs for electricity. Sustainability embraces meeting the "public benefits" agenda. This covers social, environmental, research, planning and developmental goods and services that bring about notable social improvements (Clark, 2001). The focus for sustainability in the electricity sector relates to environmental protection, efficiency in electricity supply, affordability of electricity and safety in supply and usage (Clark, *ibid*). The public benefits are likely to fail if it is not planned for, particularly because the market, for example the liberalised electricity market, will
not invest in them because it does not pay financially and directly to do so. Further government interventions often tend to be less efficient than market approaches and often have unintended consequences at odds with their original aims.

Efficiency of the sector requires monitoring to establish losses at various stages in the generation of electricity. For example, converting primary energy to electricity; transporting electricity, and supplying electricity to customers (Vundule et al, 2003). The higher the loss, the higher is the cost of electricity production. Production costs, particularly when they are high, adversely affect the tariffs, forcing customers to pay more for electricity services.

There is, generally, a concern over affordability of cost-covering tariffs for electricity. There is suspicion in a number of instances, particularly in developing countries whether indeed the tariffs charged have relationship to costs of production (Christensen, 2000). The sustainability of businesses depends on affordability of services. Affordability is a serious concern to poor households. Therefore designing a tariff should weigh carefully all consumers in all income brackets, not least the poor.

The process of using mandatory regulation to control or manage the environmental impacts of industry is begun by establishing principles and setting standards which govern the operations of regulated enterprises (Gouldson et al, 1998). In the electricity sector when fossil fuels are burnt in the production of electricity, a variety of gases (such as sulphur dioxide, nitrogen oxide, carbon dioxide) are emitted. Such emissions have to be monitored. Monitoring traditional fuel use is one of the human development indicators of the United Nations. It is thus important to promote efforts of business to enhance environmental performance and to ensure that the policy and regulatory framework within which business operates is consistent with the need to gain competitive advantage (Gouldson et al, *ibid*).

Electricity by its nature is inherently a potential danger to lives of people who are exposed to it in generation, transmission or distribution. Safety to human lives is,
as a result, a matter of great concern. Policies, regulation, codes of practice are important and essential. Safety regulations, therefore, have to be applied and controlled strictly to ensure operating errors do not occur (Vundule, 2003)

7.5.4 Access

Access to electricity is an integral component of socio-economic and human development. Access to electricity is one of the World Bank's development indicators. To improve electricity access means finding technological and institutional innovations that lower costs of obtaining and using electricity services (Dubash, 2000). However, substantial barriers may prevent low income households and communities from gaining access to electricity. The main challenges to access, particularly to low income households include: prohibitive high costs of funding connections of households to grids; electricity networks are costly to build and need high densities of for demand; the cost of installing alternative sources of electricity are high in areas where there is no electricity; investments in electricity not only need physical infrastructure but also intervention of customer relations (Dubash, 2000). These are the challenges that the regulator of the electricity sector has to deal with.

Access to electricity is generally low, particularly in developing countries. This is compounded by the fact that there is increasing demand for electricity with increasing population and amenities, while simultaneously economies are getting weaker and donor funding is decreasing (Bhagavan, 1999). Access is further compromised by the weak financial performance of most utilities, which then find it hard to invest in the future development of the power sector.

Access to schools, hospitals, clinics and poor households pose special challenges related to access of electricity (Vundule, 2003). It is critical for the electricity sector to be monitored in its performance in narrowing the electrification backlog in both rural and urban areas – a task that an electricity regulator must be innovative in achieving.
7.5.5 Customer services

One of the main elements of customer delivery is determining customer’s perceptions of service quality. Pursuing service quality in the provision of electricity is an important regulatory responsibility. Customer quality index among various users of electricity – small, larger or medium in rural or urban areas fosters planning and implementing customer satisfaction programmes.

The number of customers per employee is a telling indicator of system management efficiency. In mid-1990s, in Pakistan it stood at 38 customers per worker; Argentina 126 customers per worker, and Thailand at 150 and in the USA the average is 145 (Czamanski, 1999). The higher the number the better is the customer service.

Many existing electricity market designs emphasise supply-side bidding with little participation from electricity consumers of distributors representing them. However knowing how much consumers value electricity at different locations and times or reliability or other ancillary services may be the key to resolving many market design problems (Chao et al, 1998). The regulatory regime has an important part to play in fostering the market entities towards achieving customer satisfaction without resorting to conflict resolution.

A survey by McKinsky (Mcquinsky, 2003) concluded that customers are largely content with their service and almost oblivious of service interruptions. The survey, however, found that customers would prefer more frequent and accurate billing, shorter call-centre waiting times, and speedier connections for new properties from their distributors. These improvements in quality of service would be relatively cheap to implement compared to reliability of service or supply, which is a very important attribute for quality of service.

7.6 Key Results and Analysis of Issues Related to the Electricity Sector in Botswana
Consultations with stakeholders and industry key players have been carried out at three levels: (i) interviews and (ii) workshop (iii) document review. Several issues emerged that require policy consideration of which the following are pre-eminent.

### 7.6.1 Exposure to excessive electricity imports

At current levels of electricity supply, imports constitute about 69% while local generation makes up the remaining 31%. The imports are sourced from the Southern Africa Power Pool’s (SAPP) Short-Term Energy Market (STEM) and from Eskom. This creates a risk of exposure to excessive electricity imports, particularly when it is viewed in the context of imminent loss of excess capacity in the region. This is officially predicted to occur in 2007. The country has to plan well ahead to have adequate supply to forestall the impact of loss of capacity.

### 7.6.2 Rural Electrification and Economic Sustainability

Significant progress has been made since the last Botswana Energy Master Plan (BEMP) (1996) in rural electrification with 237 villages electrified to date and 411 villages left to be electrified (BPC, 2003). The financing option in place is such that for villages that are projected to generate, at least a 6% annual rate of return on investment, the Botswana Power Corporation (BPC) will assume responsibility for electrification. However, for villages where the Internal Rate of Return (IRR) is projected at less that 6%, the government subsidy is provided to cover for cost overruns that cannot be recouped through 6% IRR. With deregulation and restructuring of the electricity supply industry (ESI) being considered in policy circles, a new approach may be required to finance rural electrification for long-term sustainability.

### 7.6.3 Electricity Sector Reforms and Implications for BPC

A preliminary study on the restructuring of the electricity supply industry (ESI) in Botswana was concluded early in 2003, and the outcome has recommended four reform strategies, namely: Public governance; Privatization of the BPC; Private
Generation; and Competition. These are subject to a government decision to proceed with restructuring the ESI. If government accepts to proceed with the restructuring process then the following changes are envisaged:

- Introduction of new Companies Act
- Amendment of the BPC Act
- Legislation for new regulator Government and BPC performance contract
- Establish a market regulator
- Preparation of privatization transaction
- Bringing the Morupule Power Station to a financial close

The key questions for policy consideration are if government proceeds with restructuring:

- What time frame would be appropriate?
- What reform model would be suitable?
- What should BPC do in the interim period?
- What policies will be needed to guide the restructured ESI in Botswana?

### 7.6.4 Electricity Sector Governance and Regulation

Governance and regulation for the electricity sector needs to be considered from two scenarios:

- **Scenario 1:** Current electricity sector structure;
- **Scenario 2:** Electricity sector structure following restructuring.

Under scenario 1 the key issues relate to the capacity for Department of Energy to regulate the industry. For scenario 2 further consultations and study will be required in order to determine what institution would be needed for regulation and governance of the sector, though this study aims to deal with the establishment of regulator agency when the sector is restructured.

### 7.6.5 Impact of Anticipated Loss of Load Demand from BCL and Return of Revalued Assets

Mining operations constitute a high proportion of electricity demand. Five major mining companies account for 51% of total electricity sales and 35% of revenue,
with BCL alone consuming 24% of electricity supply. In the year 2008 BCL is expected to close leaving stranded assets and a large gap in electricity demand.

The stranded assets resulting from the closure of BCL will have profound effect on the rate of return to the BPC. The BPC needs to generate 8% in return on its revalued assets in order to meet loan repayment commitments. However, the BPC has set between 6.0%-6.5% as achievable targets for return on its revalued assets. That is based on the BPC's re-evaluation of its assets. This is done every five (5) years to meet mandatory requirement. In between the five years, estimates are used for arriving at the rate of return on revalued assets.

7.6.6 Relative High Tariffs

Compiled tariffs for thirteen utilities in Southern and Eastern Africa in April 2003 for domestic (450kWh), general commercial (900kWh) and industrial (2 500 kWh at 50% load factor) are depicted in Table 4.

<table>
<thead>
<tr>
<th>Utility</th>
<th>Domestic (USc/kWh)</th>
<th>General Commercial (USc/kWh)</th>
<th>Industrial (USc/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPC</td>
<td>6.5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>CEB</td>
<td>14</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>EDM</td>
<td>8</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>ESCOM</td>
<td>3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Eskom</td>
<td>7</td>
<td>6.5</td>
<td>2.5</td>
</tr>
<tr>
<td>KPLC</td>
<td>8</td>
<td>7</td>
<td>7.5</td>
</tr>
<tr>
<td>LEC</td>
<td>5</td>
<td>8</td>
<td>4.5</td>
</tr>
<tr>
<td>NamPower</td>
<td>5</td>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>SEB</td>
<td>6</td>
<td>7</td>
<td>5.5</td>
</tr>
<tr>
<td>TANESCO</td>
<td>7.5</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>UEDCL</td>
<td>8.5</td>
<td>9.5</td>
<td>6</td>
</tr>
<tr>
<td>ZESA</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>ZESCO</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>


Table 7.2: Comparative regional electricity tariffs

In regional terms, the domestic, industrial and general commercial tariff for Botswana is moderate. The pattern for the tariffs show that Eastern African tariffs is comparatively higher than those within SADC. Within SADC the tariffs in Botswana compare favourably with those of NamPower (power utility for Namibia) and Lesotho Electricity Corporation (LEC), Swaziland Electricity Board
(SEB) and Eskom of South Africa for domestic consumers. Eskom appears to provide the benchmark through which the BPC tariffs can be evaluated. The comparison shows that industrial tariff for the BPC is much higher than that of Eskom and that overall the BPC tariffs can be improved in comparison to that of Eskom.

The BPC increased its tariffs twice during the past five (5) years, 5% in 1999 and 5% in 2000 subject to the Corporations' internal target that tariff increases should not be more that 50% of inflation. Despite these modest increases in tariff electricity remains more expensive than in South Africa (US $0.02/kWh), Zambia (US $0.02/kWh); Zimbabwe (US $0.02/kWh), and Namibia (US $0.03/kWh) when compared to Botswana (US $0.04/kWh). One of the impacts of high tariffs is that it could discourage investment into the country and affect levels of consumption especially for the low income.

7.6.7 Efficiency Monitoring at the BPC

Efficiency of operation may be realised at various points in the production, transmission and distribution of electrical energy. Inefficient operation of the utility can contribute to the cost of electricity and drives operational costs of the utility up. Measures of efficiency need to be benchmarked and reported to stakeholders, particularly the EAD as the industry regulator. For example, typical figures for system losses reported for the regional countries were, in percentages, (SAPP, 2002): 7.4 for South Africa, 8.9 for Zambia, 12.8 for Zimbabwe, 9.8 for Namibia and 11.1 for Botswana. While Botswana's system losses are not the worst in comparative terms, nonetheless there is scope to lower the system losses.
7.6.8 Complementarity between Photo Voltaic Systems (PV Systems: Off–Grid) and Grid Electricity

The consultation process has indicated that some stakeholders consider PV as an interim phase before grid electricity is provided and other stakeholders consider PV as an end in itself. The clarity of role of PV in relationship to grid has affected the development of the PV as a source of energy. Various modes of promoting PV systems as energy alternative for households have been indicated in the section New and Renewable Sources of Energy (NRSE).

7.7 A General Theory on The Characteristics of the Environment of the Electricity Sector in Botswana

The theory of the contextual characteristics of the electricity sector in Botswana is organised on the question:

*What are the contextual characteristics of the environment of the electricity industry in Botswana?*

The CLD theory of the contextual characteristics of the electricity sector is depicted in Figure 7.1. It is based on the results and analysis of data collected. The electricity sector in Botswana has both generic and peculiar characteristics, which combine to make the sector unique. The theory can be explained as follows.
The purpose of the theory is to explain the dynamic causal relationship between the variables dominant in the electricity sector emerging from the study involving literature review, workshop process and interviews. The benefit of that understanding facilitates how to identify a suitable leverage point through which optimised intervention can be achieved. The core of the theory is based on security of supply through which national economic development and individual pursuits can be realised. This can be achieved through increasing electricity access that embraces electrification under two scenarios: economically sustainable electrification undertaken by ESI; and rural electrification achieved through funding from both government and the ESI. The second scenario is driven by the principle of social equity. A well functioning economy in turn supports economic sustainability. The security of supply and sustainability of the industry must be maintained at all costs. From Figure 7.1, this can be realised from a variety of options, namely: local generation, imports, and other configurations for generation (such as PV, solar thermal). The prime requirement
is for the industry to attract more investments to be made in the supply sector of the industry – to offset the increasing dependence on imports, which in turn reduces security of supply.

Favourable investment climate into the sector requires an attractive rate of return on revalued assets of the ESI, driven by efficient operation of the industry achieved through high performance standard. The efficiency of operation of the industry can be improved through various devices and interventions such as: cost reflective tariffs, restructuring the industry to introduce competition and attract private investment, technology innovation.

The assumptions underlying this model for policy is that there is adequate and skilled human capacity to deliver on the key components of the industry involving generation, transmission, and distribution.

A more important assumption upon which this theory is dependent is that the demand for electricity is continually growing. This assumption is true when viewed from demographic and economic trends, which are showing positive growths of 3.5% and 5% annually (Bank of Botswana Annual Report, 2003).

7.8 Discussions and Recommendations

Discussions
The results, its analysis and synthesis reported in this chapter represent the output of two research methods, namely qualitative research and qualitative systems dynamics. The key issues emerging from the output of the two research methods have been integrated into a theory. The theory represents the contextual characteristics of the electricity sector in Botswana. The characteristics reflect the following issues:

- Exposure to excessive electricity imports
- Rural electrification and economic sustainability
- Electricity sector reforms and Implications for BPC
- Electricity sector governance and regulation
- Impact of anticipated loss of load demand from BCL and return of revalue assets.
- Relatively high tariffs
- Efficiency monitoring at the BPC
- Complementarity between photovoltaic systems and grid-electricity;
- Promoting renewable energy usage.

The relevance of the issues listed above is to provide insights into the prevailing situation and concerns in the current electricity sector in Botswana. Without understanding these issues, policy formulation and implementation would be extremely flawed. Short-term to long-term planning for the country's needs in electricity sector would be highly compromised. As a result, tariffs would escalate, access and rural electrification would stall and the sustainability of the sector would be seriously be undermined.

The utility of the characteristics of contextual environment of the sector is subject to a number of constraints and possibilities. The major constraints are financial resources to improve the security of supply through construction of new generation facilities; skills and management capacity shortage to formulate and implement innovative policies; inability to undertake studies whose output can be useful for informing decision making capability of those planning for the electricity sector.

On the side of possibilities, the utility of information gained can be used for exploring regional co-operation as a means of pooling resources together in order to increase capacity for new power generation plants. The information collected also form the basis for creating an effective electricity regulator.

**Recommendations**

The factors that have been identified with characterisation of the electricity sector in Botswana are either threats to the health of the sector or opportunities that can be used to strengthen the sector. Regardless of the path that the sector follows, namely, either continuation with the current form in which the sector is run as a
government controlled utility or changes its current form through reforms to become liberalised, there will be the need to mitigate the threats or the need to promote and exploit the opportunities.

The objective of design of an effective regulator agency is to mitigate the threats that the industry faces or to exploit the opportunities it offers to when the sector becomes liberalised. This requires that these factors should be built into the regulatory mechanisms that are key activities and functions of the regulator agency.

It is therefore recommended that the following factors characterising the electricity sector in Botswana should be integrated into the primary activities of the regulator:

- Promoting of rural electrification;
- Perpetuating electricity sector sustainability (affordability, environment, safety, efficiency);
- Promoting usage of renewable energy;
- Enhancing usage of renewable energy;
- Maintaining financial strength.
- Improving electricity access.

These may be considered either in terms of opportunities or threats as explained in the first paragraphs.
Chapter 8: Policy Analysis for Governance and Electricity Sector Regulation in Botswana Using VSM

8.1 Overview

The analysis of policy environment, which guides the development of the electricity sector in Botswana, is examined in this Chapter. The reforms involving deregulation and restructuring of the electricity sector, public/private partnerships; the establishment of an electricity sector regulator and a market governance body are all preceded by policy and legal frameworks, whenever these changes have taken place and Botswana is no different in that respect. Such policies aim to streamline the role of various actors, activities and stakeholders so that purpose and order of the changes expected or planned are established. The VSM has been used as a tool for policy analysis. The guide to the Chapter is as follows. In section 8.2, the chapter begins with sources of data used and current policies relating to the electricity sector reforms, current form of electricity sector regulation, and the establishment of an electricity sector regulator are indicated; in section 8.3 development for establishing regulatory governance are described; in section 8.4 policy analysis is explained and effectuated; in section 8.5 the results and implications of policy analysis are exhibited; and in the final section, approaches to policy recommendations are proposed.

8.2 State of Progress Towards Establishing Governance and Electricity Regulator: Policy Considerations

The regulation of the electricity sector in Botswana is vested with the government under the Department of Energy. The Ministry of Minerals, Energy and Water Resources (MMEWR): Energy Affairs Division (the Department of Energy) has overall responsibility for co-ordination and policy formulation of the country's energy sector.
In this chapter an attempt is made to review the policies that have been formulated to direct two important developments: the restructuring of the electricity sector and the establishment of the electricity regulatory governance. The material in this chapter complements the contextual characteristics of the electricity sector, Chapter 7 albeit, from the perspective of developments regarding reform in the industry. This is expected to guide the future establishment of the electricity sector regulator.

**Data and Information Sources and Quality Issues**

**Primary Sources of Data**

Interviews were carried out with official of the following government ministries and parastatal organisations associated with policies in the electricity sector in Botswana; namely:

(i) A Deputy Director, two Senior Energy Officer and an Energy Officer in the Department of Energy, Government of Botswana. The functional areas of officials interviewed comprise of electricity (and energy) sector policy formulation, electricity sector regulation;

(ii) The Department of Building and Engineering Services – two Deputy Directors whose functional areas include the Management and Supervision of Government Projects in Electrical Engineering Services.

The range of data and information collected through interviews from the Department of Energy reflect current and past policies used for guiding the electricity sector. The policies discussed during the interviews or obtained through questionnaires were elaborated in two government documents: The Botswana Energy Master Plan (BEMP) of 1996/97 and the Botswana Energy Master Plan (BEMP) of 2003/04.

Officials from the Department of Building and Engineering Services were interviewed on effectiveness of measures and implementation of policies in the electricity sector.
The strength of data collected from these sources represented perspectives on electricity sector policy, policy measures and their implementation strategies. Most of the information and data collected were based on reports from consultants engaged by the government in the immediate past.

(iii) One Manager from the electricity utility, the Botswana Power Corporation. The manager interviewed works in the following areas of corporate planning and is involved with the restructuring of the electricity sector, currently in its initial stages.

(iv) A Director of the Public Enterprise Evaluation and Privatisation Agency (PEEPA). The functional area of the director is in infrastructures privatisation.

(v) One official from the Ministry of Finance and Development Planning, associated with privatisation of public enterprises. The interviewees are associated with reforms being introduced into the electricity sector. The areas in which they were interviewed relate to privatisation of the public sector enterprises, particularly the privatisation policy and its implementation.

The nature of the information and data collected from this group of interviewees shows little coordination in terms of policies, their measures and implementation.

Secondary Data
Sources of policy documents used include the following:

(i) Energy Master Plan, 2004 which contains the medium and long term planning for the electricity sector for Botswana;

(ii) Electricity Act of Botswana, 1973;

(iii) Electricity (Supply) Regulations, 1988

(iv) Privatisation Policy for Botswana, 2000

8.3 Policies To Enable Establishment of a Governance body and Electricity Regulator for a Liberalised Electricity Sector
Two policies have been formulated to authorise the establishment of regulatory institutions. There are basically two policy goals to achieve the above objectives, together with associated policy measures. The policy goals and measures are given in Table 8-1. Note that the policy measure for each policy goal is bulleted. The Government of Botswana, through the Department of Energy, hired Consultants to formulate the policies on its behalf through a consultative process, among stakeholders.

<table>
<thead>
<tr>
<th>1</th>
<th><strong>Maintain the current and new regulatory responsibilities of the Department of Energy in the energy sector and enhance its capacity to implement policies and plans</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ Identify new and current regulatory responsibilities of the Department Of Energy, plans and policies to implement</td>
</tr>
<tr>
<td></td>
<td>▪ <em>Enhance the Department of energy capacity to regulate the energy sector effectively</em></td>
</tr>
<tr>
<td>2</td>
<td><strong>Establish an Electricity Regulator</strong></td>
</tr>
<tr>
<td></td>
<td>▪ <em>Enhance the Department of Energy capacity to implement ESI restructuring</em></td>
</tr>
<tr>
<td></td>
<td>▪ <em>Enact an Act for a new Regulator</em></td>
</tr>
<tr>
<td></td>
<td>▪ <em>Establish an Electricity Regulator</em></td>
</tr>
<tr>
<td></td>
<td>▪ <em>Establish a governance body for the ESI following restructuring the ESI and establishment of an electricity Regulator.</em></td>
</tr>
</tbody>
</table>

Table 8.1: Policy Goals and Measures: (Source, the Department of Energy – 2004)

A number of issues, problems are associated with these policies. Through the current study these issues and problems are surfaced below.
8.4 Drivers in the Development for Establishing Governance and Electricity Regulator in Botswana

The progress on establishing governance and electricity regulator in Botswana is being driven by two main developments since 1996:

(a) The study on "The Preliminary Investigation on ESI Restructuring in Botswana" completed in 2003 recommended deregulation of ESI. Associated with restructuring the Report from the study recommended that an electricity sector regulator should be established, although not necessarily as a separate entity.

(b) The establishment of the Public Enterprises Evaluation and Privatisation Agency (PEEPA), which was created to promote the privatisation of public enterprises in Botswana, is an implementing agency for the privatisation of public organisations. The electricity sector is a candidate parastatal organisation planned for restructuring and privatisation. It is expected that PEEPA and the Department of Energy will participate in the programme of action to liberalise the electricity sector and establish the sector regulator.

Table 8.2 shows the responsibilities of PEEPA, as set out in the Privatisation Policy for Botswana, 2000.

<table>
<thead>
<tr>
<th></th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>To identify candidates for privatisation or commercialisation / corporatisation and decide on the appropriate course of action;</td>
</tr>
<tr>
<td>(ii)</td>
<td>To prepare a privatisation master plan;</td>
</tr>
<tr>
<td>(iii)</td>
<td>To oversee all aspects of the implementation of commercialisation and privatisation on behalf of government;</td>
</tr>
<tr>
<td>(iv)</td>
<td>To review objectives of existing parastatal and set objectives for entities to be commercialised and / or corporatised;</td>
</tr>
<tr>
<td>(v)</td>
<td>To assist Government in setting performance targets for parastatals and other public entities;</td>
</tr>
<tr>
<td>(vi)</td>
<td>To monitor the performance of these entities in meeting their objectives and targets;</td>
</tr>
<tr>
<td>(vii)</td>
<td>To advise the Government on the appointment of directors of public companies and parastatals;</td>
</tr>
<tr>
<td>(viii)</td>
<td>To monitor the performance of those directors and boards;</td>
</tr>
<tr>
<td>(ix)</td>
<td>To hire and supervise consultants on privatisation and performance evaluation;</td>
</tr>
<tr>
<td>(x)</td>
<td>To publicise its activities; and</td>
</tr>
<tr>
<td>(xi)</td>
<td>To develop and execute a public education programme.</td>
</tr>
</tbody>
</table>
Table 8.2; Responsibilities of PEEPA (Source: Privatisation Policy for Botswana, 2000)

The function of PEEPA inter alia is that of regulating the electricity utility with regard to performance and guiding the restructuring process.

8.5 Electricity Sector Policy Analysis Using the VSM

The Viable Systems Model (VSM) can be an effective tool in the analysis of the policy issues and problems related to implementing the restructuring process of the sector and establishing a regulatory institution. In this section policies related to establishing the regulator in the context of the sector reform agenda is the focus of analysis. The analysis is based on the VSM for the electricity sector which is shown in Figure 8.1 and explained in the paragraphs below.
Figure 8.1: Representing recursion in the electricity sector.

From a policy perspective; The VSM may be explained as follows:

**Recursion 0:** Systems 5; system 4; system 3, and system 1 are as indicated in the Figure 8.1. The Government, through the support of Parliament determines the overall direction the country takes. The Government is responsible for major policy decisions, which have a major impact on the country on the basis of
macro-economic and political consequences. The Ministry of Minerals Energy and Water Resources, through the Department of Energy formulates policies on the electricity sector – both long and short-term policies. Such policies are applied. The Energy Officers for electricity sector, three in number are responsible for overseeing the policy implementation within the electricity sector.

**Recursion 1:** Systems 5, system 4, system 3, and system 1 are shown in Figure 8.1. This recursion represents the power utility, the Botswana Power Corporation, which is the sole electricity power supplier. The stakeholders are responsible for the overall direction of the utility and implementation of policies emanating from the Department of Energy, both on a long-term and short-term basis. The management and officials of the utility have responsibility of managing the operations of the organisation on a day-to-day basis in line with government policies.

**Recursion 2:** System 5, system 4, system 3, and system 1 are indicated in Figure 8.1. This recursion represents electricity consumers of different categories – domestic; industries; government; rural; urban; and commercial enterprises. The consumers are the beneficiaries or victims of the policies emanating from government. The measures of effectiveness of the policies can be gauged from the level of satisfaction of customers.

**8.6 Results and Analysis for Policy Towards Restructuring the Electricity Sector and Establishing an Electricity Regulator in Botswana**

There were a number of issues and problems raised by workshop participants. The key results from the workshop can be explicated by the VSM as follows.

**8.6.1 Policy Co-ordination**
The policies on privatisation of public enterprises by the Ministry of Finance and Development Planning (MFDP), which affect the electricity sector, are formulated by the government officials in that ministry (Ministry of Finance and Development Planning – MFDP) without the active participation or direct consultation with the officers in the Ministry of Minerals Energy and Water Resources (MMEWR). This view is supported by the contents of the Privatisation Policy (a product of the MFDP) or the Proposed Energy Policy (which is the product of the MMEWR). Both of these documents do not make explicit references on cooperation between the two ministries in achieving the reform agenda. Policy, as a result, is not co-ordinated at two levels: between officials of the two ministries formulating the policies within the two ministries and; between the two ministries. The implications of the problem become more serious at the management of reform and its implementations. The VSM in Figure 8.2 highlights this problem.

Figure 8.2: Illustrating problems associated with policy co-ordination in the electricity sector.
8.6.2 Control and Implementation Gaps in Levels of Recursion

A well-designed structure for managing and implementing a policy requires levels of recursion to be linked vertically between the levels. Referring to the Figure 8.2, there are no structures for linkage between PEEPA and the MMEWR or between the BPC and the MFDP. The significance of such gaps is that they create barriers to effective management / control and implementation of reforms in the electricity sector. This is a result of policies emanating from the two ministries, without the prospect of collaboration and cross-checking.

8.6.3 Skills and Professional Capacity

At each level of recursion, there are several problems and shortages associated with skills and professional capacity to perform challenges related to:

- Reforms in the electricity sector (restructuring and privatisation);
- Regulation of a liberalised electricity sector;
- Managing the reform process;
- Policy formulation.

These shortages are aggravated by the ascendancy of regulation and privatisation in the electricity sector worldwide in the last two decades but without the benefits of corresponding parallel increase skills capacity in the area. The consequences of such developments have negative implications on the various systems of the VSM at each level of recursion.

At systems 5, recursion 0, government officers are responsible for policy formulation. Here there is shortfall of capacity and as a result consultants undertake policy formulation under the supervision of government officers. While this in itself may not be negative, it however, holds the possibility of manipulating policies for political interest. Similar deficiencies can be traced at recursion 1 in Botswana Power Corporation.

The intelligence, system 4, at recursion 0 and recursion 1, the skills capacity for functions of intelligence within the Government, Botswana Power Corporation
can be described as insignificant. This adds to the difficulty and challenges of formulation of policies and implementing them.

At system 3, recursion 0 and recursion 1, management cadre within Government and the Botswana Power Corporation, respectively, exhibit skills capacity problems relating to implementing regulatory policies regarding the reform agenda for the electricity sector.

8.6.4 The Mechanism for Managing and the Change Process

The transition from the current vertically operated electricity sector, under the Botswana Power Corporation, to a liberalised sector owned by investors with monopoly elements within it such as transmission systems represents a major reform programme and change in the dimensions of operation, management and ownership.

The problem of managing change can be clarified using the VSM shown in Figure 8.2. The change is required within recursion 1, in the Botswana Power Corporation. The change envisaged here is reform hence this demands that the change agents should be located externally as well as internally to entity that has to be changed, if the reform is to be effective. The managers of change must be located within recursion 0, which is the government or its agent as well and within recursion 1, the Botswana Power Corporation. The managers of the change have to establish mechanisms for co-ordination and audit of the change process.

8.6.5 The Mechanism for Implementing the Change Process

One of the main problems that are evident on the electricity sector reform process leading to the establishment of the electricity regulator is the lack of clarity of how the reform should be implemented. As already discussed, the Ministry of Minerals Energy and Water Resources is in charge of regulating the electricity sector, while the Ministry of Finance and Development Planning is in
responsible for the privatisation of public utilities and other parastatals. The mechanisms of implementing the privatisation are neither clear nor transparent.

8.7 Policy Gap Towards Establishment of Market Governance Body Following Restructuring the Electricity in Botswana

Examining relevant government documents upon which the anticipated restructuring of the electricity sector has been based, it is clear that the formation of a market governance body has not been discerned in any meaningful way. The matters of interest under a market governance body involves:

- Structure and responsibilities of a market governance body;
- Functions of the market governance body;
- Composition and size of the market governance body.

8.7.1 Policy recommendations

The workshop identified and discussed the problems associated with the restructuring of the electricity sector, as well as the associated problems and issues of implementation and establishing regulatory governance, for the sector from a policy perspective.

An analysis of the issues and problems raised begins with the clarification of focus regarding the objectives for the sector reform and the process and programme of managing and implementing the reform. The groundwork for the preparation of the regulatory requirements including the formation of an electricity regulator is part of the wider task and effort of the sector reforms. The problems surfaced are, therefore, not unique to Botswana but do represent the kind of problems which are peculiar countries which have either restructured their electricity sector, or are in the process of restructuring their utilities have to undergo. The workshop identified and recommended these approaches as part of electricity sector reform and the establishment of an electricity regulator in Botswana.
First a policy formulation process should include representation from both ministries where such policies embrace the electricity sector: finance and Development Planning and Minerals energy and Water Resources. Such and approach will ensure the co-ordination of policies at the highest level. The interests of each ministry will be built into the policies as appropriate. The VSM depicting a co-ordinated approach is shown in Figure 8.3.
Figure 8.3: Recommended levels recursion in policy formulation

The VSM shown above reflects a coordinated approach to the reforms in the electricity sector involving the ministries of Finance and Development Planning; and Mineral Energy and Water Resources as well as the implementing institutions comprising the Botswana Power Corporation and the Public Enterprises Evaluation and Privatisation Agency (PEEPA);

The coordinated approach would facilitate or initiate the articulation, realisations and implementation of the following goals: (i) Reform objectives; (ii) studies
needed to inform the reform process; (iii) establishing the power sector reforms task forces.

In addition the proposed coordination model suits the phasing of the reform process to meet specified objectives.

The VSM in Figure 8.3 representing policy relationships, in terms of recursion, suggests that the formulation and communication channel should be aligned between the government, the utility and customers, in order to achieve maximum success during implementation.

The policy contents need to be specific on issues related to goals, measures and implementation if the policy is to be well implemented. The policy contents should be guided and informed by further studies of the sector, both in terms of diagnosis and new and final forms and options preferred of the electricity sector and its regulation. The studies should link their findings to government objectives and goals for the electricity sector reforms, and the establishment of an electricity regulator. In particular, detailed attention needs to be directed at sector institutional guidelines and the regulatory principles to be pursued. The reform timeline for activities and programmes envisaged for the reform need to be articulated.

Policy content as already reported in section 7.2; in relation to the reforms in the electricity sector and the necessity to establish electricity regulators, exhibits gaps in managing change and lacks strategy implementation detail. The management of change should be entrusted to a Government Committee established specifically to steer the reform process. The Committee, in turn, should establish task forces among its rank: to deal with specific issues identified as major components of the sector reform.

Based on the activities of the power sector reform committee and its task forces. The related outcome should identify action plans for policy implementation. This should result in the formation of an Implementation Committee. The Implementation Committee will then activate all measures intended to initiate the reform and kick-start the operation of the new liberalised electricity sector. This
measure will include contracts for generation, distribution and launching the new electricity regulator.

8.7.2 Policy on Market Governance Body

A clear policy associated with the formation, structure, functions and composition associated with a market governance body is needed. The government, and the proposed power sector reform committee in consultation with stakeholders should spearhead the policy formulation process for the purpose.
Chapter 9: Building A Model of an Effective Governance and Electricity Sector Regulator for Botswana

9.1 Overview

The present chapter brings together various aspects and components of the results of the study into the design of an electricity regulator for Botswana; as well as the proposition for a governance body for the emerging energy market. The goal of the integration process is to achieve an organisational design that reflects the ability to perform optimally in the task of electricity market regulation within a national, regional and international context.

To achieve the goal indicated, the design of the model regulator features both key innovative and novel considerations. These are:

- The core elements of the model designed which include: functional elements of the organisations (regulatory functions); value adding elements (human resources, finance, administrative);
- The innovative elements which include: the MBA theory on management
- The VSM elements that include intelligence, coordination and audit
- The local (that is Botswana) characteristics of the electricity sector which include – rural electrification; effect of high imports; demand characteristics;
- Contributions from literature enabling critical evaluation of best practices and structure for an electricity regulator based on lessons drawn from the case studies of the electricity regulator agencies in South Africa and Namibia.

The final design of the model electricity regulator for Botswana is presented in the form of structure, in relation to recursions of the primary activities of the electricity regulator – that is promoting electricity sector sustainability, and competition. The market governance structure selected is based on the multi-stakeholder Board.

The guide to the chapter is as follows:
Section 9.1 summaries of lessons drawn from case studies of electricity regulator agencies in S Africa and Namibia as well as best practices as gained from literature review;
Section 9.2 deals with the selection and integration of relevant local conditions in regulatory regime;
Section 9.3 presents adaptation and integration of EMBA management lessons into designing an effective governance and electricity regulatory platform for Botswana;
Section 9.4 presents the application of VSM in the design of an effective regulator for Botswana;
Section 9.5 presents the model for electricity regulator for Botswana
Section 9.6 presents the proposed Governance body for the electricity market

9.2 Focused Group Participants and Process

A focused group made up six people was assembled as follows:

- One principal Energy Officer responsible for regulating the electricity supply industry from the Department of Energy. His skills and experience in the sector spans over seven years and has been involved in the formulation of national energy policy of which electricity sector policy is a part.
- One Manager person from the Public Enterprises Evaluation and Privatisation Agency responsible for privatisation of public enterprises, of which the electricity industry is a part. His selection was prompted by his involvement and participation in the restructuring of the electricity industry in Botswana, which is at the inception stage at the moment. Furthermore he is positioned to take charged of developments that will lead to the creation and establishment of the electricity regulator agency in Botswana.
- Two members of the academic staff, one from the Department of Electrical Engineering, University of Botswana with over ten years experience in regulation and consulting in the deregulated electricity industry. The other member from the academic staff of the University of Botswana is a specialist in Engineering management with over seven years of teaching and consulting. He has applied the VSM in several instances in his consulting and
is considered to have a deep understanding of application of VSM in practical applications – particularly in organisational design.

- On senior electrical engineer with the Botswana Power Corporation, responsible for planning. His selection was based on his participation in preparing and planning for the restructuring of the electric utility. His insights regarding the role that the electricity regulator will play were essential for the process.

- One Manager from the Botswana Telecommunications Authority (which is a regulator of the telecommunications sector) responsible for the telecommunications market and licensing service providers in the telecommunications sector. His hands on experience of regulation in the telecommunications field were considered important contribution for the tasks at hand.

The objective of the focused group was to address the question:

*How can the results of the analysis and diagnosis of a model of electricity regulatory institutions and the results of study of contextual characteristics of the environment of the electricity sector, in Botswana be integrated to design a model of governance and electricity regulator to suit Botswana?*

The process of problem solving approach was adopted for the workshop. It involves four steps: planning; designing of the regulator agency (doing), evaluating the outcome (checking) and acting. Only the three steps of the four-step process were relevant for the workshop. Of these the design stage was the most critical and important the tasks involved were:

- Articulating the research questions;
- Reviewing all relevant inputs into the process: lessons drawn out of the case studies for the electricity regulator agencies in South African and Namibia; the contextual environment of the electricity sector in Botswana; the theory of management from the EMBA programme; policy framework for the electricity sector in Botswana; the application of the VSM to the process;
- Undertaking the design process by integrating the inputs discussed above; and determining the form of governance institution;
- Evaluating the process.

9.3 Implications of Analysis and Recommendations from the Case Study of the National Electricity Regulator of South Africa and the Electricity Control Board of Namibia

The implications of analysis and recommendations of the case studies offer fundamentals on the practical means of establishing a new regulatory agency, such as the one being mooted for Botswana. The main lessons drawn from case studies that can be used for establishing a regulatory agency in Botswana are:

(i) The organisational structure of an electricity regulatory agency;
(ii) The core functions and regulatory practice of the electricity regulatory agency;
(iii) Areas of key skills needed to operate an agency effectively;

Briefly these are:

Structure

A robust structure for a regulatory agency requires a minimum of four business areas: legal services (dispute regulation and interpretation of regulations); value adding services (finance and administration); regulation (technical and economic); stakeholder consultation. Onto these other structures can be added appropriate.

Functions and practice

The core functions and practice for a regulatory agency include: Core functions: setting electricity prices and tariffs; licensing market operators and participants; monitoring customer services and concerns. These core functions are undertaken within the broader objective of increasing competition within the market.
Main practices involve: transparency, accountability, transferability, flexibility, and consistency. The practices marshalled here constitute factors, which increase efficiency of operation of the market and indeed the electricity sector.

Skill Capacity for Effective Regulation

For effective regulation, a regulatory agency must have human resources with adequate skills in both economic and technical areas of regulation. This has to be supported by a broad range value adding skills – such as in management, finance and administration. Skills capacity is a factor that has to be addressed prior to and during the establishment of an electricity regulatory agency in Botswana if the agency is to succeed in the case of Botswana.

9.4 Building Key Results Of The Contextual Characteristics Of The Electricity Sector In Botswana into the Sector's Regulatory Mechanism

From the qualitative study, the contextual characteristics of the electricity sector in Botswana exhibit the following key factors:

- Exposure to excessive electricity imports
- The challenge of rural electrification and its economic sustainability
- The proposed reforms of the electricity sector and its implications for electricity utility, the BPC;
- The proposed structures for governance and regulation linked to the reforms;
- Impact of anticipated a major loss of load demand, from the impending closure of the BCL copper mine and its implications on the return of revalued assets
- The relatively high tariffs charged for power;
- Considerations and monitoring of efficiency of operation of the Botswana Power Corporation;
- Managing and promoting application of off–grid (PV) electricity and its complementarity with grid electricity
These factors constitute challenges and opportunities that must be engaged when the sector is liberalised. Therefore, it is important to determine how best to incorporate them into the regulatory mechanism that the electricity regulator should deal with in a way that will promote the performance of the sector. These factors may be viewed from a stakeholder perspective, namely:

- Security of supply (local generation, imports and loss of major load);
- Financial Performance (tariffs and rate of return)
- Sustainability of the sector: industry-efficiency; safety; affordability; and the environment
- Access (grid and non-grid)
- Customer services
- Sector reforms
- Governance and regulation

The critical question is: How can these factors be built into the regulatory mechanism?

To build these factors into the regulatory systems, there is need to consider both the instruments that are chosen to achieve the desired result and the ways these are chosen and then used. To survive, a regulatory system must be seen to be legitimate by the people it seeks to control. There are several considerations that need to be taken into account, when building desired factors into a regulatory system. This involves decisions on the following:

- Whether the regulation should be central or delegated;
- How precise the regulation ought to be;
- The mechanism of enforcing the rules.

As indicated in section 9.5 these contextual characteristics of the electricity sector in Botswana have been factored into the regulatory functions or recursion levels as a primary activity of the electricity regulator.
9.5 Building The EMBA Management Lessons Into Designing Effective Governance And Regulator For Botswana

The theory developed from the EMBA programme addresses the question: How do organisations create and manage value for their customers? The CLD-driven theory regarding this question was based on the assumptions that:

(i) The organisational form, design and structure reflect robustness consistent with its mission and purpose;

(ii) The theory is applicable to shareholder value management, for private organisations and business enterprises rather than public sector organisations;

The CLD depicting the theory is shown in Figure 9.1. The drivers and outcomes upon which the theory is built are as follows.

Drivers

- The level of effective leadership and management;
- The level of understanding the role of complexity theory in management;
- The level of effectiveness of critical management thinking in management;
- The level of application of effectiveness of management skills to an organisation;
- The level of effectiveness of systems thinking in management;
- The level of effectiveness of Intellectual capital affects the level of creating value by an organisation;
- The degree of impact of economy determines the level of business performance;

Outcomes

- The level of effectiveness of marketing;
- The level of extent of globalisation of business;
• The level of innovation and entrepreneurship;
• The level of effectiveness of lean production systems;
• The level of understanding and application of work systems in management;
• The level of understanding customer values;
• The level of effectiveness of shareholder value management;
• Level of effectiveness of performance measures in strategic management;
• The level of effectiveness of accounting reports as a decision support tool in organisational management;

9.5.1 EMBA Driven CLD Theory of How Organisations Create and Manage Value from EMBA4

Figure 9.1 presents the CLD theory of EMBA4 on creating and managing value by organisations.
Elements of the Theory

The theory subsumes four main elements represented in Figure 9.1 each representing a CLD theory in its own right. These elements repeated here for convenience are:

(v) Normative management in entrepreneurship and innovation – CLD1;
(vi) Effectiveness of leadership – CLD2;
(vii) Strategic management and performance – CLD3;

Each CLD theory is made up of key loops, all which are reinforcing loops. These theories themselves are derived from CLD theories from the position papers. The details of this theory are available in my Position Paper 4.6. The core of the EMBA theory on normative, strategic and operational management is reflected in the DoMain of management described below.

9.5.2 DoMain Model of Management

The part of the theory which is relevant for this dissertation involves DoMain of management; namely normative, strategic and operational.

There is a close correlation between Espejo's levels of management and Hoebeke's domains of management. The domain is used rather than levels of management to avoid a possible sense of hierarchy. The following domains are used in the DoMain model (EMBA4, notes 2002).

Domain 1

Domain 1 is called the operations Domain and is a synthesis of Espejo's operations level and Hoebeke's value added value domain with the following characteristics.

- Time horizon for decisions and plans – 1 day to 2 years;
Primary purpose – to realise and deliver the value for which the customer is prepared to pay for.

Measures of performance – throughput time, volume, intrinsic quality, price;

Management indicators – profitability (revenue and costs) and solvency (income, expenditure);

Management process – regulation;

Management criteria – efficiency.

**Domain 2**

Domain 1 is called the Strategic Domain and is a synthesis of Espejo's strategic level and Hoebeke's innovation domain. It has the following characteristics.

- Time horizon for decisions and plans – 1 to 10 years
- Primary purpose – to create the potential for value creation within the organisation and a strategic advantage for the organisation. In doing this it creates the conditions for the operations domain and set the parameters for its performance.
- Measures of performance – desirability, feasibility, transferability, systemicity.
- Management indicators – extant value potential (critical success factors) and new value potentials (distinctive competencies)
- Management process – co-ordination.
- Management criteria – effectiveness.

**Domain 3**

Domain 1 is called the Normative Domain and is a synthesis of Espejo's normative level and Hoebeke's value system domain. It encompasses the area of corporate strategy:

- Time horizon for decisions and plans – greater than 5 years;
- Primary purpose – manage the normative content (values and beliefs) of the organisation's long term policies and strategies to ensure long-term survival and development. In doing so it creates the conditions for the strategic Domain and set the parameters for its performance;
- Measures of performance – generative capacity, tolerance, dialectic interactions, congruence;
- Management indicators – development (systems philosophy and dynamics) and viability (systems structure and culture);
- Management process – balancing advocacy with inquiry;
- Management criteria – Legitimisation.

The concept of the Business Idea is used to integrate the three domains into systemic model of management. The DoMain Model is shown in Figure 9.2

Figure 9.2: The DoMain Model of Management

The question of application of this model in the design of an electricity sector regulator follows:

**How can these management factors (EMBA and DoMain Model) be built into the electricity regulator design for Performance?**

Consultations with regulators have identified the framework of integrating these factors into designing the regulator organisation through

(a) Capacity building for regulation

Capacity building approach that subsumes of the following drivers:

(i) Institutional analysis involving:
- Policy formulation; and
- Institutional design;

(ii) Management components:
- Planning
- Works system design
- Performance management;

(iii) Capacity building enhancers
- Key skills provision;
- Effective institutional learning;
- Managers as enablers of high performance;
- Appropriate culture for high achievement;

(iv) Specification of regulatory capacity – which underscores regulatory impact:
- Regulatory outputs;
- Stakeholder relations.

It is important to recognise that what is proposed above comprehensively deals with performance management in terms of efficiency and effectiveness, at operational and strategic levels respectively. Managing at normative level calls for more intuition, innovation through inquiry and advocacy.

(b) Management performance reflecting effectiveness and efficiency

Normative, strategic and operational level management performance, which reflects efficiency and effectiveness can be evaluated using the VSM framework. This is indicated in Figure 9.3, incorporated in the organisational design for the electricity regulator using the VSM.

9.6 The Application of VSM for Designing an Effective Regulator Model for Botswana
In using the VSM for designing for an effective regulator, three requirements, which are consistent with cybernetic principles, comprise:

- Self-organising
- Feedback
- Requisite variety

Figure 9.3: The Fitness of an organisation based on VSM and DoMain management level (Source: Espajo, 2002)

The VSM offers a way of gaining both functional decentralisation and cohesion of the whole. It is underpinned by the fundamental cybernetic principles of communication and control in a complex organisation. These principles offer a way of providing true autonomy and empowerment within an integrated framework, together with the necessary supporting links between the individual parts. In short, the VSM provides a framework for designing flexible, adaptable
organisations that balance external and internal perspectives and long and short-term thinking.

The recursion function development of the regulator organisation is the starting point of the organisational design process. This is based on VSM model for the electricity regulator as shown in Figure 9.4. The figure shows how the VSM is aligned to the Electricity Regulator.

![Figure 9.4: The Alignment of the VSM with the electricity regulator](image)

**9.7 Electricity Regulator Organisational Design**

**9.7.1 Addressing Organisational Complexity Using Law of Requisite Variety**

To achieve effectiveness and efficiency in dealing with its environmental complexity, the management of the electricity regulator must communicate with
the environmental complexity through its implementation organ. This is depicted in Figure 9.5.

Management must remain in communication with those implementing its tasks. At the same time those implementing the tasks must be in communication with the environment. Management communicates with the environment through implementation. This does not mean that management do not communicate directly with the people in the environment. It means that management depends on the complexity of implementation to close the loops they open with the environment.

**The law of Requisite Variety**

"The control achievable by a given regulatory sub-system over a given system is limited by the variety of the regulator and the channel capacity between the regulator and the system" (Clement, 2004, PP 201)
Ashby's law

"Every good regulator of a system must be a model of that system" (Clement, 2004, PP 201). These laws apply both to the relation between management and implementation, and the relation between implementation and the environment. Management must develop strategies to manage all the relevant complexity of implementation process otherwise implementation will get out of control.

Implementation must develop strategies to manage all the complexities of the environment otherwise the environment will overwhelm the organisation. Despite the above, there is an apparent contradiction. On the one hand the relevant complexities of the environment and implementation are de facto larger than the complexities of implementation and management, respectively. On the other hand these complexities have to match each other for viability.

Strategies to overcome this contradiction are fundamental to the VSM. Figure 9.6 explains how organisational communication links with the environment to effectively attenuate its complexity, thus enhancing the organisation's understanding of its environment. The organisations' capacity for action is also amplified; thus making its interaction with the environment more effective. People supported by enabling resources as they go about their daily work carry out amplification and attenuation. Equally, it helps us to see how to implement tasks with minimum interference. In this respect amplifiers and attenuators assure organisation cohesion.

These amplifiers and attenuators exist in one form or another, the most common amplifier being delegation, and the most common attenuator being sheer ignorance. Systemic interaction of implementation with the environment and of the management with implementation requires a consideration of attenuators and amplifiers as two sides of the same coin. It does not help to understand the environment very well if there is no action capacity (amplification); it does not help to have action capacity if there is no adequate understanding of the environment.
The VSM helps to focus on these interactions, and helps in their design to make organisations more effective.

The imbalance between the environment, the implementation process and between management and implementation are common and must be managed. Fortunately, for the organisation and management much of the relevant environmental complexity and the organisational complexity can be and to a large degree are soaked up through self-regulation in the environment and implementation themselves.

In Figure 9.6:

- Seven arrows –or complexity drivers –represent environmental complexity namely: critical success factors for the organisation – that is, areas in which they must do well in order to succeed.
- Organisational complexity: represented by three complexity drivers in the implementation. These are the three critical success factors for management that is, areas in which high performance is necessary in order to achieve organisational cohesion.
- Self-regulation: These are exemplified in the environment when customers do work on behalf of the organisation. For example when bank customers use...
ATMs; when suppliers do work for a company's logistics like in electronic data interchange where suppliers are able to supply company just in time. Another example of self-regulation in implementation is teamwork with local problem solving capacity in a shop floor.

The remaining complexity or residual variety of the environment must be balanced by the ability of the organisation to respond. Equally, the management must balance the residual variety of the organisation. Hence:

- Residual complexity, which is not managed in the environment itself, must be managed by the organisation otherwise performance suffers. Benchmarking, however helps to work out the level of this residual variety
- The organisation needs to develop functional capacity to cope with this residual variety; this cap
9.7.2 Application of the Law of Requisite Variety to Design Model of the Electricity Regulator for Botswana

When the law of requisite variety is applied in the design of the electricity regulator the implementation arm of management has to deal with the question of how regulation of the electricity sector should be achieved. The management on the other hand has to deal with the question of what they must do so that the electricity sector will fulfil the goal for which it is being regulated – namely to be sustainable and competitive. The list of elements, which answer the question "how?" and list of elements which answer the question "what" for implementation and management in the regulation mechanism are shown in boxes in Figure 9.7.
It is important to note that many complexities within the environment are absorbed by the environment itself through self-regulating, without there being a need for external regulation from the regulator.

### 9.8 Electricity Regulator Organisational Design With VSM

The use of VSM in the design of the regulator design is to ensure its viability and fitness for effective regulation of the electricity sector. The design process involves four key steps:

- Recursive Modelling of complexity of primary activity components of the regulator;
- Identifying the functional elements (including sub-elements) of the regulator;
- Mapping the elements in the matrix table of functional elements against recursive elements in relation to each specified VSM elements. This results in the function-recursion table;
- Discussion of possible options and strategies of achieving organisational design that effectively fulfils the functions it is intended to serve.

The function-recursion table is a very important element in the design of an organisation for three key reasons:

(i) Allows for a systemic way of thinking about the recursion and function of the electricity regulator being design.

(ii) Represents a tool for discussing the possible option strategies of managing an organisation's complexity effectively;

(iii) Allows for the inclusion of contextual characteristics (or other suitable considerations) of the electricity sector into strategies of managing the sector effectively.

#### 9.8.2 Recursion Modelling of Complexity

The recursion function development of the regulator organisation is the starting point of the organisational design process. This is based on modelling of distribution of complexity within the organisation. Recursion is illustrated in Figure 9.8. This is further developed in the recursion function table, which is a tool for discussing the possible options strategies of managing an organisations
complexity effectively. In particular, under the present context it is useful in offering a useful distribution of discretion (authority and resources).

Figure 9.8: Representing primary activities for the electricity sector using the VSM.

The recursion has to be defined in terms of the primary activities of the regulator. These are defined below, regarding the electricity regulator:

(i) Sustainability of sector
   - Increasing efficiency
   - Ensuring affordable electricity prices
   - Promoting capacity building in the industry
   - Supporting the environment
   - Encouraging safe work practice

(ii) Promote competition
   - Increasing access to electricity
   - Ensuring equitable access to the transmission system by Independent Power producers (IPPs)
   - Sustaining security of supply
   - Ensuring financial health of the sector
- Enhancing customer services
(iii) Rural electrification
(iv) Renewable sources of energy
(v) Links with other energy sectors
(vi) Research and development

The above primary activities are linked to the functions of the regulator organization. The workshop deliberated on these functions ought to be linked to primary activities as selected above.

In Figure 9.9 the primary activities contain and are contained in other primary activities. For example the primary activity of promoting sustainability contains five (5) elements: increasing efficiency, ensuring affordable electricity prices; promoting capacity building in the industry; supporting the environment; encouraging safe work practice. In turn promoting sustainability is contained within the electricity sector.

Figure 9.9: Recursion of Primary Activities
9.8.3 Functional Elements of the Regulator

The functional discretions offer the means by which important regulatory needs can be built into the regulations for the sector. There are three main categories of regulatory discretions, detailed as below:

<table>
<thead>
<tr>
<th>Value adding functions:</th>
<th>Core Functions</th>
<th>Regulatory Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance; Human resources; Research &amp; development</td>
<td>Licensing; Tariffs and pricing; Quality of Service; Customer relations; Enforcing rules and standards; Policy development; Communications; Legal</td>
<td>Consultation; Consistency; Predictability; Flexibility; Independence; Accountability; Transparency; Legitimacy; Timely; Responsive approach</td>
</tr>
</tbody>
</table>

Table 9.1: Regulatory discretions

9.8.4 Distribution of Functions Among Primary Activities

The distribution of functions among primary activities is shown in Table 9.2. The purpose of distribution of functions among primary activities is to map the distribution of

Table 9.2: Distribution of regulatory functions among primary activities
resources and control (authority) throughout the organisation.

The goals for the use of the distributions of functions table are:

(i) To create autonomous units within autonomous units, that is, to have recursive levels such that there are links between functions within the autonomous units. For example, the sustainability sub-unit (primary activity) is contained within the electricity regulator organisation, and it contains sub-units such as – increasing electricity sector efficiency or ensuring affordable electricity prices.

(ii) To distribute complexity within the organisation. For example, several sub-units are contained within the sustainability of the electricity sector. Similarly, there are many sub-units contained within the primary activity of promoting competition in the electricity sector.

(iii) To distribute functional capacity among the primary activities. For example, the licensing function is distributed among several autonomous sub-units of primary activity listed along vertical axis.

The key features of the distribution show that:

(i) Finance and human resources, which are value-adding functions, are decentralised to all primary activities within the main units and sub-units. These have to be made available to all primary activities so that such activities achieve the objectives underlying the goals of the organisation through managing the complexities. The resources for these functions have to be made available throughout the organisation.

(ii) The core functions (effectiveness factors - licensing, tariffs and pricing; quality of service; enforcing rules and standards; policy development, communications, legal matters) are distributed among the main primary activities but not their sub-units. The resources are, as a result, distributed to primary activities in the organisation where the functions are located. Strategies to manage the distribution of the functional capacities represent the strategies to manage the organisation's complexity. The core functions are critical to the organisation's success in respect to the external world. The resources allocated to such functions are, therefore, strategic irrespective of whether they are centrally located or located in a
decentralised configuration. This is so because their role is closely linked to the mission of the organisation.

(iii) The regulatory practice (efficiency factors – stakeholder consultation, consistency, predictability, flexibility, independence accountability transparency, legitimacy and timeliness) are both centralised and decentralised depending on strategic management approach adopted. For example, consistency, predictability, flexibility, independence accountability are centralised while stakeholder consultation, transparency, legitimacy and timeliness are decentralised. Resources and authority are, therefore, distributed to reflect the pattern of location of the functions within the organisation. There should be a clear distinction between functional decentralisation and resource decentralisation or centralisation. The function may be decentralised while resource may be centralised without compromising the efficiency factor.

9.8.5 Functional - Recursion Table in Relation to VSM Elements

The functional recursion table shown below is aligned to the VSM, a process achieved during the workshop. At the time of the exercise, the crosses entered in the table represented the best possible strategies in which the electricity sector regulator could manage its functions with respect to its primary activities shown under recursion in the Table 9.3.
Table 9.3: Alignment of VSM with mapping of distribution of regulatory functions among primary activities

9.8.6 Summary: Recursion- Systemic Function Table Aligned to VSM

The linking of recursive primary activities and regulatory functions to the VSM constitutes forms the foundation through which the electricity regulator organisation can be effective in delivering on its mission. This linkage also constitutes the design of the electricity regulator as an organisation using the VSM. The features of this design are shown in the Table 9.3. Its purpose is to allow for a systemic way of thinking about recursion of primary activities and the functions of the regulator, which are now summarised below as follows:

(i) The legal framework understands the market environment and enforces rules and law through corporate intervention.
Involves policy; intelligence; corporate intervention
(ii) Finance has a strong impact on intelligence in respect of budgeting, resource bargaining; monitoring; and coordination based on standards; It covers intelligence (dealing with the market enterprises); budgeting (resource bargaining); audit (monitoring); standard financial systems (coordination). Capital expenditure has strong elements of intelligence and coordination. Credit control – coordinates by developing common system and providing centralised service.

(iii) Human resources – Has strong elements of policy, intelligence, corporate intervention, resource bargaining, monitoring and co-ordination. Reflects manpower needs; attracts corporate intervention (stopping recruitment); encourages participation in resources bargaining; Provides intelligence about future trends in electricity market; contributes to resource bargaining through company manpower needs; coordinates common personnel systems. Capacity development provides monitoring through providing a common forum where people can share their experience; and co-ordination through developing common approaches to tasks of the organisation;

(iv) Licensing -Has strong elements of policy, intelligence, corporate intervention, resource bargaining, monitoring and co-ordination. Independent Power Producers, market operators, distributors, supplier and all enterprises need to be licensed to operate in the market.

(v) Tariffs & pricing for electricity has elements policy, intelligence, corporate intervention, resource bargaining, monitoring and co-ordination. The tariffs reflect ways in which electricity is charged for consumption, transmission and services at various levels.

(vi) Quality of service has elements such as policy, intelligence, corporate intervention, resource bargaining, monitoring and co-ordination. The quality of service relates to standards by which electricity, as a product must be generated and supplied to consumers. This has to be monitored.

(vii) Enforcing rules has elements of monitoring and coordination.
This involves compliance audit in terms of standards, prices, tariffs, rules in all relevant sectors of the market.

(viii) Policy development has elements of policy, intelligence, and corporate intervention. This involves research and stakeholder consultation.

(ix) Communication has strong elements of policy, intelligence, corporate intervention, resource bargaining, monitoring and co-ordination. Communications involves management information systems, regulatory, and business communications linking relevant individuals or enterprises involved in it.

(x) Regulatory practice – has selected elements in the VSM as indicated in Table 9.3.

Note that the functions discussed above, relate to primary activities as indicated under recursion- namely: electricity regulator; sustainability of the sector; promoting competition; rural electrification; renewable sources of energy; links with other energy sources; and research and development.

9.8.7 Management and Control of The Electricity Sector Regulator Organisation – Designing for Effectiveness in Functions

Effective management and control of the electricity sector regulator takes place at all levels of recursion. The recursive primary activities relevant to management include:

- Electricity sector regulator
- Sustainability of the sector
- Promoting competition
- Rural electrification
- Renewable sources of energy
- Links to other energy sources
- Research and development

These are shown as recursion in the recursion-function table and can be observed in the top left hand column. Each is concerned with different aspects of the regulator's work. These activities are carried out through co-ordination; audit; corporate intervention, resource bargaining and intelligence capacity explained as follows:
(a) Provide intelligence capacity, if their purpose is to create within the primary activity an appreciation of its "outside and then"

(b) Support the resource bargaining if their purpose is to negotiate the allocation of resources to primary activities

(c) Support corporate intervention if their purpose is to give non-negotiable instructions to contained primary activities

(d) Make monitoring of primary activities possible if their purpose is to bridge the communication gap between two levels of recursion

(e) Enable co-ordination among primary activities if their purpose is facilitating moment to moment alignment of operational activities without interfering in those aspects related to their main purpose

These primary activities are performed through specialised functions of the electricity regulator, namely:

- Licensing
- Tariffs and pricing
- Quality of Service
- Customer relations
- Enforcing rules and standards

These functions are strong indicators of effectiveness of the regulator.

In management these functions have to work closely among themselves with overlap of personnel between functions to achieve the primary objectives and activities. Figure 9.10 explains the need for overlap between the functions. In practice the design of implementation these functions have to overlap. The following Figure 9.10 shows the relatedness or linkage between the functions in performing primary activities. The linkages between the functions translate to effectiveness in undertaking the primary activities.

The intelligence component of the VSM plays a significant role in the mechanism of effective control. The intelligence collected in the electricity market is used to refine the management of regulatory functions.
9.8.8 Management and Control of The Electricity Sector Regulator Organisation – Designing Efficiency into Functional Elements

Monitoring and coordination

The mechanism of efficient control and management of implementation involves four key elements:

- Co-ordination through known systems and methods;
- Audit through reports, meetings, work-study, and sharing skills learned;
- Resource bargaining to meet agreed service / production targets;
- Corporate intervention to promote or achieve results on external demand;
Typical monitoring and coordination of each of the control functions of the electricity regulator can be achieved through the mechanisms detailed in Table 9.5.

<table>
<thead>
<tr>
<th>Functions</th>
<th>Finance</th>
<th>Human resources</th>
<th>Research &amp; development</th>
<th>Licensing</th>
<th>Tariffs and prices</th>
<th>Quality of services</th>
<th>Customer services</th>
<th>Enforcing rules and standards</th>
<th>Policy development</th>
<th>Communications</th>
<th>Legal</th>
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</tbody>
</table>

Table 9.4: Overlap and links among regulatory functions for primary activities

<table>
<thead>
<tr>
<th>Regulatory Element</th>
<th>Monitoring</th>
<th>Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariffs; Pricing</td>
<td>Verification of report by market players (meetings and reports)</td>
<td>Documented prices and standards (RPI, index)</td>
</tr>
<tr>
<td>Monitoring industry standards</td>
<td>Audit; inspectorate; spot checks</td>
<td>Documented system (registration and checks)</td>
</tr>
<tr>
<td>Research</td>
<td>▪ Commission relevant studies</td>
<td>▪ Resource allocation</td>
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<td></td>
<td>▪ Post research assessment</td>
<td>▪ Resource scheduling</td>
</tr>
<tr>
<td>Compliance</td>
<td>▪ Observation</td>
<td>▪ Identification and use of legal framework</td>
</tr>
<tr>
<td></td>
<td>▪ Reports and returns</td>
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</tr>
<tr>
<td>Arbitrating disputes</td>
<td>▪ Audit</td>
<td>▪ Establishment of dispute resolution mechanism (including technical, accounting, and legal etc)</td>
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<tr>
<td></td>
<td>▪ Reports on audit arbitration process</td>
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<tr>
<td>Capacity development for firms in the ESI market</td>
<td>▪ Meetings to assess progress</td>
<td>▪ Training / development plans</td>
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<tr>
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<td>▪ Reports</td>
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<tr>
<td>Localisation plans</td>
<td>Resource bargaining</td>
<td>Corporate intervention</td>
</tr>
</tbody>
</table>

Table 9.5: Details of monitoring and coordination mechanism for the electricity regulator
It is important to realise that the term co-ordination is by mutual adjustment between support functions and between autonomous units. This is an area where IT systems can be extremely helpful in avoiding more direct and intrusive human intervention - provided they are designed with the correct principles in mind.

Another important channel used to direct control is the monitoring channel. The control function needs an assurance that the accountability reports it receives are indeed an accurate reflection of the status of primary activities. Often the information provided in accountability reports tends to reflect personal biases and other natural communication problems. There is thus a need to corroborate this information with an alternative source. This is achieved by developing a monitoring channel that runs directly between the meta-level management and the operations of the sub-units, bypassing the sub-unit's management.

The efficiency of the regulator organisation depends on the strategies used in linking the functional elements, which directly affect efficiency. This comes in the form of adding functions and regulatory practice factors: finance; human resources; research & development; consultation; consistency; predictability; flexibility; independence; accountability; transparency; legitimacy; timely; and responsive approach. Each functional element must adequately overlap each of the other efficiency factors as appropriate when implementing each of the primary activities. This is indicated in Table 9.6. For example consultation must reflect consistency, predictability or flexibility as deemed necessary.
### Table 9.6: Overlap and links between regulatory functions for primary activities

<table>
<thead>
<tr>
<th></th>
<th>Consultation</th>
<th>Consistency</th>
<th>Predictability</th>
<th>Flexibility</th>
<th>Independence</th>
<th>Accountability</th>
<th>Transparency</th>
<th>Legitimacy</th>
<th>Timely</th>
<th>Responsive approach</th>
<th>Finance</th>
<th>Human resources</th>
<th>Research &amp; development</th>
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<tbody>
<tr>
<td>Consultation</td>
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<td>Responsive approach</td>
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</table>

Table 9.6: Overlap and links between regulatory functions for primary activities

### 9.8.9 Adaptation Mechanism and Policy Based on VSM

The adaptation mechanism is intended to diagnose (achieve) a balance between management reflecting the "inside and now" and management responsive to (intelligence) the "outside and then". To achieve this, the regulatory functions in the table of functions versus recursion are transferred (linked) to the relevant parts of the VSM;

Management related to the "inside and now" which is referred to here as control management and the "outside and then", which is referred to here as development management or management responsive to (intelligence) are identified in Table 9.7. Both control and development management are linked to
efficiency functions associated with primary activities of the regulator as shown in Table 9.7.

<table>
<thead>
<tr>
<th>Management responsive to (intelligence) the &quot;outside and then&quot; (Development management)</th>
<th>Management related to control &quot;inside and now&quot; (Control management)</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Finance</td>
<td>▪ Finance</td>
</tr>
<tr>
<td>▪ Human resources</td>
<td>▪ Human resources</td>
</tr>
<tr>
<td>▪ Licensing</td>
<td>▪ Consultation</td>
</tr>
<tr>
<td>▪ Tariffs and pricing</td>
<td>▪ Consistency</td>
</tr>
<tr>
<td>▪ Quality of Service</td>
<td>▪ Predictability</td>
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<td>▪ Customer relations</td>
<td>▪ Flexibility.</td>
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<tr>
<td>▪ Enforcing rules and standards</td>
<td>▪ Independence</td>
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<td>▪ Policy development</td>
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<td>▪ Responsive approach</td>
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Table 9.7: "Development" and "control" management regulatory functions for primary activities

The policy issues determine the richness of the interconnection between functions related to control and functions related to development. The functions within each management domain (control management and development management) are also interconnected to ensure effective management. With reference to specific policy issues, intelligence and cohesion must be richly connected. The communications between development and control varies from organisation to organisation.

Poor communication leads to poor decision-making. The mechanism for adaptation tells us that achieving good communications should be a major concern of the primary activity’s policy concern. Policy issues should be sensitive to how different functions influence the need for different communications between those representing control management and development management. From the perspective of managing complexity, the main purpose of policy is to orchestrate necessary debates and conversations between development and control resources. The orchestration is normally issues-related.
Furthermore it is expected that the orientation of existing resources for control or development and the quality of their interactions will trigger some policy issues while ignoring others. Hence, it is relevant to create a balance between these resources within the organisation.

In the current situation the resources from each of the systemic functions come from the function-recursion table. As with any system function, policy requires resources of its own to be effective. Often these resources emerge from within the organisation by default, and not by design. Often these resources are the same as existing resources for development (intelligence) and control. A significant factor is the degree of awareness about the primary activity's purposes and values. The policy function ought to develop the awareness of the systemic purposes of existing resources. Should any of these conditions fail their ability to steer the primary activity will be impaired. The mechanism for adaptation is illustrated in Figure 9.11

Intelligence from the environment of the electricity market; as well as developments in technology are continuously monitored by the intelligence function of the electricity regulator and through the tripartite mechanism between control management, development management and policy triggers appropriate response from the electricity regulator.
9.8.10 Summary: The Proposed Structure for Electricity Sector Regulator—
for Botswana

The organisational structure based on the VSM considerations and design is shown in Figure 9.12 indicating the key directorates that need to be created to achieve effectiveness and efficiency for the organisation.

The objectives of the organisational design are intended to:
- Promote sustainability of sector
  - Increase efficiency
  - Ensure affordable electricity prices
  - Promote capacity building in the industry
  - Support the environment
  - Encourage safe work practice
- Promote competition
  - Increase access to electricity
  - Ensure equitable access to transmission system by Independent Power producers (IPPs)
  - Sustain security of supply
  - Ensure financial health of the sector
  - Enhance customer services
- Increase access and rural electrification
- Enhance capacity for application of renewable energy sources
- Achieve links with other energy sectors
- Research and development

### 9.9 Electricity Sector Market Governance Body (EMGB)

One of the major outcomes of the workshops held relate to the need of an electricity sector governance body when the sector is liberalised. The key issues, which surfaced, include:

- The need for a market governance body
- Structure, responsibilities and functions of a market governance body;
- Composition and size of the market Governance body

#### 9.9.1 Purpose of EMGB

The purpose of the Electricity Market Governance Body (EMGB) will be to administer the rule change process in the regulation of the sector consistent with
guiding principles. The EMGB would be the primary governing body of the competitive elements of the electricity market. Such participants include: market operators; energy suppliers (Independent Power Producers, Traders, and Brokers); ancillary service providers (for reactive power, spinning reserve, and cold start); demand entities (wholesalers, brokers, traders and retailers); Other necessary entities participating in the market but not necessarily part of the competitive elements of the market are: information specialists (internet operators, data entry and capture specialists, systems and business analysts); network operators (independent system operators).

The rules for the market are documented in what is commonly referred to as the Market Code to which all members of or subcommittee of members of the EMGB undertake to be responsible for achieving the following:

- Formulation and review of the market code through a stakeholder consultative process;
- Review and make recommendations regarding proposals to amend the market code;
- Facilitate the provision of expert technical advice to an electricity sector regulator;
- Review and make recommendations regarding proposals for exemption to comply with the Market Code; and
- Oversee the functions of the market operator.

9.9.2 Functions of the EMGB

(i) The EMGB will be the primary governing body of the competitive elements of the electricity market with a leadership and strategic role to play in overseeing the development and day-to-day operation of the market. The body also allows for clear accountability and for the efficacy of the market. Such accountability extends to other stakeholders such as the government and the general public.

(ii) The EMGB will be in charge of the rulemaking process. It is anticipated that there will be a plethora of rule making since the electricity markets
have only existed in their current form for a little less than two decades. In terms of market design this means that these markets are immature and can be expected to evolve substantially over time. Moreover the constant drive to improve the technology used in the electricity sector will necessitate change to market design.

### 9.9.3 Structure of EMGB: A Multi-Class Stakeholder Board

The Board can take one of the following forms (see chapter 3):

(i) Multi-class stakeholder Board;

(ii) A non-stakeholder Board;

(iii) A single-class Board;

(iv) A Single For-Profit Corporation Not Affiliated with Market Participants;

Of these, a Multi-class Stakeholder Board was selected as the most suitable for the future liberalised electricity market for Botswana. By design this type of Board is the club or legislature approach to governance. In its governance structure, most or all classes of users and owners are represented on the governing Board. It is designed for collective, self-governance such all who participate in the market are represented.

A number of reasons were advanced in favour of the choice of market governance preferred for Botswana:

(i) To increase the level of understanding and expertise among all participants in the market through sharing knowledge and experience about the evolution and developments of the market;

(ii) To ensure that the evolution of the market meets with policy and development goals of the country;

(iii) The diversity represented in such a Board is likely to generate debates that optimises the quality of decisions arrived at by the Board;

(iv) The boundary judgements of the Board would be more ethical and than otherwise possible.

(v) The resulting liberalised electricity market in Botswana is likely to be small rendering the creation of the Board less challenging and less arduous.
The other facets and details of the Board, which were not detailed in this process, include: the size of the Board, its composition and operational processes. It was concluded that such details would require details on the design of the market (wholesale or retail); and government approach to the reforms in the electricity sector.

9.10 Discussion and Recommendation

9.10.1 Discussion

The relevance of the design of the regulator agency may be seen from the perspective of dealing with three major concerns that would flow from deregulation of the electricity sector in Botswana, namely: to ensure that the liberalised electricity sector is competitive; that the enterprises within the sector perform efficiently especially the supply side; and that local condition such as rural electrification, renewable energy sources, electricity access are sustained. All these efforts are geared towards achieving the objective of establishing an effective regulator, which is responsive to local conditions.

If electricity market competitiveness in the liberalised sector in Botswana cannot be realised as a result of ineffective regulator, there would serious consequences for the sector. First and foremost investments in the supply segment of the sector would be stalled with dire consequences to the economy and social life. The immediate consequences in terms of the economy would be: shortage of electricity, which would affect current production capacity and investments in the economy; tariffs are likely to rise and that would affect all categories of consumers. The social consequences would be reflected in a fall in accessibility to electricity; the quality of life of people who are eligible to be connected to electricity but are not connected would suffer as a consequence; application of technology requiring electricity would be affected.
If on the hand efficiency of the liberalised industry is not satisfactory, as a consequence of ineffective regulator, that would be reflected in a number of negative off-spins such as increased tariffs that customers would have to pay; reduced rate of accessibility to electricity; poor customer services; investments in the sector would fall.

The utility of the regulator agency proposed would achieve or enhance the regulatory process in Botswana through these perspectives:

(iii) The agency’s ability of being able to deal with environmental complexity in the liberalised electricity sector as a result of applying Ashby’s law to allow for the agency to have features which are a reflection of needs in the environment – using attenuators and amplifiers. These features relate to implementation and management systems of the agency.

(iv) The identification of primary activities within the electricity regulator that that are relevant for the agency – in the context of Botswana. These include: promoting competition in the sector; rural electrification; electricity sector sustainability; links with other energy sectors; promoting use of renewables.

(v) Identification and classification of functional elements of the agency into classes comprising: value adding functions; core functions; and regulatory behaviour and practice.

(vi) VSM based organisational design;

(vii) Adaptation mechanism for the agency;

(viii) Structure of the proposed regulatory agency;

(ix) Governance body of the electricity market.

The utility of these propositions can be affected by a number of issues of which the following are critical, in the context of Botswana:

- Skills and management capacity in the electricity regulation;
- The detailed nature of the overall design of the agency may render it complicated to implement in practice; this is in contrast to an organisational structure which would be very easy do implement;
- The number of primary activities defined is many – sustainability of the electricity sector; promoting competition; links to renewable energy
sources; research and development; and rural electrification. These may blot the personnel requirements of the agency.

9.10.2 Recommendation

The recommendations from this chapter involves the product of the design process for a regulatory agency based on the integration of the inputs from the results of the research drawn from the following areas: case studies of the regulator agencies from South Africa and Namibia, management theory from the EMBA4, contextual characteristics of the electricity sector in Botswana, policy framework on electricity sector in Botswana, and the application of VSM.

The institutional set-up of the regulator agency for Botswana predicated on the principles indicated should incorporate four key modules:

(a) **Module 1: Primary Activities**

Primary activities which form the main drivers of the operation of the regulator; drawn from reform agenda in the electricity sector and the contextual characteristics of the industry in Botswana, namely: sustainability of the sector (efficiency, safety, affordability, environment); promoting competition; rural electrification; renewable sources of energy; links to other energy sources; research and development.

(b) **Module 2: Regulatory Functions and Practice**

Module 2 consists of a list of regulatory functions and practice that define the effectiveness and efficiency of the electricity regulator. The efficiency and effectiveness factors and should be supported through value adding functions. Elements of modules 2 are shown in the Table 9-12.
Table 9-12: Regulatory functions and practice of the regulator agency.

According to Ashby's law, the efficiency functions are a reflection of the complexity that the implementation system of the regulator agency must have to deal with in the environmental complexity while the effectiveness functions are the complexities that the management system must deal with in the environment.

(c) Module 3: Control and Development Management

The factors, which characterise control and development management elements, are shown in Table 9-13. Note that these are based on the functions of the regulator.

Table 9-13: Control and Development Management elements

There should be two forms of overlap between the functions:
(iii) Intra-management functions overlap, that is, overlap between functions in one element of management;

(iv) Cross-management functions overlap. That is, overlap between functions across both elements of management.

Both cross management functional and intra-management functional overlaps are driven by system 5 or policy function in the VSM of the organisation. The aim of policy should be to adapt the organisation to environmental changes.

(d) Module 4: Organisational Structure

The organisational structure is based on the primary activities (here referred to as directorates) that the regulatory agency must fulfil in the electricity sector, namely: access and rural electrification; research and development; technical and economic regulation; renewable energy and energy planning; finance and administration; legal arbitration and stakeholder affairs. The structure is shown in Figure 1-14.

![Organisational Structure Diagram](image)

Figure 9-14: Organisational structure for electricity regulator.

Module 5 essentially shows the power relationship between the directorates, which are designed to relate to primary activities of the regulator agency.

It is important to note that these modules have incorporated the following insights:

- The contextual characteristics of the electricity sector in Botswana;
- Management theory developed from the EMBA programme;
- Case study results of electricity regulators in S African and Namibia;
- Analysis of the current policy framework in Botswana formulated to guide and legitimise the electricity reform agenda and the establishment of the electricity regulator;

**Multi-Class Stakeholder Board**

A Multi-Class stakeholder Board as an Electricity Market Governance Board is preferred for a liberalised electricity sector in Botswana. The key advantage of such a Board is that it would contain the relevant stakeholders of which government representatives would form a part and hence ensure that government development goals are linked to the evolution of the market.
PART IV: CONCLUSION AND REFLECTIONS

CHAPTER 10: CONCLUSION

10.1 Overview

The work embodied in this dissertation represents the work undertaken as part of the final dissertation for the EMBA. It contains three convoluted and overlapping parts: the research context, the research methodology and area of application. In particular the dissertation contains:

- Part one: A broad outline of the introduction to the research, the rich picture of the context- being the electricity sector in Botswana; problem formulation; relevant literature review- covering management concepts, electricity governance and regulatory perspectives, and systems thinking;
- Part two: The research design and methodology. The research design and methodology being guided by a philosophical position (positivist, phenomenological, pragmatism) in relation to and aligned to both sociological paradigms and systems thinking approaches;
- Part three: Application of methodological processes to the contextual environment of the electricity sector in Botswana. This area covers data collection analysis and synthesis, relating to design of an effective electricity regulator organisation for Botswana.

The overall purpose of the research is to develop effective governance and to design an electricity regulator organisation for a liberalised electricity sector in Botswana. The output of the research is part of the search for a model regarding the effective regulation of the electricity sector, when it becomes liberalised soon. This comes against the background of concerns and problems that have been associated with the effectiveness of regulatory institutions in other countries where the electricity sector has been liberalised. The main problems associated with the newly established institution of electricity regulation have been identified as: the importation from countries where the electricity sectors have been...
liberalised earlier to countries which have newly liberalised their sector, without adequate adaptation of the institutions of electricity regulation in their new local settings; the inadequate understanding of the regulatory processes for electricity markets resulting from the escalation of electricity reforms since in the 1980s; the failure of electricity regulators to adequately achieve desired objectives of electricity liberalisation – such as a decline in tariffs or an enhancement of efficiency of operations or promotion of competition; the inadequate skills and management capacity for electricity sector regulation to perform the mission for regulation satisfactorily.

The overall objective of the research was to design an electricity sector regulator organisation for Botswana taking into account local factors and considerations, which would optimise benefits of liberalisation to general society in Botswana. Some examples of such initiatives are electrification, increasing access to electricity, and the sustainability of the sector. These issues have been determined as necessary components of a regulatory mechanism that must be incorporated in the regulation of the electricity sector for Botswana.

Relevant literature which has been surveyed from several sources to support the research include: (i) governance and electricity sector regulation; (ii) areas of management – normative, strategic an operational, and (iii) a systems thinking approach. Mixed philosophical research approaches, positivist and phenomenological have been contrived to achieve the objectives through functional and interpretive systems approaches. In particular, organisational cybernetics, qualitative system dynamics have been identified as appropriate functional research methods suited to the research area. Similarly case study and qualitative research methods have been selected as interpretive methods, which are suitable for achieving the research objectives.

The design of the research is encapsulated in pragmatism – drawing from the strengths of both positivist and phenomenological philosophical positions. In practice this has been realised through the choice of functional two functional methods – organisational cybernetics and system dynamics; and two interpretive methods – qualitative and case study research. Functional methods have been
adopted because "the process of intervention is systemic and is aimed at discovering the best way to achieve a goal" and because the "solutions are tested primarily in terms of their efficiency and efficacy" (Jackson, 2000, pp 203). The interpretive approach on the other hand has been adopted because its use entails "the conscious thought about how to adopt it to a particular circumstance" (Jackson, 2000, pp 282). The suitability of these approaches is justifiable in the context of this research. That is, the development of governance and electricity sector regulator in Botswana needs to be adapted to the peculiarities of Botswana.

The methodological processes involve – both inductive and deductive methods of inquiry. Data sources selected include: questionnaire, interviews, workshop and documents. The problem solving approach chosen is based on systems thinking.

The general weaknesses and strengths of functional and interpretive research methodologies are well documented (Jackson, 2000) but similar evaluation of the methodology within the context may not be clear. The weakness of these methods within the research context takes the following forms: adequate knowledge and skills in the field by people who were interviewed; the use of models for regulatory institutions instead of actual institutions. Two issues drive these weaknesses: the relative newness of regulation of electricity markets and the lack of history in this field in Botswana.

10.2 Key Outcomes of the Study

The outcomes of the study can be consolidated under these items.

10.2.1 Contextual Environment of the Electricity Sector in Botswana

From the qualitative aspect of the study, the factors which influence and attract policy intervention subsumes of

(i) Exposure to excessive electricity imports

At current levels of electricity supply, imports constitute about 69% while local generation makes up the remaining 31%. Such import/export mix is
considered unsatisfactory by the political establishment. There is concern that the sector needs to attract investments in the generation sector of the industry.

(ii) Rural Electrification and Economic Sustainability
Significant progress has been made since the last Botswana Energy Master Plan (BEMP) of 1996 in rural electrification with 237 villages electrified to date and 411 villages left to be electrified (BPC, 2003).

(iii) Electricity Sector Reforms and Implications for BPC
A preliminary study on the restructuring of the Electricity Supply Industry (ESI) in Botswana was concluded early in 2003, and the outcome has recommended four reform strategies, namely: Public governance; Privatization of the BPC; Private Generation; and Competition. These are subject to a government decision to proceed with restructuring the ESI.

(iv) Electricity Sector Governance and Regulation
Governance and regulation for the ESI needs to be considered in view of the government-preferred move to a liberalised electricity sector.

(v) Impact of Anticipated Loss of Load Demand from BCL and Return of Revalued Assets
BCL copper mining operations, alone, consume 24% of electricity supply in Botswana. In the year 2008, BCL is expected to close down leaving stranded assets and a large gap in electricity demand. In addition, it will have adverse effect on the internal rate of return in the sector thus making the sector an unattractive investment opportunity.

(vi) Relative High Tariffs
A tariff comparison regarding thirteen utilities in Southern and Eastern Africa in April 2003 for domestic (450kWh), general commercial (900kWh) and industrial (2 500 kWh at 50% load factor) indicates those in relative terms, prices of electricity in Botswana are higher.

(vii) Efficiency Monitoring at BPC
The relatively high tariffs when juxtaposed with cheap electricity imports suggest a measure of inefficiency in the industry as is currently managed by the Botswana Power Corporation. Concerted efforts to regulate the industry more effectively are therefore proposed.

(viii) Complementarity between solar electricity (off–grid) and grid Electricity

The promotion of PV electricity and other alternative sources of electricity remains a major problem. There is a prevalent perception that many stakeholders consider PV as a short-term measure and that the long sustainable measure is the provision of grid electricity. The clarity, or lack of it, of the role of PV in relationship to grid has affected the development of the PV as a source of energy. A new approach, which involves the renewable energy sector, is central to the way forward regarding renewable energy's integration in the electricity sector.

10.2.2 Case Study Results on Electricity Regulators for Namibia and South Africa

Analysis of the electricity regulators in S Africa and Namibia yielded the insights discussed below.

The roles of the regulators have been clearly spelled out. For the NER of South Africa these were to license generation, transmission and distribution of electricity, to approve the prices at which electricity is sold and to set minimum standards for quality of supply and service. The NER also resolves disputes among suppliers of electricity and their customers, as well as between suppliers. The NER operates under the mandate given by the Minister of Minerals and Energy to be the custodian and enforcer of a regulatory framework which is to monitor and ensure that the interests and needs of present and future customers
of electricity respectively are safeguarded. The criteria include efficiency, effectiveness and long term sustainability of the ESI in S Africa. These functions involve different businesses and enterprises operating in the market as follows.

The functions of the Electricity Control Board of Namibia as outlined in Act include action to:

- Promote an efficient, reliable and economic system of electricity generation, transmission, supply and distribution internally, as well as importation into and exportation from Namibia;
- Regulate licenses in a manner that maintains and improves efficiency, economy and reliability on the part of licenses so as to enable all reasonable demands for electricity to be met, in accordance with prevailing Government policy;
- Have regard to the need of licenses to be able to finance the carrying out of their licensed activities;
- Encourage efficiency, economy and safety in the use of electricity;
- Regulate the quality of service and the tariffs, fees and charges payable for electricity while keeping in view both the interests of consumers and of licensees;
- Act in a manner that is transparent and fair;
- Have regard to the promotion of health, safety and the environment;
- Oversee the effectiveness of the mechanisms, processes and forces prevalent in the electricity sector to ensure that there is a reasonable balance between the demand for electricity and the supply; and
- Act in a manner consistent with the objects of the Act and any regulations made thereunder.

There are problems with the definitions of the functions of the regulators because the functions specified are not explicitly linked to the primary activities of these organisations. These are to promote competition and sustainability of the industry. The functions are hence isolated in terms of key drivers.

From the case study, and the performance of these two regulators, some the areas of regulation showing clear signs of weak regulation are: professional and
skills capacity; responsive approach; timeliness; understanding the rules, policies, and roles; predictability.

There are a number of reasons for these problems occurring in the practice of regulation regarding both the NER and ECB. At the root of the problems is the relative lack of experience gained in the practice of electricity regulation. The ECB has been in operation for slightly over three years and the NER has been in practice for slightly over five years. The second point is that there is a shortage of professional and management skills in these two organisations. These shortages are particularly apparent among technical cadres of staff. These shortages may be due to a number of factors, among which are: general national skills shortages in technical fields; skills shortages due to the late development of electricity regulation as a practice and by default lack of experience in the same; the slow strategic approach in dealing with problem.

The complexity of regulating the electricity sector is another reason for the poor ratings in the practice of regulation. The rules, policies and roles do not lend themselves to easy interpretation, particularly where government policies are conflicting. This is another factor that creates delays in response to stakeholders.

Information asymmetry and regulatory capture are other factors, which impede the practice of regulation. The information asymmetry is a result of monopoly and older elements of the new electricity market players, while regulatory capture tend to emanate from political interference.

Another important consideration leading to the poor performance of these organisations may be seen in the context of failure to adapt local conditions and needs into the regulatory framework. The manifestation of such situation leads to these organisations not being able, in some cases, to interpret their regulations effectively.

The purpose of the analysis was to identify hotspots in the practice of regulation. The results of the analysis were used to improve the design of the regulator for Botswana in order, to deliver superior performance. The main cause of poor
performance in the functions specified in the two organisations appears to be professional and management skills shortage. It is a factor that has to be picked and considered in the functional capacity of the electricity regulator for Botswana.

10.2.3 Analysis of Policy Framework Towards Establishing the Electricity Regulator for Botswana

The analysis of policy framework in which the electricity regulator for Botswana would be established indicated a number of relevant factors. These, however, turn out to be either inadequate or lacking for the purpose of setting up an electricity regulator. They are as follows.

Policy coordination

Policy is not co-ordinated at two levels: between officials of the two ministries (Ministry of Finance and Development Planning / Ministry of Mineral Energy and Water Resources), which formulate the policies affecting electricity sector reforms and implementation of establishment of an electricity sector regulator. The other level is that of co-ordination between the ministries themselves, rather than the interaction between officials, at an individual level. The implications of the problem become more serious at the management of reform and its implementations.

Control and Implementation Gaps in Policy for Electricity Sector Reforms and Establishment of an Electricity Regulator

A well-designed structure for managing and implementing a policy requires levels of recursion to be linked vertically between the levels. In the case of electricity sector reforms and the establishment of an electricity regulator; there are no structures for linkage between PEEPA and the MMEWR or between BPC and MFDP. The significance of such gaps is that they create barriers to effective management / control and implementation of reforms in the electricity sector resulting from policies emanating from the two ministries.
Structure for Managing Changes

The transition from the current vertically operated electricity sector under the Botswana Power Corporation to a liberalised sector owned by investors with monopoly elements within it, such as transmission systems, represent a major reform programme and change in the dimensions of operation, management and ownership.

One of the main problems that are evident on the electricity sector reform process leading to the establishment of the electricity regulator is the lack of clarity of how the reform should be implemented. As already discussed, the Ministry of Minerals Energy and Water Resources is in charge of the regulating the electricity sector, while the Ministry of Finance and Development Planning is in responsible for privatisation of the public utility. The mechanisms of implementing the privatisation are neither clear, nor transparent.

Professional and management Skills Capacity Shortage

The policy problems in the electricity sector reforms are due to professional and management skills capacity shortages, which are aggravated by the ascendancy of regulation and privatisation in the electricity sector worldwide. This phenomenon, which has occurred in the last two decades has, unfortunately, not been accompanied by a corresponding and parallel increase skills capacity in the area.

Policy Recommendation

As a policy recommendation to deal with above problems; the management of change in the electricity sector should be entrusted with a Government Committee established specifically to steer the reform process. The Committee, in turn, should establish task forces among their rank to deal with specific issues identified as major components of the sector reform.
In respect to these activities, the power sector reform committee and its task forces, should identify an action plan for policy implementation. This should result in the formation of an Implementation Committee. The Implementation Committee will then activate all measures intended to initiate the reform, and to kick-start the operation of the new liberalised electricity sector. This measure will include contracts for generation, distribution and launch the new electricity regulator.

10.2.4 The Theory Management from the EMBA

The theory of management from the EMBA is CLD- based and has the following elements:

(i) Normative management in entrepreneurship and innovation – CLD1;
(ii) Effectiveness of leadership – CLD2;
(iii) Strategic management and performance – CLD3;

The details of this theory and its development are contained in my position paper EMBA4.6. A careful assessment of this theory reveals that the DoMain model of management is the most efficient way of contextualising the theory to the present task of designing electricity regulator. That is the DoMain model is the main vehicle for transporting the insights from the CLD theory to the management of an electricity regulator. The outline of the model is as follows at the three domains of management.

(i) **Normative level:**

   *Level of fitness:* legitimacy;
   *Control variables:* system philosophy; system dynamics; system structure; system culture;
   *Reference variable:* development; viability.

(ii) **Strategic level:**

   *Level of fitness:* capability and capacity;
   *Control variables:* customer problem; problem solution; competitive position; experience;
   *Reference variable:* new value potentials; extant value potential;
(iii) Operational level:

Level of fitness: economic efficiency

Control variables: Revenue and cost; income and expenditure;

Reference variable: Profits (earning); solvency (liquidity)

10.3 Synthesis of Results and Design of Electricity Sector Regulator For Botswana

The design of the Electricity sector regulator organisation for Botswana was based on the VSM has been achieved through integrating the results of the research from these sources:

- The contextual characteristics of the electricity sector in Botswana;
- Management theory from the EMBA theory;
- Case study results of electricity regulators in S African and Namibia;
- The current policy framework in Botswana formulated to guide and legitimise the electricity reform agenda and the establishment of the electricity regulator;

The resultant model of the electricity regulator for Botswana that has been designed is based on the following modules:

(a) Module 1: Primary activities which form the main drivers of the operation of the regulator; drawn from two sources - reform agenda for the electricity sector and the contextual characteristics of the industry in Botswana, namely:

(i) Sustainability of sector articulated through:
   - Increasing efficiency
   - Ensuring affordable electricity prices
   - Promoting capacity building in the industry
   - Supporting the environment
   - Encouraging safe work practice

(ii) Promotion of competition in the electricity market through:
   - Increasing access to electricity
- Ensuring equitable access to transmission system by Independent Power producers (IPPs)
- Sustaining security of supply
- Ensuring financial health of the sector
- Enhancing customer services

(iii) Implementation of rural electrification
(iv) Increasing application of renewable sources of energy in the production of electricity
(v) Promotion of links with other energy sectors
(vi) Development of culture of research and development

Module 1 list constitute and define the primary activities of the electricity regulator, which ought to be recursive within the organisation.

(b) Module 2: Regulatory functions

(i) Value adding functions
  - Finance;
  - Human resources;
  - Research & development;

(ii) Core Functions (effectiveness factors)
  - Licensing
  - Tariffs and pricing
  - Quality of Service
  - Customer relations
  - Enforcing rules and standards
  - Policy development
  - Communications
  - Legal

(iii) Regulatory Practice (efficiency factors)
  - Consultation
  - Consistency
  - Predictability
  - Flexibility.
  - Independence
- Accountability
- Transparency
- Legitimacy
- Timely
- Responsive approach

Module 2 list are the regulatory functions, which ought to define the effectiveness and efficiency of the electricity regulator.

(c) Module 3: Control and Development Management

Module three categorisation of regulatory functions into two categories; namely development management (intelligence management) and control management respectively is a means through which the organisation can achieve viability when the two are richly connected through organisational policies.

<table>
<thead>
<tr>
<th>Management responsive to (intelligence) the &quot;outside and then&quot; (Development management)</th>
<th>Management related to control &quot;inside and now&quot; (Control management)</th>
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<tr>
<td>Finance</td>
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<td>Human resources</td>
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<td>Licensing</td>
<td>Consultation</td>
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<td>Tariffs and pricing</td>
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<td>Quality of Service</td>
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<td>Customer relations</td>
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<td>Responsive approach</td>
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Table 10.1: Development and control management systems

(d) Module 4: Organisational Structure
Figure 10.1: Structure of model of regulator agency

This module shows the organisational structure of the electricity regulator reflecting power relationships between the CEO and six directorates whose logic are consistent with the design principles of the regulator in terms of the VSM and the integration of the factors alluded to paragraph one of the section 10.3. The restructure of the regulator is depicted in Figure 10.1.
CHAPTER 11: PERSONNAL REFLECTIONS

11.1 Overview

The purpose of this section is to evaluate the research in terms of four critical tests that the research must satisfactorily meet if it is to add value to its intended audience. These comprise: relevance, utility, validity and ethics. In brief, arguments for relevance deal with whether the concern is relevant in the context of the situation and whether the context satisfactorily explains why the concern is relevant in the situation. The arguments for utility involve showing how the answers can resolve / solve the concerns in a given context. Finally the arguments for validity involve arguing for the dependability, credibility, conformability and transferability of the research methodology output (EMBA note, 2003).

As a brief guide to the chapter, section 11.2 deals with the relevance of the research, section 11.3 is about utility, section 11.4 covers validity and section 11.5 presents the ethics of the study and section 11.6 identifies future research areas that can follow from this work.

11.2 Relevance

In chapter 2 several concerns about the electricity sector in Botswana were highlighted in relation to the reform process challenges associated with establishing an electricity regulator and a market governance institution upon the liberalisation of the sector. Specifically, the concerns were: the inefficiency of operation of the industry under the Botswana Power Corporation; the security of supply reflected in the high import of power in relation to locally generated component – the percentage for import and local generation being 71% and 29% respectively; lack of private sector in the electricity supply industry since it is perceived to represent an unattractive investment. These concerns were explicated as follows: The current electricity sector in Botswana is not
deregulated. There are a number of concerns that the industry now faces from different stakeholders. The efficiency of the industry is a major concern to stakeholders. The relative inefficiency in managing the industry is manifested in the increasing operating expenses. For example, in 2001/02 the operational expenses increased by 16% over the previous year. Over the same period profits dropped from P165.3 million to P135.3 million. Although the main cost drivers were attributed to a rise in the salary bill, other factors such as depreciation, increase in tariffs, increase in volume of imports at relatively cheaper prices, ought to have more than compensated for salary bills.

A very critical aspect of concern within or about the industry involves the level of security of supply. With imports comprising 71% of total supply, and local generation complementing the remaining requirement for supply, the Government is concerned about the security of supply. This situation is definitely going to get worse before it gets better because the national load demand is continuing to grow due to developments and growth in the macro-economy and demographics, while current local generation remains constant, resulting in further increase in imports.

This concern is linked to investments within the industry. The government would like to develop private-public partnerships, and is in the process of doing that in order to attract private investments into the industry. The outcome of these concerns has resulted in Government decision to consider implementing reforms through restructuring and privatisation of the power sector in accordance with international trends.

Because of these concerns, the Government appointed consultants to undertake a study on the feasibility of restructuring the sector, dubbed the "Preliminary investigation on Electricity Supply industry (ESI) restructuring in Botswana". The final report of the study on "Preliminary investigation on Electricity Supply industry (ESI) Restructuring in Botswana" recommended that the electricity sector in Botswana should be restructured. The study was commissioned by the Department of Energy in 2002: to investigate the possibility of restructuring the electricity sector in Botswana. The final report from the study recommended the
option of reform of the electricity sector as a means of dealing with concerns in the sector. Further, the final report of the study on "Preliminary investigation on Electricity Supply industry (ESI) Restructuring in Botswana" also made recommendations on the arrangement for the set up of an electricity regulator. In this regard the report said:

"Options for regulation of the electricity sector, under the recommended restructuring strategy were considered. Our recommendation is that an electricity sector regulator should play a greater role in monitoring the performance contract between Government and BPC. Our preference is for a multi-sector network regulator rather than a separate electricity regulator in order to make best use of the synergy that exist and to make optimal use of skilled resources that are required for utility regulation." (EAD Report for Study on Restructuring ESI by Planning Associates, 2003, pp 9-10).

Thus the government's response to problems affecting the electricity sector is the proposal to liberalise the sector and the set up of an electricity sector regulator to oversee the operation of the emerging market.

Under problem formulation-in Chapter three, the chapter that articulates the concerns of the problems associated with electricity sector regulation, a number of weaknesses related to regulation were indicated. The problems connected with regulation may be considered at two levels: at the national level or at the regional and international level, depending on approach. These include: capacity to regulate; current state of poor regulation; data and Information inadequacy and gaps; gaps in policy and legal framework; resources and capacity for regulatory institution; differences in country developments of electricity sector; environmentalists and social rights activists; problems of importing models of electricity regulator; market power. In particular the weaknesses of the regulators were enumerated in Chapter 3.

These examples point towards the need for better methods for developing regulatory frameworks and regulatory institutions relevant for Botswana. The importance of the research can be seen in the context of generating new
perspectives on the debates about the need to develop effective electricity regulator and market governance body.

The purpose of the research is therefore to evolve an electricity sector regulator, which is able to deal with the current regional and international problems, and weaknesses associated with the regulation of the sector in countries where it has been liberalised while at the same time meet the national needs of the sector. Such problems involve, upon liberalisation of the sector in Botswana:

- Failure to introduce and sustain competition;
- Failure to enhance efficiency.

The outputs of the research are two-fold:

- Model for an electricity sector regulator for Botswana based on the design of an organisation using the VSM;
- An electricity market governance body.

The model of the electricity sector developed integrates characteristics that make it responsive to the local requirements and problems of the sector in Botswana, which have been enumerated and elucidated in Chapter 3. The Model is adequately infused with relevant concepts and practice drawn from literature, case studies of electricity sector regulation in S Africa and Namibia, and new Botswana policy needs to guide its establishment. The relevance of the approach adopted were three-fold:

- To reduce the level of regulatory weaknesses encountered in electricity regulation demonstrated worldwide;
- To ensure that Botswana does not import models of electricity regulatory agencies that have not delivered in accord with their missions; and thereby ensure that Botswana does it right first time when it establishes its regulator upon liberalisation;
- To ensure that the objectives for liberalisation of the sector is fulfilled.

The stakeholder views on the model of regulatory agency proposed varied according to the type of stakeholder as indicated below.
The government of Botswana would support the models proposed as the purpose of the model is in line with government policy. However, government concern would be about the cost of establishing it. Such concern would emanate from the blotted structure of the proposed organisation in comparison to the leaner structures of similar organisation in South Africa and Namibia.

The views of the current employees of the national electric utility, the Botswana Power Corporation would be connected to fears of possible loss of employment or changes in employment opportunities. Other employers on the other hand, particularly skilled professional and management cadre would welcome new opportunities and challenges that liberalisation of the sector would usher.

Investors, both national and international would welcome opportunities for new investments when the opportunities meet their expectations such as taxes; returns on their investments; government policies; and foreign exchange repatriation.

11.3 Utility

The model of institutional set-up of the electricity regulator designed as a result of the research incorporates four key modules:

(a) Module 1: Primary activities which form the main drivers of the operation of the regulator; drawn from reform agenda in the electricity sector and the contextual characteristics of the industry in Botswana.

(b) Module 2: Regulatory functions

Module 2 is about the regulatory functions that define the effectiveness and efficiency of the electricity regulator.

(c) Module 3: Control and Development Management

(d) Module 4: Organisational Structure

These modules are infused with the following insights:

- The contextual characteristics of the electricity sector in Botswana;
- Management theory developed from the EMBA programme;
- Case study results of electricity regulators in South Africa and Namibia;
- Analysis of the current policy framework in Botswana formulated to guide and legitimise the electricity reform agenda and the establishment of the electricity regulator;

11.3.1 Utility of the Answers to the Concern / Question

The utility of the model for electricity regulator agency proposed for Botswana are intended to address the research questions cited Chapter 1 and the Concerns elucidated in Chapter 1. The utility of the answers to those concerns and questions are now discussed in the following section.

11.3.2 Promoting Competition

One of the primary activities for the electricity regulator is to promote competition. In the Botswana situation, the missing jigsaw puzzle in promoting competition is the competition policy and law, which are needed for guiding and sustaining competition in the electricity sector when it becomes liberalised. At the moment Botswana has neither a competition policy nor a competition law. These instruments are necessary although the telecommunications regulator – the Botswana in Botswana Telecommunications Authority has been operating since 2000. As noted in paper No2 by the University of Manchester Centre for Competition and Regulation (CRC Policy Brief, 2004, pp3):

"The urgent questions for competition policy include:

What are the rules of the economic game and how much do they depend on the institutions of market place?

What makes for a good set of rules?

What shapes the behaviour of the contestants? How differently can they behave and what processes result in more differences?

What are the uncertainties that make economic contests unpredictable?

Where does organisational and behavioural innovation fit into the competitive scheme of things?
It is important that the government of Botswana formulates a competitive policy that will enable the electricity regulator to achieve economic regulation effectively.

11.3.3 Capacity Building for Regulation

The sustainability of the electricity sector is another primary activity of the electricity regulator, and within that activity there are a number of requirements, notably capacity building, efficiency of operation of the sector, ensuring affordable prices and so on. The regulator to be established will need qualified people to manage it, unfortunately there is no pool of skilled regulators to recruit from within Botswana. As Centre for Regulatory Competition (CRC) notes: "CRC research on the performance of regulatory institutions has uncovered a lack of conceptual understanding on the part of regulators of the management and organisational aspects of putting regulatory intentions into practice" (CRC Policy Brief, 2004, pp3).

For the new electricity regulator to be effective, there is need for the Government of Botswana to undertake training of personnel ahead of the creation of the regulatory institution so that well-trained manpower to manage electricity regulation is available when the industry is liberalised.

11.3.4 Research and Development

Research and development is a value adding primary activity to the electricity regulator. Outside academia, investments in research and development are not priority areas because the outputs from research are not immediate but take long to be felt and realised. In the area of regulation, research is an important element and investments in it should be made unreservedly in Botswana. The main reason is that many complexities abound in the electricity sectors, which warrant detailed technical and economic investigation.
11.3.5 Regulatory Functions of the Regulator

Module 2 of the electricity regulator is concerned with the efficiency; effectiveness and value adding factors identified as follows below:

(i) Efficiency factors: consultation; consistency; predictability; flexibility; independence; accountability; transparency; legitimacy; timely
(ii) Effectiveness factors: licensing; tariffs and pricing; quality of service; customer relations; enforcing rules and standards; policy development; communications; legal;
(iii) Value adding functions: finance; human resources; research & development;

The importance of effectiveness and efficiency factors to the management of the electricity sector will depend on their measures of performance, which has to be quantified; measured; evaluated and integrated with feedback arrangement. In addition the first two factors (effectiveness and efficiency) must be strongly supported with value adding factors (finance, human resources; research and development) within the organisation. The ability to use these factors requires that the electricity regulator operate through strategic management and planning.

11.3.6 Organisational Management

Module 3 in the configuration of the electricity regulator is concerned with the organisational management divided between two forms: control management mainly dealing with efficiency factors; and development (intelligence) management dealing with the effectiveness factors. These two forms of management are tightly coupled through policy to achieve adaptation. And in practice, three key ingredients are needed if these forms of management are to be judged as good as well as meeting the expectations of stakeholders, that is:

- Strategic planning, which requires that all managers place emphasis on the need to think strategically and place their actions within an agreed strategic framework;
- Work system design, which conceptualises the organisation as a system driven by intention that consists of a series of interdependent processes.
Each process is broken down into a series of tasks and it is important for those involved to understand how tasks transform inputs into outputs, the essential interrelationship between the tasks and how effectiveness of the processes can be measured;

- Performance management, which come in various forms but all of which are intended to achieve management commitment by supporting a continuous dialogue between managers and their staffs on how results may be achieved and learning activities focused on priorities.

11.3.7 The Inadequacies in the model of the Organisational Structure

The organisational structure proposed for the electricity regulator reinforces power relationships between managers and other cadres of the employees. It defines the key primary activities of the organisation, and hence it is instrumental in focusing the work of the organisation to its objectives as an electricity regulator.

However it is important to recognise that the structure does not indicate many important aspects of management as well as tools and concepts. Factors that the structure omits include some of the following: organisational culture; organisational learning; team work; communications; change management; and diversity. High achieving organisations have integrated these concepts in their management outfit.

11.4 Validity

11.4.1 Validity of The Study

The criteria upon which validity rests depends on four pillars:

- Dependability – which refers to acceptability of research inquiry including how well the research process is understood and defended as well applied to construct the situation, concern, and answer;
• Credibility – which concerns the data and the evidence collected as well as the theories needed in the construction phase. The burden of establishing credibility can be effectively achieved through triangulation.
• Conformability - which is concerned with the degree to which the process followed in constructing the situation, concerns can be followed; this can be achieved largely by through audit trail;
• Transferability – which is concerned about how the lessons learned form the research may be applied other situations.

(EMBA4 notes, 2003)

This section gives an elaboration of the extent to which the research process meets the requirements of validity stated above.

11.4.2 Methodology

The philosophy embodied in the methodology embraces the positivist, phenomenological, and pragmatic approaches selected to fit the research process. The positivist approach was used for the case studies conducted to get insights of the structure, functions, and the operation of the newly created electricity regulators in South Africa and Namibia. The electricity regulator for South Africa is known as the National Electricity Regulator and the one for Namibia is known as the Electricity Control Board. Phenomenological approach was employed for qualitative research and systems dynamics to develop insights into the current state of the electricity sector in Botswana. The weaknesses and strengths the philosophical approaches used, and the areas where they have been used are outline in the Tables 11.1. A positivist philosophy and functionalist sociological paradigm based on the systems thinking method -Viable Systems Model (VSM) was used as a methodology to analyse the policies related to electricity sector, particularly to assess policy adequacy in providing a suitable framework for enabling the establishment an electricity sector regulator in Botswana. A pragmatic philosophy and a functionalist sociological paradigm using the systems thinking method – the VSM, was applied in the design of the organisation of the electricity sector regulator for Botswana. The application of
this system-thinking tool – the VSM, its strengths and weaknesses as a method
are presented in Table 11.2.

<table>
<thead>
<tr>
<th>Philosophical approach</th>
<th>Research method used</th>
<th>Area of application</th>
<th>Strength of method</th>
<th>Weakness of Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positivist</td>
<td>Case study</td>
<td>Study of structure functions &amp; operation of the National Electricity Regulator of S. Africa</td>
<td>A Facts obtained from documents, literature, internet, reports, and network referrals. Some of the facts could be corroborated (Legal, Policy documents, vision, strategy, structure, functions, operation)</td>
<td>A Documents available are those in the public domain B Range of material available not comprehensive C Scope of information obtained from interviews narrow &amp; reflect biases</td>
</tr>
<tr>
<td>Phenomenological</td>
<td>Qualitative method</td>
<td>The contextual environment of the electricity sector in Botswana (supply, demand, tariffs, primary energy sources, finance, policy, legal, rural electrification, efficiency)</td>
<td>A Material review (documents, reports, literature (published and unpublished) used to help in interpretation of data and information collected. Range of document adequate. B Questionnaire administered used Returned and completed questionnaires enough for analysis C Interviews undertaken with officials in public and private sector to get multiple perspectives</td>
<td>A Time line analysis was not easy to arrive at during analysis stage from material review in relation to electricity sector B There was redundancy in data obtained from questionnaires relating to opinions C Some of the opinions were personal</td>
</tr>
<tr>
<td>Phenomenological</td>
<td>Systems dynamics (qualitative)</td>
<td>Current situation in the electricity sector in Botswana</td>
<td>A Workshop and focused group discussions B Interviews with government officials and private sector officials</td>
<td>A Nearly all participants did not have first hand experience with electricity sector regulation</td>
</tr>
</tbody>
</table>

Table 11.1 Philosophical approaches, areas of use and their weaknesses and strengths
11.4.3 Triangulation: Methods and Data Sources

The methodology for this research has been triangulated through research methods – to gain a better insight into the research topic. Four methods have been used: case study research; qualitative; systems dynamics; systems thinking (organisational cybernetics - VSM).

The use of several methods has enabled data and information with greater scope and scale to be collected so that a better understanding of the research area could be achieved. More importantly the use of multiple methods has enabled the research process to harness the power of interpretive as well as functional sociological paradigms for research so that both hard and soft issues could be explored, analysed, and interpreted to construct the situation, concerns and the answer.

The methods used, the purpose why they were used, and the data collection processes used are shown in Table 11.3. From the table it is evident that triangulation of data sources as well triangulation of methods was undertaken in the process of the research.
Table 11.3: The methods, data collection processes used and the purpose why they are used.

11.4.4 Tests for Validity

To meet the requirements of validity, the research work undertaken ought to meet the following tests or criteria: dependability, credibility, conformability and transferability. These criteria have been met during the research process through strategies, which are shown in Table 11.4.
Table 11.4: Meeting the tests for validity of the research.

### 11.5 Ethical Issues

#### 11.5.1 Overview

The organisational design for the electricity regulator for Botswana is fraught with ethical issues and considerations. The identification of ethical factors embedded in this study is based on the principles, which "strive to act so as to reduce or end the unnecessary pain and suffering of innocent persons and creatures" (EMBA notes, 2004). This is relevant in the context of human behaviour, as noted in the following quote:

"**Human behaviour has consequences for the welfare of others. We are capable of acting towards others in such a way as to increase or decrease**
the quality of their lives. We are capable of harming others. What is more, we are capable of understanding at least in many cases-when we are doing the one and when we are doing the other. This is because we have the raw capacity to put ourselves imaginatively in the place of others and recognise how we would feel if someone were to act towards us in a manner in which we are acting toward them” (EMBA notes, 2004).

In the context of regulating the electricity sector, the ethical concerns embrace the following critical issues.

- Regulatory functions versus ethics;
- Sustainability of the electricity sector in relation to affordability, environmental degradation resulting from harmful generation technologies, safety of people at work, and efficiency;
- Rural electrification as one of the primary activities of the regulator;

The ethical dimensions of these issues are captured in the sections that follow.

11.5.2 Regulation and Ethics

Regulations are rules, which try to control human behaviour, and such rules may be directives or they may allow people some leeway. In the electricity sector, regulation deals with the electricity supply industry in accordance with government policy and law, in order to meet the needs of existing and future electricity stakeholders. In a liberalised electricity sector, the purpose of electricity sector regulation is to promote competition and efficiency in the sector. Regulators have therefore to undertake a number of functions to fulfil that responsibility. The functions of the regulator in Botswana will therefore involve the following tasks:

- Approving and withdrawing licenses, including the relevant rules and conditions to generate; transmit; and distribute electricity;
- Approving appropriate tariffs. This is a delicate task that has to set the permitted rate of return of those investing in the electricity sector.
- Approving prices;
- Resolving disputes;
- Developing and applying these instruments of control constitute the regulator's functions.

The regulator will be expected to perform these functions effectively through being: timely; responsive; flexible; understanding of the rules, policies, roles and responsibilities.

(a) The ethical dimensions

The key debates about ethical issues take different angles. First there is a risk of undue political interference in the execution of regulatory functions of the regulator. The interference may be categorized as interference in the regulatory process, which may be historical in nature given that the industry since its inception has been under the portfolio of the Minister of Minerals Energy and Water resources. Such interference may involve decisions on granting of licences, resolving disputes; and setting tariffs.

The second form of ethical issues involves corruption in the execution of regulatory functions by the regulator. The type of corruption may affect licensing, approving prices, withdrawing licenses. This type of corruption may lead to unfair licensing of withdrawing of licences.

Information asymmetry, which market entities such as Independent Power Producers or transmission system operators may hold, and use inappropriately to mislead regulators constitute another ethical problem in the effective functioning of the regulatory mechanism.

The dimensions of ethical problems indicated can be at organisational, individual or systemic level. Corruption in licensing for example can be individual, political interference can be systemic or organisational and price setting may be affected by systemic approach.
(b) Alternative Approaches

Alternatives of approach to ethical issues described above in the performance of regulatory functions of the electricity regulator include:

(i) Regulation through market forces;
(ii) Regulation through electricity sector regulator; supported by legislation.

For example laws which would be needed in the following areas:
- Laws on corruption
- Competition law that contains the conditions for competition. The law should including entry and exit conditions to and from the market by participants;
- Defining the levels of government involvement. When the electricity sector becomes liberalised it is important to define clearly the role of government in the sector;
- Laws defining requirements for market participants;

(c) The Primary Stakeholders

The primary stakeholders who ought to be party to the regulatory functions are:
- The electricity regulator;
- The government;
- Regional electricity utilities – Eskom and member utilities of SAPP
- Independent Power Producers;
- Transmission system operator;
- Market operator;
- Electricity distributors;
- Current and potential electricity customers in Botswana;
- Traders and brokers

(d) Ethical Evaluation of Alternatives

The evaluation of alternatives to ethical approaches was undertaken based on the three key ethical dimensions of utility; rights and justice. In the evaluation
Tables 11.4, 11.6, and 11.7, which follow the symbols, may be interpreted as follows:

♦♦♦ = Extremely desirable;
♦♦ = Desirable;
♦ = Desirable but not necessary

(ii) Utility

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<tr>
<th>Stakeholder</th>
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<td>(ii) Regulation by market forces</td>
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<tr>
<td>The electricity regulator;</td>
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<td>The government;</td>
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<tr>
<td>Regional electricity utilities – Eskom and member utilities of SAPP</td>
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<tr>
<td>Independent Power Producers;</td>
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<td>Market operator;</td>
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<tr>
<td>Traders and brokers</td>
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Table 11.5: Evaluation of ethical alternatives against stakeholders for utility

In terms of utility, alternative methods for regulation that the government, and the regulator would prefer (desire highly) is regulation through the electricity sector regulator. In addition laws can be prepared to complement the regulatory approach. The market participants on the hand would prefer (desire) that market forces should be made to prevail in lieu of regulation. These alternatives are thus ethical in terms of utility ethics albeit different degrees

(ii) Rights

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<td>The government;</td>
<td>♦</td>
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<tr>
<td>Employees of the electricity market institutions</td>
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</table>
Table 11.6: Evaluation of ethical alternatives against stakeholders for rights

All stakeholders have a basic belief that market forces left on their own cannot protect the basic human rights. Examples from other markets show a strong link between exploitation consumers and market forces if the markets are not regulated. The stakeholders however see market forces as an effective hand in enhancing human rights, when viewed from the perspective of investors. Competitive markets in particular have a great impact on lowering prices.

Regulatory approach on the other hand, is usually designed with the mechanism of protecting customers against abuse by market forces. On the whole the evaluation indicates that human rights, respect, and impartiality are best protected through regulation by the electricity regulator.

These alternatives are thus ethical in terms of rights ethics except market forces albeit different degrees

Table 11.7: Evaluation of ethical alternatives against stakeholders for justice
In terms of justice concerning individuals or entities of the electricity sector, there is greater belief that justice can only be brought about and strengthened by regulation through electricity regulator than by market forces alone. The rules and codes implemented by the regulator are indeed form the mechanisms needed for implementing and bringing about justice. The justice that regulation brings about is the application of market rules in a consistent way and the treatment of all stakeholders fairly and equally. The criteria for justice here is distributive.

Regulation by market forces however is considered by the stakeholders to be complementary to regulation through the electricity regulator. These alternatives are thus ethical in terms of justice ethics albeit different degrees. The alternative of regulation through a regulator however carries a bigger weight in terms of the justice.

(e) Implementation Obstacles

In terms of the foregoing analysis, the obstacles for implementation may be considered from three angles:

(i) Systemic

It is clearly indicated by the foregoing analysis that the utility of legislation as a complement to regulation must be endorsed and is indeed part of the regulatory mechanism. Without adequate legislation regulation is unlikely to achieve its purpose. The obstacle to introducing a suitable legislation is lack of a policy framework to guide its introduction. The value system of organisations, and individuals who will be involved in the development of the policy may be very different. That could lead to unintended consequences. The other obstacle is the poor co-ordination of the liberalisation of the electricity sector and the establishment of an electricity sector regulator. This is evident from the relationship observed between Government organs and the parastatal organisations handling the issue. This is mainly a result of skills capacity in the
field of privatisation and regulation currently unfolding in Botswana. Finally the enactment of legislation requires time and money.

(ii) Organisational

It is important to note that the electricity regulator has not yet been established in Botswana as the electricity reform process has hardly begun. Once the regulator is established then it will carry out the functions of regulation. The possibility of conflict between the mission of the regulator and the strategies it may use to achieve its mission may not be congruent. For example, information asymmetry between the regulator and the regulated can present a big challenge to proper decision-making on the part of the regulator. The ability by the regulator to make a correct judgement and decision under such conditions may therefore be impaired.

(iii) Individual

Individual biases are at the core of human activity. This can be purposeful or unintended. Skills and management capacity may be the obstacles in the performance of regulatory or management functions, which may be caused by lack of information, lack of appropriate experience or sheer ignorance.

(iv) Choice of Alternative.

In terms of ethics and regulation the choice for regulating the electricity sector through electricity regulator is ethical in terms in terms of utility, rights and justice. However it is fraught with systemic, organisational and individual obstacles indicated above. In addition, the limitations are skills and management capacity, resources, policy, appropriate legislation, and co-ordination create special challenges in realising choice of alternative.

11.5.3 Sustainability and Ethics in electricity Sector.

(a) Sustainability in the Electricity Sector
Sustainability in the electricity sector requires:

- That the stock of electricity resources (primary energy sources) man-made, social and human capital should not decline or depreciate, below its present level, and ideally should be increasingly;
- That life represents a complex bundle of values, objectives and activities with ethical, environmental, economic and social dimensions;
- Some notion of fairness of access to basic resources needs for all populations.

These dimensions define the relationship between ethics and sustainability in the electricity sector. The main categories of ethical issues concerned with sustainability of the sector and which an effective regulation of the sector can play a significant role in promoting include the following: affordability (tariffs); the environmental pollution; safety of individuals; efficiency of the sector. These are discussed below.

(i) **Affordability: Tariffs and financial issues**

One of the main functions of the regulator is to approve tariffs. The task of approving tariffs is complicated. The fundamentals are based on the costs of producing electricity and these include:

- Fixed costs: wages and capital costs of replacement of plants and facilities;
- Variable costs: fuel and spare parts.

The revenue of suppliers is directly dependent on the amount of energy sold. The difference between revenue and costs can diverge because the amount of electricity sold may not bring sufficient revenue to cover the costs; reflecting a high fixed portion or because the tariffs are set too low and the revenue becomes less than the cost of producing the electricity. Under the current regulation of the electricity sector the prices of electricity in Botswana has been relatively high compared to its regional neighbour, South Africa. When the electricity sector becomes liberalised one of the main debates will be about the need to maintain electricity prices at affordable levels.
(ii) Efficiency of the Electricity Sector

Efficiency in the electricity sector is about ensuring that the costs of producing electricity are minimised so that the prices are cost reflective. This means that electricity suppliers have to be innovative in the way they produce electricity. For example, suppliers must use cost-effective plants for power generation; they must manage resources in such a way that their usage is optimised. Stakeholders are concerned that the costs of power generation and management of power producers ought to be maintained at a sustainable level. While the rate of return regulation can prevent a supplier from making profits, which are seen by the public to be unacceptably high; indirect exploitation by inefficient working and management practices tend to go unchecked. Price cap regulation on the other hand can be used as a regulatory leverage to minimise the problems of excessive profits and exploitation through inefficient management.

At the moment, in Botswana the rate of return is used as a means of measuring the financial performance of the utility. On the basis of the foregoing, it is evident that this form of measure does not and cannot by design eliminate exploitation of customers through poor management. This suggests that when the sector becomes liberalised the electricity regulator will need to seek means and ways of exploitation of electricity consumers in the manner described.

(iii) Safety

A number of engineering skills have been applied in the electricity industry to reduce harm caused by plants to people and the environment. This calls for the public, the media and the pressure groups that all new products of technology should be safe without qualification. It is therefore, important that safety should be built into electricity sector regulation. Safety management is akin to the process of risk management where it is recognised that there is no such thing as zero risk, and that the aim must therefore be to reduce it to a tolerable level. Modern safety management and indeed risk management works on a four-stage process:

- Identifying the hazards – the processes that could conceivably lead to harm;
Risk assessment, a two-dimensional quantity combining the severity of the harm and the probability of its occurrence;

Judging the tolerability of the risks;

Where needed, effective continuing control of the risk to a tolerable level by operating on the severity, the probability or both.

Skilled and safe operation and maintenance of plant whatever its function is thus necessary and this should be built on these factors: training for competence as a key issue for safety; the human contribution to operation and maintenance which must be part of the integrated strategy for safety and operability. Such approach must take cognisance of the importance of the nature of tasks; frequency of use of the equipment; functional groupings of controls and equipment; and the sequence of use.

Above all a successful safety policy requires a published standard on equipment representing a statement by its issuing body that if you control the risks in these products this way, we consider that the product will be safe enough. Such statements, it should be noted, are only as trustworthy as the understanding of the drafters at the time of the compilation.

(iv) Environment

The extent to which large electrical systems such as power stations, transmission lines impinge on the environment has become topical and even controversial in recent times. The effects of electric and magnetic fields on the health of individuals and the interference of these fields with communications systems continue to of concern to the society. Radio and TV interference sources inject parasitic currents into overhead conductors, causing radio noise fields that vary according to frequency. It is these radio noise fields that affect communication systems.

Emissions from very large generation plants have attracted criticisms and demonstrations from environmental activists in many parts of the world. This has led to new electricity generation technologies, which are relatively modest in
terms of generation size and capacity and have less negative impact on the environment. The Combined Cycle Generating Plant (CCGT) is a power plant is a typical example. Therefore, electricity regulators need to attract investors who are able to introduce such technologies, with minimal negative impact on the environment, in the power sector. At the moment, in Botswana, thermal generating plants using coal as a primary energy source produces 29% of the electricity consumed in Botswana. These plans emit smoke into the atmosphere.

Corona effects on the surface of high voltage overhead power transmission lines are the principle source of radiated noise. Another source of noise from electricity transmission include the radio interference caused by discharges around the insulators, which are mostly a result of corona discharges along the insulator's surface. The level of radiated noise depends on the degree of pollution and on the potential along the surface of the insulator.

The visual effects of transmission lines and substations and their space requirements have negative impact on the environment view of their large dimensions and conspicuousness. It therefore, necessary to seek innovations and new approaches that can be applied minimise such concerns, and regulation can be an important driver in that aspect.

(b) Ethical Issues- Sustainability of the Electricity Sector

Sustainability of the electricity sector is a primary activity of the proposed electricity sector regulator for Botswana. The key ethical issues for the regulator will comprise of:

(i) The need to regulate the electricity sector so that the environment is not harmed by the industry in a way that human habitat is endangered. For example, regulations will be needed to protect such things as diverse as agriculture, forestry, flora and fauna, archaeology and hydrology.

(ii) The need for electricity prices to be affordable by current and potential consumers. If the cost of electricity is beyond the means of most the potential consumers, demand will be low. On the other end if the cost
of production exceeds the selling price, the industry may not be viable. So the regulator will have the delicate task of setting the permitted rate of return to make the industry viable while at the same time making electricity prices affordable to potential consumers. The ethical question for the regulator will be, when in the process of approving tariffs: what price setting mechanism by a regulator is seen to be fair both to potential consumers and to the electricity suppliers?

(iii) The need to ensure that the safety of the people who work in the electricity sector secured through appropriate regulations on safety of workers in the industry.

(c) Alternative Approaches

The alternatives of approach to ethical issues in the performance of regulatory functions of the electricity regulator in regard to sustainability of the sector consists of two options:

(i) Regulation through market forces;

(ii) Regulation through electricity regulator; supported by legislation, for example laws in the following areas will be needed:

- Laws on corruption
- Competition law which sets out the conditions for competition – including entry and exit conditions to and from the market;
- Defining government involvement- as the electricity sector becomes liberalised it is important to define clearly the government in the sector;
- Laws on requirements for market participants;

(d) The Primary Stakeholders

The primary stakeholders who are party to regulatory functions are:

- The electricity regulator;
- The government;
- Regional electricity utilities – Eskom and member utilities of SAPP
- Independent Power Producers;
- Transmission system operator;
- Market operator;
- Electricity distributors;
- Current and potential electricity customers in Botswana;
- Traders and brokers

(e) Ethical Evaluation of Alternatives

For sustainability of the sector, the evaluation of alternatives has been undertaken based on ethics relating to: utility, rights and justice. Tables 11.8, 11.9, and 11.10, which follow the symbols, evaluation of these ethics are indicated. The symbols used in the tables may be interpreted as:

- ♦♦♦ = Extremely desirable;
- ♦♦ = Desirable;
- ♦ = Desirable but not necessary

(i) Utility

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<tr>
<td>Traders and brokers</td>
<td>♦</td>
</tr>
</tbody>
</table>

Table 11.8: Evaluation of ethical alternatives against stakeholders for utility

From Table 11.8, alternative one would not deliver the interests of sustainability of sector on its own will and needs some cohesion to embrace all that which sustainability entails. Alternative one would only be able to deliver certain
categories of sustainability but not all of the categories. Under alternative two, all stakeholders would be having their interests built in the regulatory mechanism.

Although both these two alternatives are ethical in terms of utility, albeit different degrees, alternative one is least ethical in comparison to alternative two.

(ii) Rights

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(ii) Regulation by market forces</td>
</tr>
<tr>
<td>The electricity regulator;</td>
<td>♦</td>
</tr>
<tr>
<td>The government;</td>
<td>♦</td>
</tr>
<tr>
<td>Employees of the electricity market institutions</td>
<td>♦</td>
</tr>
<tr>
<td>Regional electricity utilities – Eskom and member utilities of SAPP</td>
<td>♦</td>
</tr>
<tr>
<td>Independent Power Producers;</td>
<td>♦</td>
</tr>
<tr>
<td>Transmission system operator;</td>
<td>♦</td>
</tr>
<tr>
<td>Market operator;</td>
<td>♦</td>
</tr>
<tr>
<td>Electricity distributors;</td>
<td>♦</td>
</tr>
<tr>
<td>Current and potential electricity customers in Botswana;</td>
<td>♦</td>
</tr>
<tr>
<td>Traders and brokers</td>
<td>♦</td>
</tr>
</tbody>
</table>

Table 11.9: Evaluation of ethical alternatives against stakeholders for rights

The evaluation for all stakeholders indicates that the rights, respect, and impartiality of individuals are best protected through alternative one. The nature of electricity market is such that customers can easily be made captive, as the case is at the moment. Alternative one is least capable of protecting individual interest. By design, alternative two is intended to protect and promote individual welfare and interest. Alternative two is therefore more ethical in terms of rights ethics.
(iii) **Justice**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Alternatives</th>
<th>(ii) Regulation forces</th>
<th>(ii) Regulation through electricity regulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>The electricity regulator;</td>
<td>♦</td>
<td>♦</td>
<td>♦♦♦</td>
</tr>
<tr>
<td>The government;</td>
<td>♦</td>
<td>♦</td>
<td>♦♦♦</td>
</tr>
<tr>
<td>Regional electricity utilities – Eskom and member utilities of SAPP</td>
<td>♦</td>
<td>♦</td>
<td>♦♦♦</td>
</tr>
<tr>
<td>Independent Power Producers;</td>
<td>♦</td>
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<td>♦♦♦</td>
</tr>
<tr>
<td>Transmission system operator;</td>
<td>♦</td>
<td>♦</td>
<td>♦♦♦</td>
</tr>
<tr>
<td>Market operator;</td>
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<td>♦♦♦</td>
</tr>
<tr>
<td>Electricity distributors;</td>
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<td>Current and potential electricity customers in Botswana;</td>
<td>♦</td>
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<td>Traders and brokers</td>
<td>♦</td>
<td>♦</td>
<td>♦♦♦</td>
</tr>
</tbody>
</table>

Table 11.10: Evaluation of ethical alternatives against stakeholders for justice

In terms of justice among individuals or entities of the electricity sector, relating to sustainability of the sector there is greater belief that this can be brought about by legislation rather than by market forces with regard to the electricity sector regulation. For example market forces are not linked to protecting the environment. Alternative two by design addresses the need for justice among stakeholder in the electricity sector. The second alternative is thus ethical.

(f) **Obstacles to Implementation**

Obstacles to implementation may fall under systemic, organisational or individual arrangement as follows.

(i) **Systemic**

The ethical alternatives considered in relation to sustainability of the electricity sector are diverse in nature – that is: efficiency, affordability, safety of personnel, and the environment. One of the major setbacks for implementing these issues is that each one affects different stakeholders of the industry in a different way. For example Independent Power Producers affect the environment through pollution while and Transmission System Operators affect the environment through...
obtrusive structures. A coherent method implementing the environmental aspect of sustainability becomes a problem between two organisations.

Affordability is relative. If the cost of electricity is beyond the means of most potential consumers demand will be low. On the other end if the cost of production is exceeds the selling price, the industry may not be viable. So the regulator has the delicate task of setting the permitted rate of return to make the industry viable while at the same time making electricity prices affordable to potential consumers. Information asymmetry may make it difficult to be ethical in setting the tariffs. Another problem associated with implementation is regulatory capture – in which interest groups can misdirect the regulatory process.

Efficiency, and safety of personnel need reference datum and standards of equipment operation respectively. If sources on this information are flawed, then implementing these factors present new sets of problems.

(ii) Organisational

The main problem associated with implementing issues of sustainability is that such issues tend to detract the organisation from its mission. For example money spent on buying new technology to improve efficiency may lead to decreased rate of return or reduced shareholder value. Leadership and normative management are key factors in promoting the issues of sustainability in their organisations through vision and mission. A great effort has to be spent on ensuring that such elements support concepts of sustainability.

(iii) Individual

The main constraint associated with implementation at the individual level is caused by failure to empower individuals adequately. If workmen maintaining an electricity plant are not properly equipped with protective gear then their workplace safety becomes severely breached.
The second problem of constraint is related to management performance. Inadequacy of capacity and skills to manage business effectively due to lack of experience or formal training remain a main factor why individuals cannot deliver on sustainability of the electricity sector. The result is often underperformance of organisations operating in the sector.

(g) Choice of Alternative

In terms of ethics and sustainability of the electricity sector, the choice for regulating the electricity sector through electricity regulator is ethical in terms in terms of utility, rights and justice. It has however problems associated with systemic, organisational and individual obstacles indicated above such as limitations in skills and management capacity, resources, policy, appropriate legislation, and co-ordination.

11.5.4 Rural Electrification

The Minister of Minerals Energy and Water Resources through the Department of Energy is responsible for rural electrification being implemented by the Botswana Power Corporation. The Government subsidises the utility to undertake rural electrification. Though rural electrification has political and social benefits, it is not economically sustainable. Rural electrification is rarely viable though very desirable. Many rural electrification programmes run at a loss. In Botswana, the loss currently incurred in rural electrification – from project phase to commissioning, and during operation are subsidised by the government. Under liberalisation of the electricity sector, Government policy will require that rural electrification should be sustained, notwithstanding the losses it incurs. At the same time the new owners of the electricity sector will want returns on their investment and that means the sector has to operate efficiently to satisfy its new shareholder owners. These are contradictory requirements relating to rural electrification when the sector becomes liberalised.
(a) Ethical Issue

The ethical issue is that people in rural areas just like those living in urban areas, should be provided with electricity regardless whether they are rich or poor and regardless whether rural electrification is sustainable or not. Failure to extend electricity services to rural places will be seen to be discriminatory and therefore unethical in terms of human rights, impartiality, and respect for individuals. The question is: who will subsidise for the losses in rural electrification if rural electrification has to be sustained and maintained?

(b) Alternative Approaches

The alternative approaches to ethical issues in rural electrification are:

(i) Regulation through market forces;
(ii) Regulation through electricity regulator; supported by policies and legislation, for example laws that will be needed in the following areas:
   - Laws on corruption
   - Competition law which sets out the conditions for competition – including entry and exit conditions to and from the market;
   - Defining government involvement in the electricity sector. When the sector becomes liberalised it will be important to define clearly the government in the sector; particularly in rural electrification where government's continued participation will be necessary and critical;
   - Laws on requirements for market participants;
   - Policies on injection of government subsidy into rural electrification;

(c) The Primary Stakeholders

The primary stakeholders who are party to regulatory functions are:

- The electricity regulator;
The government;
Regional electricity utilities – Eskom and member utilities of SAPP
Independent Power Producers;
Transmission system operator;
Market operator;
Electricity distributors;
Current and potential electricity customers in Botswana;
Traders and brokers;
Rural population.

(d) Ethical Evaluation of Alternatives

There are two alternatives under which rural electrification can be sustained taking into account ethical considerations, namely: market conditions and electricity sector regulation. Ethical evaluation of these two alternatives is described below.

(i) Utility

Market forces are unlikely to make impact into business areas; such as rural electrification where losses are known if there is not mechanism of recouping their losses. The electricity regulator with the intervention of the Government is best suited to achieving rural electrification. The current situation involves ring fencing rural electrification financially and removes any negative financial impact it may place on the operation of the utility. This arrangement can be retained when the sector is liberalised with the role of the government and the regulator being directed at managing subsidies to the electricity distributors who will be the implementing agencies for rural electrification.

(ii) Right

The market forces in electricity market are unlikely to uphold the rights of rural people or to uphold their human rights if rural electrification is loss making
business. It is the alternative of regulation with Government intervention that will take up human rights as an issue.

(iii) Justice

Rural electrification in regard to justice is only possible through regulation and government. This can be achieved through Government by policy and legislation. The market approach is voluntary and based on appropriate signals – particularly financial ones.

(e) Constraints

(i) Systemic

There are large areas of Botswana where provision of grid rural electrification will remain difficult for some time. The territorial expanse is a factor that aggravates the remoteness of many rural communities makes it difficult to distribute electricity to such areas because of technical problems associated with the distribution of electricity over long distances at low voltages, notwithstanding economic subsidies that go with rural electrification. The long-term management associated with electricity supply in remote areas will continue to give challenges in the areas of operation, technical losses and financial sustainability.

(ii) Organisational

Managing rural electrification has unique problems for utilities or electricity distributors. Overland transport to travel long distances on rugged roads to remote locations for maintenance, construction, and installation will be needed and which can be costly. Second the challenge of meeting safety requirements in installing electricity in grass thatched houses, which are sources of fire hazards and are predominant in remote villages, will continue to be explored.

The third difficult decision on the types of electricity supply most suited for remote locations other than grid electricity is not by any means certain in terms of
economy and technical superiority and feasibility. Fourth, electricity supply industry employees are unwilling to work in remote locations, without suitable incentives. Fifth the financial resources needed for effective rural electrification has to be raised through government sources such as taxes and approval of tariff policy and schemes that can sustain rural electrification.

In some instances renewable energy sources are the most economic option and indeed the only practical way of supplying the energy necessary to lift rural economies above subsistence level. This has been recognised by the major aid and financing institutions. As a result such institutions have created special policies and funds to stimulate the development of renewables for rural electrification. The World Bank and Global Environmental Facility's Solar Initiative are examples of the institutions involved.

(iii) Individual

Financial constraints to pay for electricity use remain a drawback to many rural dwellers even when they are connected to electricity.

(f) Choice of Alternative

In terms of ethics of rural electrification within the electricity sector, the choice for regulating the electricity sector through electricity regulator is ethical in terms in terms of utility, rights and justice. It has however problems associated with systemic, organisational and individual obstacles indicated above. Typical obstacle in rural electrification involves sustainability of financial resources, technical issues, maintenance, and limited resources among rural the majority of rural population.

9.5.6 Further Work

Based on this research further areas of work that can be built on this are:

- Regulatory impact assessment of an electricity sector regulator that has been designed to meet local needs of the sector;
- Understanding the factors which contribute to poor regulation in developing countries.
- Managing transformation of electricity sector regulation
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