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Decision making practices in the pharmaceutical sector: Implications for Uganda

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This paper is a preliminary analysis of decision making principles and practices with in the pharmaceutical industry. The subject of managerial decision making in the sector forms an important area of research and policy debate and it has of recent become a much prominent sector for obvious reasons. First, the pharmaceutical industry contributes to improving the citizen's health outcomes and productivity. Second, effective decision making is at the heart of what managers and administrators sector do. Third, there are glaring inefficiencies in the sector which blames the decisions made by those who run the sector. While organizations generate information at a much faster rate, the utilization of such information in decision making remains a matter of concern given the ineffectiveness in which some decisions continue to be made. This dilemma has generated a new and exciting interest for scholars. Moreover, the existence of noticeable historical practices that traditionally informed decision making over the long history of civilization makes it imperative to assess the interparty of these factors within the current decision making environments. This paper therefore traces how decisions have been made over time as specifically as applied to the pharmaceutical sector. The purpose of this study is to draw important insights for contemporary decision making challenges of the pharmaceutical sector within Uganda and the rest of the world. Research may also be carried out on how the buying of reliable information can influence judgment and the optimization of decision outcomes leading to better decision making in the regulation, management and administration of the pharmaceutical sector.

Key words: Decision making, decision making practices, productivity, information management, Pharmaceutical sector, Uganda.

INTRODUCTION

The pharmaceutical sector presents a unique sector with access to almost unlimited amounts of information on the global scale (Darrouch and Miles, 2011:6), but effective decision making remains a momentous challenges. There is meanwhile an impressive history of effective decision making practices, models and approaches that have traversed the civilization journey from which contemporary managers can borrow useful insights. The expansive wealth of information on how earliest people made decisions and how similar approaches were meticulously accomplished when man began living in organized societies shed much light on how contemporary

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decision making can be improved. Similar lessons abound the medial and industrial revolution epochs. Contextually, decision makers in the pharmaceutical sector at times 'feel lost and perplexed' amidst the influx of this multitude of information occasioned by the opportunities brought by information technology using internet and the computer technologies. Unfortunately, even with these technologies managers remain incapable of making effective decisions.

The pharmaceutical industry in any country contributes immensely to improving the citizen's health outcomes and productivity and life expectancy. A report by Cheraghali (2010:11-15) shows that Americans and British have a well developed pharmaceutical industry, that contributes to their high quality of life (i.e. life expectancy in United Kingdom is at 78.1 for men and 82.1 for women; deaths under 45 yrs dropped from 50% in the 1900s to 4.4%; cardiovascular deaths at 75 yrs reduced by 44%, chemotherapy saving up to 1,600 lives of cancer a year). In comparison to some countries like Iran, which still have a relatively poorly developed pharmaceutical industry, limited to the formulation of cheap and fairly old medicines that cannot cure many diseases, their life expectancy and productivity is low. It is uncontestable that the pharmaceutical sector develops produces, and markets medicines, medical equipments, drugs, cosmetics, and dietary supplements, for both human and veterinary use. The sector thus requires accurate, reliable and robust decision making as it touches on all the lives of individuals in any society. Effective decision making requires accurate and timely information.

In Uganda's context, Omaswa (2002:3) demonstrated how access to health services, qualified healthcare staff and medicines were necessary components of any healthcare system. However, the issue of medicines presented a special importance for various reasons: - they save lives, improve health, promote trust and participation in health services. Serutoke (2002:23) emphasized that; communities will quite understandably equate the quality of healthcare primarily with the availability of basic essential medicines and drugs. In the USA for example, the biopharmaceutical sector produces drugs and medicines and employs citizens to a tune of $790 billion on an annual basis when direct, indirect and induced effects are considered. Reports by the Value for Medicine (VM) magazine indicate that citizens of the United Kingdom, boast of their pharmaceutical industry because it delivers a significant contribution to the country's economy and the population as a whole (Vanessa, 2011:31-36).

According to the report by the US-based Fogarty International Centre (2010), over a third of anti-malaria drugs in sub-Saharan Africa that have been tested over the last 10 years, have been identified as either counterfeit or of poor quality. The report further indicates that apart from malaria-fighting drugs, ARVs and drugs treating tuberculosis are the most commonly counterfeited medicines. One of the major reasons why counterfeit drugs are flourishing in Africa is cost (WHO, 2010). Developing countries are an obvious target for counterfeiters, because the cost of legitimate drugs may be beyond the reach of much of the population and legal controls are often weak. In the absence of adequate national health care provisions, the burden of the cost of drugs too often falls on the patient, who then may feel tempted to seek cheaper alternatives.

International health experts are warning of a mounting health crisis in parts of Africa because of an influx of counterfeit medicines from Asia and India. General awareness of counterfeit products is worryingly low in many African countries .In a recent Gallup survey, although 70% of adults said they were aware of counterfeit drugs and the potentially fatal consequences of taking them, awareness was recorded to be as low as 25% in South Africa.

White (2010:1647-1657) observed that counterfeits are a massive problem that people have simply ignored, despite the fact that everything from life-saving Aids medication, to emergency contraception are being copied, faked and made with shoddy components on a huge scale, "It's a crisis any time someone dies". Garett (1997) notes that, "Nobody has the head count – or body count – on the numbers of Africans that have died as a result. But China's role certainly has been dreadful." While the precise data is hard to track down because of the informal nature of African health systems, several studies warn that as many as one-third of malaria drugs in Uganda and Tanzania are fake or substandard, with most believed to originate from China or India. With the same concern, Lukulay (2013) observed that, it was no secret that the majority of dangerous medications came from China and India, as those countries had the world's largest production bases for both active ingredients and finished drugs. This is a great challenge and calls for the robustness of effective decision making in our societies.

This paper traces the decision making debate from the ancient times through the medial up to the contemporary times. On the basis of the decision making practices and principles in these periods, we draw implications for the regulation, management and administration of Uganda's pharmaceutical sector. The paper is structured under five major sections. Section one introduces the paper and describes the research problem, the possible causes that determined the research questions of the study, the unique nature of the pharmaceutical sector and the kind of decision making requirements needed. Section two describes theoretical and conceptual models relevant for understanding decision making in the pharmaceutical sector. In section three, we discussed related literature using empirical studies which have been done on this subject, including the decision making processes across a historical spectrum; a task that we execute based on the ancient, medieval, industrial revolution and

contemporary periods. Section four proposed a methodology and anticipated results from the study. Finally, in section five the paper draws important conclusions and managerial implications emphasizing areas for future empirical study.

Research problem

Uganda is a country faced with a very low average life expectancy of 54.07 years, in comparison to other countries like the 91 years life expectancy in Monaco, 60 in Rwanda, 62 in Sudan, 64 in Senegal, 66 in Botswana, 73.2 in Egypt, 79 in the USA, and 82 in the United Kingdom, (WHO, 2012). Further the problem of low life expectancy is compounded with Uganda's very high infant mortality rates of about 45/1000 compared to other countries, for example, USA 6/1000, United Kingdom 4/1000, Norway 2/1000, South Africa 33/1000, Netherlands 3/1000, and Monaco 3/1000 (UN 2009-2013). Society benefits from increased life expectancy, because when people live and work for longer periods, generally productivity increases with corresponding improvements in the total Gross Domestic Product (GDP) with the overall general improvement of the quality of life of the nation at large (NPA, 2010).

Given Uganda's low life expectancy, progress is low and so that is one of the reasons why it is under-developed as a nation (UN, 2011). It is believed that Uganda's low life expectancy and high infant mortality rate, are the problems, among other things, caused by fake or expired drugs, (Mclaughin, 2012), counterfeit and adulterated drugs (Buwule, 2013:5), insufficient supply of basic life-saving drugs like ARVs and Anti-malarial drugs, engagement of unqualified personnel in the provision of pharmaceutical services, as well as the operation of unlicensed pharmacies and drug shops by un qualified personnel (Nahamya, 2012:4-6). These are indicators of mismanagement in the regulation, management and administration of the pharmaceutical sector in Uganda. Could it be that the mismanagement of the pharmaceutical sector is caused by ineffectiveness in the decisions making practices? The study intends to answer the following questions:

1. Is there provision of complete information to the decision makers in the pharmaceutical sector?
2. To what extent is an individual's judgment influenced by his management position in the pharmaceutical sector?
3. Does experience with drug development, handling and distribution influence the decision outcomes of the pharmaceutical sector?
4. Are there fundamental rules that shape individual or group-decision making practices in the everyday management of the pharmaceutical sector?

THE PHARMACEUTICAL SECTOR IN UGANDA

According to the Uganda Pharmaceutical Manufacturers Association (UPMA), Uganda's pharmaceutical market has an estimated value of US$ 276 million, of which 90 per cent of the medicines are imported, mainly from India and China, and 10 per cent produced by local manufacturers. The imported medicines and health supplies account for 5.4 per cent of Uganda's total imports (UIA, 2009). Medicines are supplied through both the public and the private sectors and there are also non-governmental organizations (NGOs), faith-based organizations (FBOs) and international aid agencies involved in the procurement and distribution of medicines and health supplies.

The supply of essential medicines for the Humane Immune Virus/Acquired Immune Deficiency Syndrome (HIV/AIDs), malaria and tuberculosis depends on the funding mechanism. All the donor and development partners' funded procurements for antiretroviral drugs (ARVs), Artemesinin-based Combination Therapies (ACTs) and Tuberculosis (TB) medicines source their medicines outside Uganda (WHO, 2009). This is mainly because of the requirement that the suppliers should have World Health Organization (WHO) product prequalification. This situation will probably change in the near future as the local pharmaceutical industry, which produces ACTs and ARVs, acquires international certification. Although these locally produced ACTs and ARVs are not WHO prequalified at the moment, in January 2010, Quality Chemical Industries Limited (QCIL) received the WHO Good Manufacturing Practices (GMP) certification and the firm is working on the product prequalification process for ARVs and ACTs. As of December 2009, procurement of locally manufactured ACTs and ARVs was funded solely through Government of Uganda resources (MoH 2009). UGX 60 billion of government funds have been allocated for these purchases as part of government efforts to increase the availability of ACTs and ARVs and to support the local pharmaceutical industry (UBOS, 2009, 2010, 2011).

Uganda has a total of 11 licensed local pharmaceutical manufacturers, 477 registered pharmacies and over 4,370 chemist shops (NDA, 2009). As of 2006, the country had 114 hospitals, 60 of which were public, 46 private not for profit or FBO, and eight private (UNBOS, 2009).The National Medical Stores (NMS) are responsible for the procurement, storage and distribution of medicines and health supplies for the public sector, while the private sector is served through a chain of wholesale and/or retail pharmacies, chemist shops, and private clinics. Unfortunately, there remains a lot of public outcry about the inefficiencies in Ugandan's pharmaceutical services sector. Ugandans complain of the high cost of medicines, inadequate supply of drugs, lack of enough choice and effective medicines and other pharmaceutical services which have lead to increased

death rates. The World Health Organization (2010) indicated existence of so many unlicensed pharmacy traders on the market, fake / adulterated drugs being sold in pharmacies and clinics, and involvement of un-qualified personnel in the dispensation of pharmaceutical services. The high prices of pharmaceutical products in Uganda compared to other countries in the region leads to a situation of smuggling in drugs from neighboring countries. Yet, the available information ought to have guided effective decision making in the regulation, management and administration of the sector. One therefore wonders whether there is any causal relation-ship between information management and effective decision making in the pharmaceutical sector. This study is being undertaken in this context to examine how information management and effective decision making in the pharmaceutical sector in Uganda are related.

Counterfeit drugs constitute probably the single biggest challenge to the pharmaceutical industry in Africa. Such drugs are defined by the World Health Organization as "deliberately fraudulently mislabeled with respect to identity and source" (WHO, 2009). It is believed that more than half of the drugs sold in Africa are fake (Mclaughin, 2012:4).

In 1993, Uganda formulated the National Drug Policy and Authority Statute which in 2000 became the National Drug Policy and Authority (NDP/A) Act (2000 Edition). The Act established a National Drug Authority (NDA) to contribute to the attainment of a good standard of health by the population, through ensuring the availability, accessibility and affordability at all times of essential drugs of appropriate quality, safety, and efficacy. The role of NDA is also embedded in the National Veterinary Drug Policy, whose vision is to have quality veterinary drugs accessed by all stakeholders for sustainable animal health and production. According to the NADP/A Act, this institution is charged with the development and regulation of pharmacies and drugs in the country, control to the importation, exportation and sale of pharmaceuticals, control to the quality of drugs, promotion and control to the local production of essential drugs, encouragement to research and development of herbal medicines, establish and revise professional guidelines and dissemination of information to health professionals and the public, provision of advice and guidance to the Minister and bodies concerned with drugs on the implementation of the National Drug Policy. There is also the Pharmacy Council as part of the Ministry of Health, whose overall goal is to ensure that National and International pharmacy practice standards and codes of ethics are adhered to, both in the public and private sectors and controls the conduct and discipline of registered pharmacists.

MoH (2010) indicates that over the last 12 years, the Government of Uganda has developed two comprehen-sive National Health Policies (NHP); National Health Policy I (NHP I) in 1999, and National Health Policy II (NHP II) in 2009. Both these policies are aimed at increasing access to essential medicines as part of national efforts to deliver the Uganda National Minimum Healthcare Package (UNMHCP), which puts particular emphasis on management of communicable diseases, especially HIV/AIDs, malaria and tuberculosis. Demand for generic essential medicines is driven by the absolute size of the disease burden and interventions to reduce this burden (Beaglehole et al., 2004:2084-6). He continues that at 6.4 per cent, Uganda's HIV prevalence, although stable, is still high compared with many other countries and the number of people requiring HIV/AIDS treatment and care is increasing. There are interventions to scale up HIV/AIDS treatment and care services and, according to the Ministry of Health (MoH), at the end of June 2009, the number of people on anti-retroviral drugs (ARVs) stood at 187,974, of whom 18,000 were children. The HIV/AIDS burden also impacts on the burden of tuberculosis. According to the WHO (2009) Global Tuberculosis Control Report, Uganda is ranked 15th out of the 22 high burden countries in the world.

Today, there are annually 136 new tuberculosis cases for every 100,000 Ugandans and TB is the cause of death of some 30 per cent of people living with HIV/AIDs (MoH, 2009). Today, the National Tuberculosis and Leprosy control Program (NTLP) strategic plan gives particular attention to expanding quality Direct-Observed-Treatment, Short-Course (DOTS) therapy country-wide as the best option to control the disease (WHO, 2009). Malaria remains the leading killer disease and the demand for malaria medicines continues to grow both in the public and private sectors. In 2008/2009, in order to assess demand in the private sector and explore ways of responding, the Ministry of Health, in collaboration with private sector partners and with funding from the Affordable Medicines Facility for malaria (AMFm), piloted the procurement, distribution and use of subsidized Artemesinin-based Combination Therapies (ACTS) in the private sector (MoH, 2009).

Cooper andDayna (2013) observed that, one of the most intriguing aspects of the health care system in Uganda relates to how people purchase and receive drugs and over the counter products. Interestingly as they examined the nuances of how products are imported and distributed in the country, it was quite a shock in that the process is relatively convoluted. In the first place, there are many businesses in Uganda that do both wholesale and retail at the same time. They noted that, there are only about 500 pharmacists in the entire country and this implies that there is 1 pharmacist for every 100,000 Ugandans, compared to the recom-mended ratio of 1:2,000 by the world health organization (WHO, 2010). To make matters worse, more than 90% of these pharmacists practice in the central region which leaves the rest of the regions lacking. Anyone can own a pharmacy in Uganda!! It is considered a business and can be run by anyone with under the supervision of a

pharmacist. Interestingly, as there are only about 500 pharmacists in Uganda and each one is only allowed to supervise 2 pharmacies, then there should only be 1000 outlets (but there are at least 10 times more).Cooper and Dayna (2013)'s study indicated that the counter staff at a pharmacy is mandated to have a pharmacy technician, a nurse, or a midwife, but no pharmacist seemed to be present on the pharmacies they visited. Of interest was that a few pharmacies have a clinical officer on site to assist with basic healthcare services (and then the patient can purchase the products recommended).There seemed to be is no ability to log prescriptions into a computer and electronically create a label and all medications were dispensed in envelopes with a handwritten label. Prescriptions seemed to be optional in many places. Drug shops are the smallest retail medicine outlets supervised by non-pharmacist health-care professionals, and limited to handling small amounts of over-the-counter medicines. Supply chain issues occur and expiry of medicines can be a threat to access to products. Medicines are sometimes procured with a short shelf life, are expensive so there is slow turnover, or are donated (Cooper and Dayna, 2013). The contributing factors in the supply chain issue; include neglect of stock monitoring, lack of knowledge of basic expiry prevention tools, non participation of clinicians in medicine qualification, and overstocking (NDA, 2010.). Self diagnosis and medicating is an issue in Uganda (Muhumuza, 2013). For example, anyone can go into the pharmacy and purchase anti-malaria drugs when what they needed was an antibiotic for an infection. Overuse of items that are easily purchased (such as antibiotics) are an issue. The Pharmaceutical Society of Uganda was established by the Pharmacy and Drugs act of 1970 and membership is comprised pharmacists working in Community Pharmacies, Hospitals, Pharma industries, Regulatory bodies, academia, research organizations, drug procurement, distribution entities among others, but its operation is not registered in the communities at all. The number of hospital pharmacists is still a very big challenge in Uganda. For example, Mulago Hospital (National Referral Hospital) in Kampala has only 5 full time pharmacists. This means that most of the day to day work of dispensing the proper medications and assuring safe medication use is handled by the pharmacy interns who have graduated from the School of Pharmacy and have passed their eligibility exams to practice pharmacy. How pharmacies are owned and operated in Uganda is also quite a challenge, and it is believed that in the future more pharmacies will open under the same operating conditions, a situation which is very dangerous to the Ugandan people and the world in economic terms. The National Drug Authority in 2010 estimated that in every 10 people 8 self-medicate or buy drugs over the counter. This could be attributed to the increase in number of pharmacies and drug shops in the region, expensive treatment from clinics and long distances to health facilities. This has led to many health problems like increase in drug resistance, poor compliance, over and under dosing, drug poisoning and toxicity reactions. The discrepancy thus is that a large number of people are self-medicating, people around them and using old prescription drugs from hospitals and clinics compared to those that actually seek professional health medication and administration of drugs.

THE THEORIES AND CONCEPT OF DECSION MAKING

Theories that explain the decision making practices and principles

While discussing the values of models and theories useful in analyzing ethical dilemmas and decision-making, Icheku (2011:179-182) noted that decision making has many extensively researched theories in the areas of human knowledge. Sven (1994:5) observed that almost everything that a human being does involves decisions, and therefore, to theorize about decisions is almost the same as to theorize about human activities. Literature has shown that choice and behavior represent the core characteristics of the decision-making phenomena and involve the processes of thinking and reacting (Gigerenzer, 1999; Gladwell, 2005; Daw et al., 2007; Daw, 2012). A decision is therefore a response to a situation comprehending judgments, expectations, and evaluation. Theories have been established and used in studies on the decision making process to provide in-depth explanations on how the phenomena works. In order to provide an explanatory and predictive power of a phenomenon, a theory is used, and assessed by how well it judges the usefulness of its assumptions; whether it specifies its scope conditions, and or how clear it limits its logical coherence. The fundamental assumptions of most psychological theories are realistic in the sense that they accord facts with empirical evidence, although some questions arise with respect to how well these psychological theories travel from the laboratory to the real world. The problem with psychological theories is that they generally do not specify their scope conditions, and in addition, they are often logically inconsistent with one another (Lebow and Stein, 1989; Simon, 1985; Jervis, 1986: 327-328; Tetlock and Levi, 1982: 73). In spite of all their short comings, theories and models are extremely important because they make the operation of phenomenon understandable.

Decision theories are theories that have been put forward by various scientists to explain the decision making process without forgetting that, almost everything that a human being does involve decisions. This means that, to theorize about decisions is almost the same as theorizing about human activities. The decision theory however, is not quite as all-embracing because it focuses only on some aspects of human activity, and in particular, on how we use our freedom and not what happens when

we use it wrongly. In the situations treated by decision theorists, there are options to choose between, and the choices are made in a non-random way, with consequences that must be accepted. Our choices in these situations are goal-directed activities and as such, the decision theory is only concerned with goal-directed behavior in the presence of options. Decisions are not made continuously, because in the history of almost any activity, there has been a period in which most of the decision-making is made, and other periods in which +only decisions implementation takes place. Stein and Welch (1997) observed that, decision theories have tried to throw light, in various ways, on the decision making periods, and how to operate according to the canons of these theories. They further pointed out that, before a theory can be applied, the value of certain outcomes and its probabilities must be computed and the consequences of the choices determine. Decision making theories are derived from economics by using the utility function of payoffs, because decisions are made by computing the utility and probability, the ranges of options, and also lay down strategies for good decisions. This study presents and discusses the following theories in relation to the decision making process.

Deterministic versus Probability decision making Theories: The deterministic models indicate that a good decision is judged by the outcome alone. However, in probabilistic models, the decision-maker is not only concerned with the value of the outcome but also with the amount of risk each decision carries. As an example of deterministic versus probabilistic models, consider the past and the future. There is nothing we can do to change the past, but everything can be done to influence and change the future, although the future has an element of uncertainty. Managers, are however, more captivated by shaping the future than the history or the past because they believe that uncertainty is a fact in life and business. Based on this claim, the probability theory/model becomes the best guide for making good and successful decisions in life and business. The probability model occupies an important place in the decision-making process, whether the problem faced is in business, government, social sciences, or just in one's own everyday personal life. This is because there are very few decision making situations in which perfect information (all the needed facts) is available. Most decisions are made in the face of uncertainty, and so probability enters into the decision making process by playing the role of a substitute for certainty (a substitute for complete knowledge). The probabilistic modeling is largely based on the application of statistics for the probability assessment of uncontrollable events (or factors), as well as risk assessment of one's decision. Decision-makers often face a severe lack of information, something which creates an information gap. Probability assessment then quantifies this information gap between what is known, and what needs to be known, in order that one makes an optimal decision. Goodwin and Wright (1998) concluded that the probabilistic models are used for protection against adverse uncertainty, and exploitation of propitious uncertainty. Nonetheless, difficulty in probability assessment arises from information that is scarce, vague, inconsistent, or incomplete. A general criticism of this theory is based on a fixed universe of possibilities; that it considers the "known unknowns", not the "unknown unknowns": it focuses on expected variations, not on unforeseen events, which, as some argue (Clemen et al., 2014) have outsized impact and must be considered because significant events may be outside this model. This line of argument, sometimes referred to as the 'ludic fallacy' provides that there are inevitable imperfections in modeling the real world by particular models, and that unquestioning reliance on models like this theory, blinds one to their limits.

Descriptive (psychological) Theory: The descriptive theory provides a way to understand behavior and processes. It is a theory which proposes distinct assumptions to explain the decision-making process, and as such, it posses distinct characteristics and follows specific methodologies for selecting a course of action. Descriptive theories highlight the importance psychological elements play in influencing individuals to reach decision and that they use cognition to explain decision making as the basic principles people use when dealing with problems.

Normative (rational) Theories: Kahneman and Tversky (2000) explained that, normative is the analysis of individual decisions concerned with the logic of decision-making and rationality and the invariant choice it leads to. The normative theory is about how decisions should be made. Accordingly, it indicates how decisions should be made a rational way. It also contains issues about how an individual can coordinate his decisions over time and of how several individuals can coordinate their decisions in social decision procedures. Schacter et al. (2011) noted that, in economics, it is thought that if humans are rational and free to make their own decisions, then they would behave according to the rational choice theory. And that means that people would make decisions by determining the likelihood of a potential outcome, the value of the outcome, multiplying the two, and then choosing the more positive of the two outcomes (Schacter et al., 2011). In reality, however, there are some factors that affect decision-making abilities and cause people to make irrational decisions, one of them being availability bias (the tendency for some items that are more readily available in memory to be judged as more frequently occurring).

The Normative theory of decision making is based on fundamental axioms which state that, "If the established principles in any organization are accepted and followed, then it is possible for one to make proper decisions. The Normative theory consists of rationalistic components which indicate how decision makers should decide and explain their analysis on the different outcomes from

each alternative scenario, in selecting the final choice. In the normative (rational) decision making theory, decision makers analyze a number of possible alternatives from different scenarios before selecting a choice. These scenarios are weighed by probabilities, and then the decision makers determine the expected scenario for each alternative. The final choice would then be the one presenting the best-expected scenario, with the highest probability of outcome. It explains how decision makers employ a particular set of alternatives to solve problems (Goodwin and Wright, 1998; Hoch et al., 2001).

Prospect Theory: The prospect theory has two main elements 1) a value function that works similarly to the utility function in the expected utility theory, and 2) decision weight function used to analyze the weights that are attached to the probabilities of a choice. The prospect theory was developed by Kahneman and Tversky (1988, 1991, 2000) to explain the results of experiments with decision problems that were stated in terms of monetary outcomes and objective probabilities. Nevertheless, its main features are relevant to decision-making in general. The Prospect theory differs from most other theories of decision-making by being "unabashedly descriptive and making no normative claims (Tversky and Kahneman, 2000: 272). Another original feature is that it distinguishes between two stages in the decision process: (1) The *editing phase;* which serves to organize and reformulate the options so as to simplify subsequent evaluation and choice (Kahneman and Tversky, 2000:196). In the editing phase, gains and losses in the different options are identified, and they are defined relative to some neutral reference point. Usually, this reference point corresponds to the current asset position, but it can be affected by the formulation of the offered prospects, and by the expectations of the decision maker.(2) The *evaluation phase of* the options – as edited in the previous phase – are evaluated here. According to the prospect theory, evaluation takes place as if the decision-maker used two scales; one of these replaces the monetary outcomes given in the problem, whereas the other replaces the objective probabilities given in the problem. Monetary outcomes (gains and losses) are replaced by a *value function v*. This function assigns to each outcome *x* a number *v*(*x*), which reflects the subjective value of that outcome. In other words, the value function is a function from monetary gains and losses to a measure of subjective utility. The major difference between this value function and conventional subjective utility is that it is applied to changes – that is gains and losses – rather than to final states (Kahneman and Tversky, 2000).

Expected Utility Theory: Lengwiler (2008:1) noted that the expected utility theory consists of two components: 1) People use or should use the expected value (the weighted sum of the probabilities of the different possible outcomes) of the utility of different possible outcomes of their choices as a guide for making decisions. He used

Table 1. Expected utility theory.

	Patients get healed	Patients die
True drugs	15	00
Counterfeit drugs	00	18

Source: Sven (2005) Decision Theory: A brief introduction.

'Use' or 'Should Use' because the theory can be interpreted in a positive or a normative fashion. 2) The idea or insight that more of the same creates additional utility only with a decreasing rate. This assumption of decreasing marginal utility plays a very central role in economics in general. This is the dominating approach to decision-making under risk. Accordingly, this is no doubt the major paradigm in decision making since the Second World War both in descriptive and normative applications. The Expected utility theory could, more precisely, be called the probability-weight utility theory. This is because in the expected utility theory, to each alternative is assigned a weighted average of its utility value under different states of nature, and the probabilities of these states are used as weights. Using the Counterfeit drugs versus True drugs as probable causes to body healing or death, as presented in Table 1, the study provides an in-depth explanation to the EU theory.

Suppose that the probability of a person's body to be healed is .1. Then the expected (probability weighted) utility of that person using true drugs is .1×15 + .9×15 = 15, and that of the person using counterfeit drugs is .1×0 + .9×18 = 16,2. According to the maxim of *maximizing expected utility* (MEU), we should not in this case use counterfeit drugs if a person is to get healed. This can also be stated in a more general fashion: Let there be *n* outcomes, to each of which is associated a utility and a probability. The outcomes are numbered; so that the first outcome has utility *u*1 and probability *p*1, the second has utility *u*2 and probability *p*2, etc. Then the expected utility is defined as follows:

$$p1 \times u1 + p2 \times u2 + ... + pn \times un$$

The Expected utility theory is as old as mathematical probability theory (although the phrase "expected utility" is of later origin). They were both developed in the 17th century in studies of parlor-games. To judge what one ought to do to obtain good or avoid evil, one must not only consider the good and the evil in itself, but also the probability that it will or will not happen and view geometrically the proportion which all these things have together. The Expected Utility Theory could be interpreted in two ways; 1) analytically and 2) synthetically According to the analytic view, choices represent revealing preferences, which are defined as implying utilities. Here, the decision makers first observe what to choose, and then infer what they should have expected. On the other hand, in the synthetic examination, decision

makers evaluate both utilities and probabilities, and the integration of the judgments leading to a decision. Here the decision makers discover what they want, how to achieve it, and what actions to implement and the choices to make. Lengwiler (2008:2) observed that the example (believing in God is rational and not believing in God is irrational) used to explain the expected utility theory according to Pascal (1670) generated a lot of debate in philosophy and the major criticism was that of Diderot (1875-1877) in which it was pointed out that, there are so many gods presented by the different religious factions, and these gods who would not treat followers of other gods in the same way, and so choosing to be religious would be confusing.

Economic Theory: This decision making methodology leads to the selection of an alternative after completing a simple three-step process: (a) analyzing the feasibility of the alternative, (b) pondering the desirability of the alternative, and (c) choosing the best alternative by combining both desirability and feasibility. Critics pointed out that, however, this type of decision-making model lacks analytical element because if decision makers rank one alternative above another, they would tend to rank them identically in other occasions in which these possible choices would be available. Ball (2006:1) added that, it is easy to mock the economic theory because any fool can see that the world of neoclassical economics, which dominates the academic field today, is a gross caricature in which every company or organization decides and acts in the same self-interested way – rational, cool, and omniscient. The theory has not foreseen a single stock market crash and has evidently failed to make the world any fairer or more pleasant.

Thermodynamics theory: The plain term 'thermodynamics' refers to a macroscopic description of bodies and processes (Cengel et al., 2005). The Thermodynamics theory generally states that, “the behavior of variables (internal energy, entropy, and pressure) is subject to general constraints that are common to all materials”. These general constraints are expressed in the four laws of thermodynamics, which describe the bulk behavior of the body (Kondepudi, 2008; Truesdell, 1980). Lebon et al. (2008) pointed out that, there are four fundamental kinds of physical entities in thermodynamics: 1) States of a system. 2) Walls of a system. 3) Thermodynamic processes of a system, and 4) thermodynamic operations, which allow the use of two fundamental approaches to thermodynamic reasoning (in terms of states of a system, and in terms of cyclic processes of a system). Decision making is an example of a cyclic process in which cyclic sequences of its operations and processes can be repeated indefinitely and often without changing the final state or outcome (Ortega and Braun, 2013). This is the kind of process that concerned early thermodynamicists such as Carnot (1888) and in terms of which Kelvin (1854) defined absolute temperature, before the use of the quantity of entropy by Rankine (1953) and its clear identification by Clausius (1960). According to scholars (Gigerenzer, 1999; Gladwell, 2005; Niv et al., 2007; Daw, 2012), in everyday life decision makers often have to make fast and frugal choices that are constrained by limited resources such as time, money, food, information-processing, knowledge or computational effort. And unfortunately, as Von – Neumann and Morgenstern (1944); Savage, (1954) and Fishburn (1982) observed, most classic theories of decision making generally ignore the information-processing constraints by assuming that *perfectly rational* decision makers always pick the option with maximum return—irrespective of the effort or the resources it might take to find or compute the optimal action.

However, unlike perfectly rational decision-makers, *bounded rational* decision-makers are subject to limited information-processing resources. Starting with Simon (1956; 1972; and 1984), bounded rationality has extensively been studied in psychology, economics, political science, industrial organization, computer science, behavioral economics and artificial intelligence research (Lipman, (1995); Russell, (1995); Russell and Subramanian, (1995); Aumann (1997); Rubinstein, (1998); Gigerenzer and Selte, (2001); Kahneman, (2003); and Spiegler, (2011) and these numerous experiments have shown that humans are bounded rationally and systematically deviated from perfect rationality (Camerer, 2003). In an effort to address and explain some of these deviations, the thermodynamic theory/ model of bounded rational decision-making was established.

Previous attempts to apply thermodynamics and statistical physics to the problem of bounded rational decision making (McKelvey and Palfrey, 1995, 1998; Wolpert, 2004; Wolpert et al., 2012) focused on the Boltzmann distribution, thereby stipulating an analogy between the concepts of energy and utility: Just like how physical systems tend to pick states with low energy, decision-makers tend to pick states with high utility. Being perfectly rational then corresponds to physical systems with zero temperature, in which all probability mass is concentrated on the lowest energy state. McKelveyand Palfrey (1995; 1998) pointed out that, in particular, quanta response equilibrium (QRE) models of bounded rationality typically assume bounded rational players whose choice probabilities are given by the Boltzmann distribution and whose rationality is determined by a temperature parameter. Boltzmann-like stochastic choice rules have also been extensively studied in the psychological and econometric literature (Luce, 2000; Train 2009), in particular in the form of logic choice models going back to Luce (1959), McFadden (1974), Meginnis (1976) and Fudenberg and Kreps (1993). In the machine learning and reinforcement learning literature (Sutton and Barto, 1998), Boltzmann-like choice rules are

known as *softmax* rules and used for stochastic sampling of actions in the context of the exploration–exploitation dilemma.

Callen (1985) argued that, in statistical physics, it is well known that the Boltzmann distribution satisfies a variational principle in the *free energy F=U − TS*, which instantiates a trade-off between the internal energy *U* and the entropic cost *S.* These two terms have been previously related to utility and information-processing costs in QRE models of bounded rational decision-making (McKelvey and Palfrey, 1995, 1998; Wolpert, 2004; Wolpert et al., 2012). In generalizing the previous models of bounded rationality based on the duality between information and utility (Ortega and Braun, 2010, 2011; Ortega, 2011): instead of considering absolute free energies *F*, differences in free energy ▲*F is considered* between an initial state and a final state corresponding to the situation before and after the deliberation associated with the decision-making process. Kahneman and versky (1979) observed that, considering energy differences rather than absolute energies is not only physically meaningful, but it also accounts for the fact that human decision-makers have been shown to consider *changes* in value rather than absolute value, which is one of the cornerstones of prospect theory.

It is therefore obvious that this seemingly innocuous extension leads to a substantial generalization that allows definition of a certainty-equivalent concept closely related to the physical concept of work. The simple Boltzmann distribution is still contained as a special case in the general class of exponential family distributions that satisfy a generalized variational principle in the *free-energy difference*. Intriguingly, this variational principle can be applied to both action and perception. As special cases, it allows not only the derivation of a number of decision-making frameworks including expected utility theory (Von-Neumann and Morgenstern, 1944; Savage, 1954; Fishburn, 1982), but also the formulation of a variational principle for (approximate) Bayesian inference, which has recently been suggested to underlie self-organizing systems (Friston, 2009; 2010).Von-Neumann and Morgenstern (1944) Savage (1954) and Fishburn (1982) pointed out that, similarly, in the decision theory, preferences between alternative outcomes $x \in X$ are usually represented by a real-valued function *U* over *X* called the utility function. Among other things, this requires that the preferences between any two elements of *X* can be established and that these preferences are stable and transitive. Accordingly, given a choice over the whole set *X*, a perfectly rational decision maker will consistently choose the best outcome $x* = \text{argmax}_x U(x)$, presupposing that such a unique optimum exists. However, if the set *X* is very large and the available resources to search this set are very limited, then it might not always be possible to find the best option for a *bounded rational* decision-maker. Accordingly, the more resources *β* a decision-maker spends, the more he resembles a perfectly rational decision-maker that chooses the maximum without fail, whereas for any finite number of *β*, some uncertainty about the maximum remains. In general, the boundedness parameter *β* can be thought of as a Lagrange multiplier in a constrained optimization problem. In the QRE models according to McKelvey and Palfrey, (1995; 1998), Wolpert, (2004), Wolpert et al. (2012), the Lagrange multiplier is used to constrain the entropy or mean cost, whereas in the decision theory it is applied to express a constraint on the relative entropy or Kullback–Leibler (KL) divergence. By replacing the thermodynamic energy potential ▲*φ(x)* of §2*a* with the economic utility gain *U(x)* =−▲*φ(x)*, the variation principle can be formulated in the *negative free-energy difference*. Callen (1985) stressed that just like its physical pendant the variational principle can be regarded in two ways: (i) as a minimum (relative) entropy principle where the expected utility gain is fixed or (ii) as a maximum utility gain principle where the (relative) entropy is fixed. The first interpretation provides a principle for estimation in the context of observer modeling under model uncertainty, where utility gains (or losses) can induce deviations from the probabilistic belief *p*0. The second interpretation provides a principle for bounded rational decision-making in the case of actor modeling, where the relative entropy constrains the information-processing capacity of the decision-maker. Jost (2012) concluded that, this naturally leads to a trade-off between utility gains and information processing costs, in the decision making process.

According to Ortega and Braun's (2013) conclusion, the proposed thermodynamic interpretation of bounded rationality for decision-makers can be thought of as a thermodynamic system abstractly represented by probability distributions. When information processing takes place, these distributions change. Physically, one can imagine the change in distribution as a consequence of imposing a new energy potential. The expected difference in the potential corresponds to a utility gain in economic choice. However, changing states is also costly. Wolpert (2004) remarked that, in thermodynamic systems, the KL divergence provides a natural measure for the costs that arise due to the changes in the probability distributions. The resulting tradeoff between utility gains and resource costs provide a variational principle for the bounded rational decision maker in the shape of a negative free-energy difference (Ortega and Braun, 2013).

The concept of decision making

Effective decision making practices can be measured basing on "Rationality Choice" theory in which Simon (1994) expressed the idea that human decision making is limited by available information, time, and the information processing ability of the decision maker. Effective

decision making is finding the question that focuses thinking on understanding the problem; after all, it is useless to find the right answer to the wrong question. Schacter et al. (2011) defined decision-making as a problem-solving activity terminated by a solution deemed to be satisfactory. It is, therefore, a reasoning or emotional process which can be rational or irrational and can be based on explicit assumptions or tacit assumptions. Decision making is the actual selection from among alternatives of a course of action. He states that decision making is involved in various functions of management; hence, it is a step in planning. Planning occurs in managing organizations or in personal life whenever choices are made in order to gain a goal in the face of such limitations as time, money, and the desires of other people. Accordingly, decision making is made up of six steps; Intelligence (identifying the problem and collection of information), Design (conceive alternatives and select a criteria), Choice (use the criteria to evaluate alternatives and select) and implementation (put the decision into effect and allocate resources). Arnaldo (2007:4) defines decision making as the process through which managers identify and resolve problems capitalizing on opportunities. Accordingly, it is a process involving seven steps; Identifying opportunities and diagnosing problems, Identifying objectives, Generating alternatives, Evaluating alternatives, Reaching decisions, Choosing implementation strategies, Monitoring and evaluating outcomes.

Decision making is the cognitive process leading to the selection of a course of action among alternatives. They state that every decision making process produces a final choice. It can be an action or an opinion. It begins when we need to do something but we do not know what! Therefore, decision making is a reasoning process which can be rational or irrational, and can be based on explicit assumptions or tacit assumptions According to them, the decision-making process involves, identifying a problem, identifying decision criteria, allocating weights to criteria, developing alternatives, analyzing alternatives, selecting an alternative, implementing the alternative, and evaluation (of decision effectiveness). Decision making is an event commonly associated with making a final choice. Although, they also noted, that choosing an alternative would seem to be a straightforward proposition, but in reality the choice is rarely clear-cut. Decision making is the core of planning. They further explain that, a plan cannot exist unless a decision is made. Triantaphyllou (2000:320) concluded that decision making is the most important action by managers.

Operations of the pharmaceutical sector are based on the theory of “Induced Innovation”. This theory states that, “market size is a key determinant of innovation” (Acemoglu and Linn, 2003: 1049-1090). Decision makers will thus be guided by the market signals in the administration, management and regulation of the sector. Decisions are made from well thought out judgments about the influence from the market size. To develop judgment, information on the problem for which a decision is needed is critical. Once information on the market size for example, reaches the actors in the pharmaceutical sector, then decisions are taken on whether to innovate or invent new drugs. The view that profit opportunities are the primary determinant of innovation and invention is more forcefully articulated by Griliches and Schmookler (1963). In his seminal study, “Invention and Economic Growth”, Schmookler (1966:206) wrote: “...invention is largely an economic activity which, like other economic activities, is pursued for gain”. He concludes from his analysis of innovations in petroleum refining, papermaking, railroading, and farming, that there is no evidence to suggest that past breakthroughs have been the major factor in new innovations, but “Instead, in hundreds of cases the stimulus was a potentially profitable opportunity to be seized...” (1966:199). One goal of decision making is to find opportunities and courses of action that realize one’s objectives (Mahoney, 2013:33-40). If the objective like Schmookler (1966:199) insists is for recognition and or profit making, then relevant information on how to achieve that is a must requirement.

Processes must then be managed well to provide the right information to support and realize that decision. There was generally insufficient research to develop cures for third-world diseases such as malaria. Information available on the third world nations indicated that they were not economically able to buy some of these drugs. Based on such information the pharmaceutical players decide not to waste their resources into innovating drugs that will not bring in returns. This is why those that seize the opportunity of lack, present counterfeits. “LEAN thinking and Six Sigma,” is another Theory applied in the pharmaceutical Industry. It has been utilized by manufacturing industries to decrease cost and improve quality and productivity, by reducing variation and production defects. Because of the dramatic successes in manufacturing, there is rising interest among companies in the pharmaceutical industry, which chose to implement LEAN because it helps them make quick decisions in order to accomplish such goals as; decreased time waste to release product to the market, reduce production waste, improve communication with end users and raise quality level both in the production and in testing laboratories.

CONCEPTUAL FRAMEWORK

Ingram (2009) pointed out that, small business owners and managers make decisions on a daily basis, addressing everything from day-to-day operational issues to long-range strategic planning. The decision-making process of a manager can be broken down into distinct steps. Although each step can be examined at length, managers often run through all of the steps quickly when

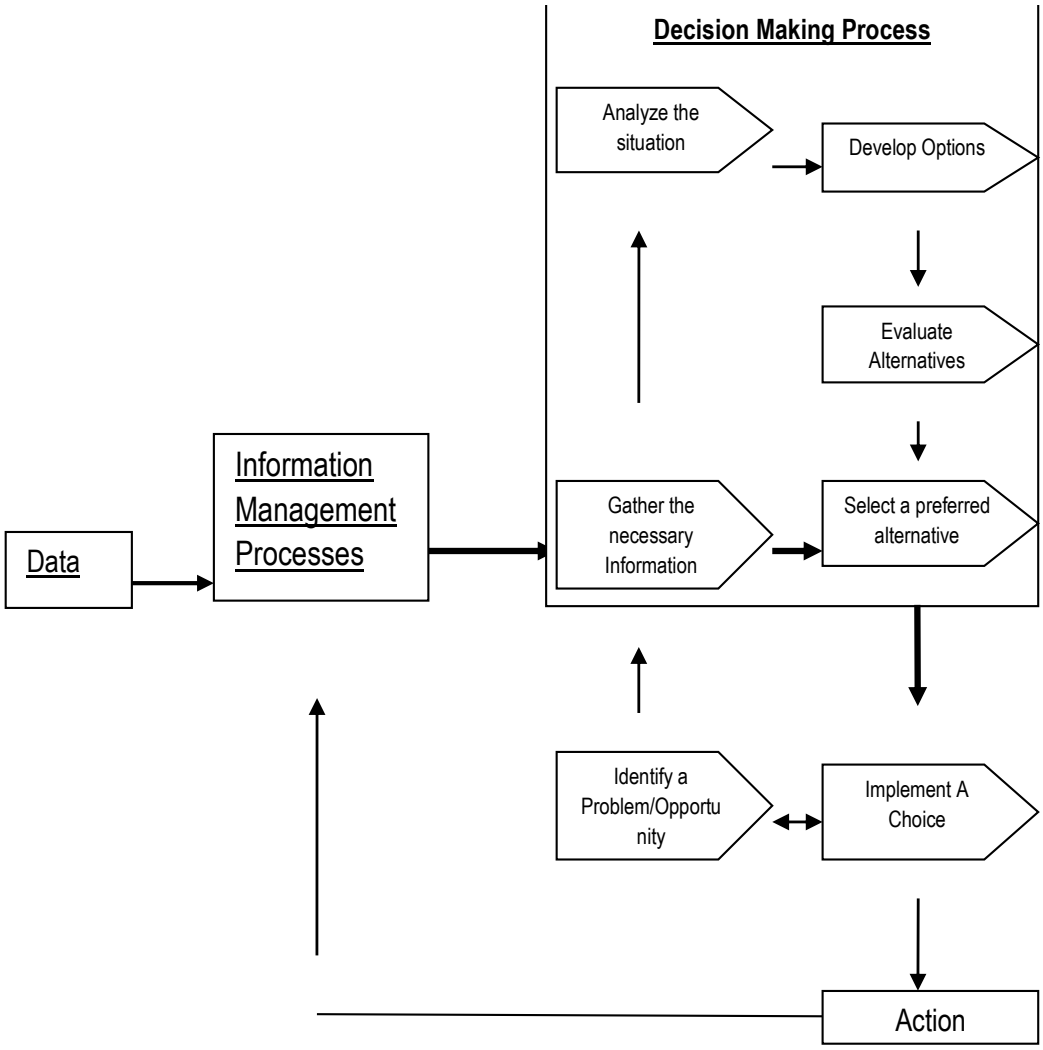

Figure 1. The use of information in decision making practices. Source: Ingram, (2009).

making decisions. Understanding the process of managerial decision-making can improve your decision-making effectiveness. Each step in the decision-making process may include social, cognitive and cultural obstacles to successfully negotiating dilemmas. It has been suggested that becoming more aware of these obstacles allows one to better anticipate and overcome them. Decision making is a process that involves the following steps: Identification of a problem/Opportunity, Gathering information, Analyzing the Situation, Developing Options, Evaluating Alternatives, Selecting a Preferred Alternative, Acting on the Decision. Figure 1 indicates the use of information for decision making.

DECISION MAKING PRACTICES IN THE PHAMACEUTICAL SECTOR

Decision Making is a process that involves; assessing choices, setting/resetting objectives, searching for alternatives, evaluating alternatives, making informed choices and implementation of the choices made. Monahan (2000) explained that, these are steps that are generally followed that result in a decision model that can be used to determine an optimal production plan. To make a decision, one needs various kinds of information and technical data, including details about the problem for which a decision is needed, actors involved, their objectives and policies, influences affecting the outcome, scenarios and constraints. Considering the use of information in decision making, there is an overriding causal model underpinning the analysis that the basis in this regard is the conversion of data into information and information into knowledge to enable informed decisions to be made. The assumption is that if we have better data, we will be able to have better information leading to better knowledge and hence better decisions. Concerning decision making in the pharmaceutical

industry, Thomas (2012) observed that decision making starts in Research & Development before venturing into the other areas. He explained that, rational decision making from the initial drug discovery to the late development and marketing is commonly carried out by a group of 10 – 15 experts when the mean group judgments over a series of decision points are clear go decisions. However, when the mean group judgments from one decision point to another vary in the go to stop processes in specific cases (involving a recycle component) there is a need to expand the R&D expert input substantially, and in such cases the drug development process more or less takes on the form of an open innovation process.

While decision making team numbers are very important in the pharmaceutical industry during the drug development processes, availability of relevant, accurate and timely information and knowledge to be used in solving these decision problems is also very crucial because it sharpens their flat probability. Useful information moves the location of a problem from the pure uncertain "pole" towards the deterministic "pole", because probability assessment is nothing more than the quantification of uncertainty. In other words, the quantification of uncertainty allows for the team of experts confronted with decisions to make, to communicate the uncertainty among themselves which helps in identifying the possible solutions easily. There can be uncertainties regarding the source of raw materials, the steadiness of the drug market, the drug reaction, the side effects of the drug, the expenses involved in the drug development, political involvement, social effects, emotional attachments, states of the world, beliefs, and so on. And so while making effective decisions, establishing probabilities is the right tool for both communicating uncertainty and managing it. There are different types of decision models that help to analyze the different scenarios, depending on the amount and degree of knowledge the experts posses, the three most widely used types are: (1) Decision-making under pure uncertainty: The decision maker has absolutely no knowledge, not even about the likelihood of occurrence for any state of nature. In such situations, the decision-maker's behavior is purely based on his/her attitude toward the unknown (Elser, 1988). Nightingale (2008) argued that most decisions are made unconsciously, we simply decide without thinking much about the decision process. The decision-maker has no knowledge regarding which state of nature is "most likely" to happen and he or she is probabilistically ignorant and therefore cannot be optimistic or pessimistic. In such a case, the decision-maker invokes consideration of security. Notice that any technique used in decision making under pure uncertainties, is appropriate only for the private life decisions. This is because the public official has to have some knowledge of the state of nature in order to predict the probabilities of the outcomes, otherwise the decision-maker is not capable of making a reasonable and defensible decision in this case (Klein, 1994; Thierrauf, 1993; Beroggi, 1999; George, 1991). Regarding the nature and functionality of the pharmaceutical industry, experts cannot make decisions under pure uncertainty because of the fundamental fact that; it serves the interests of the public, without which it cannot exist.

(2) Decision-making under risk: Risk implies a degree of uncertainty and an inability to fully control the outcomes or consequences of such an action. Taking a risk or the elimination of risk is an effort that decision experts, manufacturers, and managers employ in many cases while making decisions. However, in some instances the elimination of one risk may increase some other risks, and so effective handling of a risk requires its assessment and its subsequent impact on the decision process. The decision making process allows the decision-maker to evaluate alternative strategies prior to making any decision. (3)Decision-making by buying information (pushing the problem towards the deterministic "pole"). In many cases, the decision-maker may need an expert's judgment to sharpen his/her uncertainties with respect to the probable likelihood of each state of nature. As pointed out earlier, the pharmaceutical industry is one such area in which scientists and inventors make use of decision making experts on a large scale. The number varies between 10-15 members but often increase as the need arises. Logical decision-making is an important part in all human activities especially the science-based professions, where specialists apply their knowledge in a given area to make informed decisions. For example, the pharmaceutical and medical decision-making often involves a diagnosis of the disease and then selection of appropriate treatment. In some cases however that use naturalistic methods it is true that in situations with higher time pressure, higher stakes, or increased ambiguities, experts use intuitive decision-making rather than structured approaches – following a recognition primed decision that fits their experience – and arrive at a course of action without weighing alternatives. A major part of decision-making involves the analysis of a finite set of alternatives using information. However, sometimes Information overload occurs when there is a substantial gap between the capacity of information and the ways in which people may or can adapt to its use. The overload of information can be related to the problem- processing and tasking processes, which effects decision-making (Kutty et al., 2007). These criteria may be benefit or cost in nature, and so the problem might be found in ranking them (alternatives) in terms of how attractive they are to the decision-maker(s) when all the criteria are considered simultaneously. Solving such problems is the focus of multi-criteria decision analysis (MCDA), also known as multi-criteria decision-making (MCDM) which though very old, has attracted the interest of many researchers and practitioners and is still highly

debated as there are many MCDA/MCDM methods which may yield very different results when they are applied on exactly the same data (Triantaphyllou, 2000).

Historically, decision making has been used as the process of guessing the future consequences of impending choices. In earlier times, societies consulted their elders for alternatives and experimental data about the probability of success in making decisions. At some point in time, this advisory function shifted to soothsayers, astrologers, and religious figures — the management consultants of the day. For -instance, Alexander the Great regularly consulted oracles and fortune tellers on the eve of great battles.

As far as the pharmaceutical sector is concerned, Mits (2013:1), using information from Hadzovic note book (1997: 49), observed that the earliest drugstores date to the middle ages. The first known drugstore was opened by Arabian pharmacists in Baghdad in 754 BC and many more soon began operating throughout the medieval Islamic world and eventually medieval Europe. By the 19th century, many of the drugstores in Europe and North America had developed into larger pharmaceutical companies. Indeed most of today's major pharmaceutical companies were founded in the late 19th and early 20th centuries. Danzon et al. (2005:319) observed that key discoveries like Insulin and Penicillin, of the 1920s and 1930s, were mass-manufactured and distributed. Switzerland, Germany and Italy had particularly strong industries, with the United Kingdom, the United States,

Belgium and the Netherlands following suit. Legislation was enacted to test and approve of drugs and to ensure appropriate labeling. Prescription and non-prescription drugs became legally distinguished from one another as the pharmaceutical industry matured. The industry got underway in earnest from the 1950s, due to the development of systematic scientific approaches, understanding of human biology (including DNA) and sophisticated manufacturing techniques. According to Ozaki et al. (2012:93), the decision making process in the earliest periods was simple because the number of people involved in the pharmaceutical industry at that time was small. However as the industry grew to accommodate the growing population, decision making became complicated (Glockner and Betsch, 2011:3). Information from different fields became a necessity for decision makers. The result was an information boom that called for improved technologies to manage it.

The WHO (2000) report on drugs evolution, noted that numerous new drugs were developed during the 1950s and mass-produced and marketed throughout the 1960s. These included the first oral contraceptives, The Cortisones, blood-pressure drugs and other heart medications. MAO (Monoamine Oxidase) inhibitors, chlorpromazine (Thorazine), haloperidol (Haldol) and the tranquilizers ushered in the age of psychiatric medication. Diazepam (Valium), discovered in 1960, was marketed from 1963 and rapidly became the most prescribed drug in history. Attempts were made to increase regulation and to limit financial links between companies and prescribing physicians, which attempts further increased in the 1960s after the thalidomide tragedy came to light, in which the use of a new anti-emetic drugs in pregnant women caused severe birth defects. According to Lee (2004:211), pharmaceutical companies became obliged to prove efficacy in clinical trials before marketing drugs.

Despite the fact that legislation allowing for strong patents to cover the process of manufacturing specific products had come into force in most countries, India, from 1978, took over as the primary center of pharmaceutical production without patent protection. However, India's industry remained relatively small scaled until the early 1980s when it began to expand at a greater rate (Bate, 2008:14). The pharmaceutical industry entered the 1980s pressured by economics and a host of new regulations, both safety and environmental, but also transformed by the new Deoxyribonucleic Acid (DNA) chemistries and new technologies for analysis and computation (Goldrace, 2012:2). Decision making at this point became more complex. Fast decisions had to be made, which necessitated the availability of relevant information and so information management technologies became a necessity.

Africa's pharmaceutical industry is the fastest growing in the world, although it is relatively small in global terms. Given a population of close to a billion people and the prevalence of a host of illnesses and diseases, the demand for pharmaceutical products far outstrips the supply and this demand will continue to increase as more Africans move to urban centers. There is strong evidence that governments in African countries are aware of this growth potential of the pharmaceutical sector, and are endeavoring to implement national policies to encourage growth. Indeed sub-Saharan Africa represents a paltry 0.6% (worth $3.8bn) of the world pharmaceutical market, according to 2007 estimates by the International Financial Corporation (IFC).

In Uganda, five large and six small-scale pharmaceutical manufacturing companies operate. This number, if function at full capacity, is capable of meeting the demand for supply of many of the essential drugs to the population of Uganda. However, in practice, this is not happening. The industry continues to face challenges that threaten its growths, and even, potentially, its existence (Nazeem, 2009). The Uganda pharmaceutical Manufacturer's association (UPMA) is the registered association in Uganda of all registered drug manufacturing companies. It is mandatory for every drug manufacturing and dealing company to become a member of UPMA. The National Drug Authority (NDA) responsible for licensing the operation of all pharmaceutical manufacturers and dealers in Uganda has a duty to establish the authenticity and expertise of these companies before they are issued with operational licenses. This is one function that requires information on

the company under scrutiny and then effective decisions to be made for or against it. The problem with this task sometimes and probably the greatest challenge of Uganda's pharmaceutical sector regulators, managers and administrators, is the limited information usually provided by the companies seeking operational license which leads to ineffective decisions (NDA, 2010). In connection to this, Jamshid (2011) observed that decision-makers often face a severe lack of information referred to as an information gap and probability assessment quantifies this information gap between what is known, and what needs to be known for an optimal decision to be made, and that probabilistic models are used for protection against such adverse uncertainty, and exploitation of propitious uncertainty. Difficulty in probability assessment arises from information that is scarce, vague, inconsistent, or incomplete. According to Jamshid (2011), information is very important because it is a challenging task to compare several courses of action and then select one action to be implemented with limited knowledge. Nevertheless, difficulties in decision making practices may also arise through complexities in the decision alternatives because the limited information-processing capacity of a decision-maker can be strained when considering the consequences of only one course of action. Yet, choice requires that the implications of various courses of action be visualized and compared. In addition, unknown factors always intrude upon the problem situation and seldom are outcomes known with certainty. Almost always, an outcome depends upon the reactions of other people who may be undecided themselves. It is no wonder that decision-makers sometimes postpone choices for as long as possible. Then, when they finally decide, they neglect to consider all the implications of their decision (van Gigch, 2002; Wickham, 1998). This is when ineligible pharmaceutical manufacturing and drug dealing companies are issued with operational licenses, leading to an accumulation of fake and adulterated drugs and essentials on the market.

Nonetheless, the pharmaceutical industry in Uganda is made up of the local pharmaceutical manufacturers, importers, wholesalers, and retailers, and the Government through its regulatory arm. Civil society organizations also have a role to play in advocate of change in the drugs and medicines industry and to hold the sector management to account. In the pharmaceutical sector judgments and decisions are frequently made on a number of issues that include; drug discovery through preclinical and clinical development (investigational new drugs), market introduction, (new drug application), treatment of target population and feedback from the population (drug compatibility). Surprisingly, in the whole drug manufacturing process, the decisions made are influenced by the operator's individual judgment as a result of their experience in the field, functional role in their companies or organizations, education and entrepreneurial character. According to the study carried out by Thomas et al. (2011), it was established that, pharmaceutical dealers differ substantially in their individual intuitive judgments on benefit and risk in decisions during the drug discovery and development stages/processes, and that this lack of coherence and wide variability may reflect ineffective judgment in the real world. And that such judgments are usually taken as a result of having incomplete information, and individual decision-making rules that vary substantially between subject experts in the field. Thomas (2012) further explains that, in the pharmaceutical industry Research & Development, rational decision making from the initial drug discovery to late development and marketing, is commonly managed by a group of 10 – 15 experts when the mean group judgments over a series of decision points are clear go decisions. However, when mean group judgments from one decision point to another vary from go to stop in a specific case (involves a recycle component), there will be a need to expand the R&D expert input substantially. And in such cases the drug development process more or less takes on the form of an open innovation process.

According to Nazeem (2009), the pharmaceutical industry in Uganda has small challenges but many difficult conditions have a multiplying effect resulting in stagnation and denying opportunities to contribute to the growth of the economy through job creation and investments. However, the following are some of the challenges that are of significant importance to the pharmaceutical industry; 1) High cost of operation. The high cost of capital coupled with lack of incentives means that local companies are not borrowing money to carry out expansion and modernization programs. 2) High cost of energy. The high cost of energy has made it difficult for local companies to realize their full manufacturing potential. They are often forced to take tactical measures such as producing only at times when power is available from the national grid. The power interruptions also create wastage of reagents and other chemicals that are used in the quality control laboratories where the tests have been interrupted. 3) Unfair Competition. Local industry faces unfair competition, particularly on price, from imported finished pharmaceutical products from countries such as India and China. In these countries, governments have instituted subsidy policies that enable manufactures to lower export prices and still retain good margins. But because Uganda is predominantly supplied with generic finished pharmaceutical products, this has encouraged the registration of low-cost generic products at the expense of advancing pharmaceutical manufacturing in the country. The biggest buyer of pharmaceutical products in any country is the government, but because price has become the most single important criterion for buying, local companies are often left out in tenders. UPMA has been advocating for price differential between international bidders and the local industry, a practice that is carried out in many neighboring countries such as

Tanzania and Kenya. A report by Wambi (2013) noted that, the Ugandan government is struggling to live up to its promises to protect the local production of antiretroviral and anti-malarias from competition from abroad. Following a 2008 agreement with Indian generic drug maker Cipla Limited, a Ugandan company, Quality Chemicals Limited (QCIL), began manufacturing antiretroviral (ARVs) and Artemesinin-based combination therapies (ACTs) in 2009. But locally manufactured drugs are proving more expensive than generic ARVs produced in India, China and Pakistan, and even by big pharmaceutical firms in the West. According to the UPMA, in 2010 Uganda's pharmaceutical market was worth an estimated 276 million dollars with 90% of these medicines imported. In Wambi's (2013) report, Paul Asiimwe, a Ugandan lawyer knowledgeable about intellectual property laws and access to medicines, said that, QCIL and other pharmaceutical manufacturers in Uganda have not been given enough protection from foreign generic manufacturers eager to cash in on the multi-million-dollar Ugandan pharmaceutical market. But he concedes that government has limited room to influence this. "The problem is that the government of Uganda does not actually purchase most of these drugs, since they are largely paid for by donors and the Global Fund for AIDS, Tuberculosis and Malaria, which has insisted that all procurement should be competitively tendered out". Denis Kibira, the medicines advisor with the Coalition for

Health Promotion and Social Development (HEPS-Uganda), said that, prices for locally produced ARVs in Uganda will remain high until government and its partners such as the World Health Organization (WHO) address what he referred to as "niggling concerns". "Prices of locally-produced medicines will only come down if costs of production are reduced through availability of affordable financing for the sector, improved road infrastructure as well as local production of active pharmaceutical ingredients". Kibira added that local manufacturers still incur high costs for raw materials whose prices fluctuate widely depending on demand from other countries.

In the same report, Emmanuel Katongole, QCIL's chief executive officer, asked government to intervene to help his firm strengthen local sourcing of raw materials, because it was becoming too costly to import raw materials from India. He added that the cultivation of Artemisia in some parts of Uganda had not helped to lower the cost of producing anti-malarial medicine as raw Artemisia from Uganda was yet to be approved by the WHO. One board member of the Pharmaceutical Society of Uganda explained that in addition to competition from manufacturers in India, China and Pakistan, the local pharmaceutical industry has had to contend with cheap drugs reaching Uganda via voluntary pooled procurement. Since 2010, the Global Fund relies on pooled procurement, which secures medicines in bulk at preferential prices from the world's leading drug companies, as an effective way to solve challenges of both prices and quality control. With the Big Pharma capturing the lion's share of the nearly 20 billion dollars spent by the Global Fund on drugs for the 144 countries, local producers are disadvantaged. Advocates for better access to ARVs and other medicines suggested that Uganda should take better advantage of the exemptions for Least Developed Countries under World Trade Organization regulations – which were extended to 2021 – to acquire technology to produce high-quality, inexpensive medication. Moses Mulumba, the executive director of the Center for Human Rights and Development (CEHURD), which advocates for local generic manufacturing, said that, "We can't rely on the importation of medicines forever. This is why Uganda needs to deal with the challenges that make ARVs more expensive. "The time is now, when we have the policy space under the TRIPS (Trade-Related Aspects of Intellectual Property Rights) agreement because It will be more challenging to deal with these concerns when the policy space is finally closed." Sarah Opendi, the then country's national minister for health, agreed that the local pharmaceutical sector was facing challenges, but insisted that nobody could say that the Ugandan government has not supported Quality Chemicals Limited to reach where it is now, because it is in the interest of government to have more medicine manufactured here". Dr Gordon Sematiko, director of the National Drug Authority, revealed that the NDA was formulating a new national pharmaceutical strategy in co-operation with the Ministry of Health, in which measures would be put in place to reduce dependence on imported medicines, with a hope that, the plan would improve Uganda's pharmaceutical industry manufacturing practices and thus enhance their competitiveness on the domestic market.

4) Meeting Standards. Most local pharmaceutical manufacturers in Uganda cannot access donor funds due to very stringent compliance conditions attached to ensure that the quality of medicines is good. To qualify for the funds, Uganda local pharmaceutical manufacturers must meet the World Health Organization's pre-qualification standards. No one company from the East African region has been able to attain such status. In the whole of Africa, there are only a few companies that have reached these standards. This is why the local industry needs more support from government and other bodies to increase their capacity to meet these requirements if the local pharmaceutical industry is to flourish. 5) Inadequate research and development. As with many of the least developed countries, Uganda lacks funds, skills, and advanced technology to drive forward research and development, and this leads to companies sticking to 'me-too' products. 6) The market. The pharmaceutical market in Uganda is worth about US$200million, although no official data are available. It is estimated that between 80% and 90% of the products are imported from countries such as India and increasingly China. The vast

majority of pharmaceutical wholesalers are also importers and this trend is on the increase. Because of the very significant amount of donor funding to the public sector, the private market segment has declined over the years to approximately 30% of the total market. In the areas of malaria, tuberculosis and HIV/AIDS there is virtually no private market because there are donor funds from the G8 countries, through government procurement agencies that have been used to provide the necessary medicines to the public sector. This is a worthy achievement, but one which should not prevent efforts to produce medicines locally – unfortunately it does. The market is essentially generic, with price being the major determinant factor for purchase and use. The choice of drugs is mostly in the hands of the retail pharmacy, which is normally managed by a trader and not a professional pharmacist, who has to make the difficult balance between professionalism and commercial benefits. The latter is always more attractive, leading to the obvious choice of low-cost, high-margin products, creating competition even at the consumer levels!

7) The Government. Government's policy is to promote the local manufacture of pharmaceutical products, but the poor legislative framework within which the policy can be implemented is not yet in place. In 2006, and after many years of collaboration between the pharmaceutical, Ministry of Health, NDA, and Ministry of Finance, the East African Community imposed a 10% tax on all imports of finished pharmaceutical medicines to the East African Community with exception of anti-malarial, antiretroviral (ARVs), and Tuberculosis (TB) drugs which the countries have continued to receive through donor funding. Furthermore, following intense lobbying from the multi-national companies the law was also repealed after only a few months. The reason advanced by the multi-nationals was that the tax would increase the price of medicines to the end consumer and thus reduce accessibility. However, retail margins in the region are so high that a 10% tax would have no significant effect on the consumer prices. This was demonstrated in Tanzania, where the government had re-introduced the 10% tax in order to support local manufacturing, the prices of the medicines in Tanzania did not increase. Many African countries find themselves in a similar situation, and have resorted to the implementation of the pharmaceutical industry-supportive policies that have motivated local manufacturing. The results have been phenomenal with rapid growth in the industry. For example, the government of Nigeria banned importation of a long list of drugs that are manufactured locally, resulting in a 30% provision of all medicines by the local manufacturers. This has been a huge incentive to the investors and there are now over 80 local pharmaceutical manufacturing companies in that country. Similarly, the government of Ghana introduced a system whereby medicines are grouped in three categories: a) Medicines provided only through local production. b) Medicines that can be imported but attract tax. c) Medicines imported free of tax. In the case of Ghana there is a consistent attempt by the authorities to raise the price entry barrier in order to free the market space for greater participation by local companies. There are clear lessons to be learnt by the authorities in Uganda from the other countries. The issues about quality and price of medicines are critical to the development of the local pharmaceutical industry and whether the people in Uganda will be able to access good quality medicines at the right price. A vibrant pharmaceutical industry in Uganda is the dream of those with a heart for the country, but this requires the support from government and other bodies in the registration of local manufacturing concerns, advocating for change, working with other stakeholders, and the ultimate increase of the availability of essential medicines to the people of Uganda. Based on the above discussion, the pharmaceutical sector in Uganda is a twofold entity: 1) Business oriented and 2) Provision of proper drugs and medicines that ensure the right and proper living of the country's citizens. This clearly indicates that the sector's decision making practices and principles must be effective in order to realize its valuable and profitable objectives. These objectives are very important both in identifying problems that arise in the day-day management, regulation and administration of the sectors activities and in evaluating alternative solutions. Evaluating alternatives requires that a decision-maker's objectives are expressed as criterion that reflects the attributes of the alternatives relevant to the choice, and that the systematic study of decision making provides a framework for choosing courses of action in a complex, uncertain, or conflicting situation. However, the choices of possible actions, and the prediction of expected outcomes, derive from a logical analysis of the decision situation, which is a drawback in the decision analysis approach (DAA). You might also have noticed that this criterion always result in the selection of only one course of action and yet, in many decision problems, the decision-maker might wish to consider a combination of more than one actions (Arsham, 1987; Ben-Haim, 2001; Golub, 1997). Decision making practices are almost always accompanied by conditions of uncertainty, in which case the availability of relevant, time, and accurate information is most crucial, because the more information the decision maker has, the better the decision will be.

Mits (2013) revealed that while the Chinese, were equally fascinated by divination, they kept on searching for ways to integrate prophecy with the process of decision making. They discovered the first decision making tool called, 1 Ching, in 3,000 BC. The 1 Ching decision making tool, integrated Chinese world views about the ancient forces of Chinese gods, cycles of the calendar, the interaction of the elements of water, earth, and fire. 1 Ching, as a decision making tool at that time, offered the following valuable lessons: - proceed slowly, consider the alternatives, identify risks, and build

contingency plans before choosing a course of action. This focus on careful research, data collection, and data analysis before making the decision, is entirely consistent with modern decision making practices. However, much of ancient decision making was haphazard, largely focused on guessing or sensing the outcome of a given choice, rather than generating creative choices and then systematically evaluating them.

Throughout the Middle Ages (5^{th}-15^{th} century), the Roman Catholic establishment discouraged the practice of prophecy as well as research into many scientific areas. The official reason was that since all decisions would ultimately be affected by God's will, human decision making is trivial and/or irrelevant (Mits, 2013). Mits further noted that the second half of the 16th century, England was the home of two of the most brilliant contributors to the study of decision making (Francis Bacon and William Shakespeare (1590). Bacon's contribution was to attempt development of the scientific method, while Shakespeare's efforts included many tragedies on the consequence of decisions, including Othello, King Lear, Romeo and Juliet, and others. The most profound was Hamlet which reflects on the agony and terrible consequences of psychological indecision. Benjamin Franklin (1706) turned his analytic mind to decision making (Mits, 2013); stressing the "balance sheet" approach, which gives a simple, workable way of structuring information for evaluation. Franklin recommended making a two-column list of the pros and cons of each alternative and then calculating a "middle line" value. His evaluation technique may seem naive by present-day standards, but his information documentation process is hard to fault.

Saaty (1991) later developed the Analytical Hierarchy Process to measure the subjective "distance" between criteria. Saaty used a pairwise comparison method in which each factor of the criteria is rated against every other factor to establish ranked values. While this approach had been tried before, the earlier mathematics seemed inappropriate and didn't fit the problem. There was no way of evaluating the subjective consistency with which these alternatives were being compared. As it happened, this consistency factor emerged as one of the key issues for both decision researchers and decision makers alike, (Kahneman and Tversky, 2000:453-458). Users of the Analytical Hierarchy Process found that if they went through the pairwise comparison and found that it "didn't feel right" there was inevitably a correspond-dingly weak consistency value (Hermann, 2001). He continues to explain that Saaty's method impressed a wide range of decision makers, including the US State Department, which used it to test alternative foreign policy scenarios for real and potential events in world affairs.

Mits (2013) further observed that Herbert A. Simon (1994) built the General Problem Solver, an algorithm capable of solving problems, including those of a decision making nature. For many, the decade of the fifties was the golden age of decision making;- social and cognitive psychologists established base line data on how individuals made decisions and solved problems, scientists set to work studying how executives and management teams worked, and began building theories and models based on that data. With the development of more sophisticated statistical analysis techniques, an opportunity arose to overcome the decision maker's prime obstacle: "too much disparate data to handle at one time" (Hsee et al., 2003:257-272). Approaches therefore began to focus on the process of data collection and analysis to in order to support, and possibly replace human decision making. According to Friedman (2004:110-128), brainstorming was one of the most important outcomes of a US-federally funded project regarding the development of group activities intended to stimulate social interactions and thinking. Brainstorming is a technique in which a group facilitator asks participants to offer a stream of alternative solutions for a given problem or issue. The rules of the process are that all participants must make a contribution, which the facilitator records verbatim. The other participants must then encourage and build on these suggestions without resorting to negativity. The objective is that at the end of the brainstorming session, a lot of creative data will have been recorded, (Eisenhardat, 1989:543-576). Hasselbring (2000:32-38) noted that when the technique was published in the influential journal "Developing Human Resources," a number of facilitators were stymied about what to do with the accumulated data, because brainstorming continued to be a tool that generated and collected large pools of potentially useful data.

Based on the work done at the US-federally funded project, Kepner and Tregoe (1999) developed a practical methodology for problem solving and decision making. This was the first complete problem-solving and decision-making process. The definition of the decision making process included; defining the problem, formulating a decision objective, generating criteria and alternatives, rating how well each of the criteria are met for each alternative, comparing the scores for each of the alternatives, and finally choosing the most appropriate alternative with the best score. However, for a number of reasons, the Kepner-Tregoe process has not become the universal business methodology for decision making. The finely-constructed case studies that respond so well to the Kepner-Tregoe process in the classroom are not necessarily an accurate reflection of real world problems or the dynamics of people who make decisions. The Kepner-Tregoe process was infinitely more complete and sophisticated than any previous attempt, but still did not address the issue that decision making must allow for the so-called "soft" factors. Daft and Marcic (2003:171-215) stressed that the subjective or affective domain plays an active role in establishing criteria for even the most mechanical of decisions. They say, that whatever system

is used must therefore allow all types of criteria to figure in the evaluation process. The "*Which & Why* Decision Valuation Software" suggests the most effective decision making tool in existence. The *Which & Why* Decision Valuation Software, takes into consideration the entire pool of collected research from Bacon to Franklin, Kepner-Tregoe to Saaty, and adds the genius of modern computing power to offer what might well be the simplest, quickest, and most precise methodology ever, for decision making.

METHODOLOGY

The empirical study that will follow this theoretical paper shall employ a descriptive cross-sectional survey design, in which both qualitative and quantitative techniques will be used to complement each other. Designed questionnaires, interview guides, and other data collecting instruments will be used to collect data from the decision makers in the regulation, management, and administration of the pharmaceutical sector in Uganda. Data collection will be carried out by the use of interview guides, questionnaires, digital recorder and a review of records. Great in-depth understanding of individual perception, behaviors, attitudes, values and actual practices, will be obtained by the interviews carried out on the key decision makers. The questionnaires will be administered on the middle and junior managers. A review of records will be carried out on textbooks, quoted material, encyclopedias, copies of letters, minutes of meetings, international and government statistical survey reports, organizational documents, and online computer databases. The validity of the instruments will be ensured by 1) carrying out a respondent's check, 2) Peer evaluation, 3) Prolonged interaction with the respondents in the field, and 4) Establishing a content validity index for the scales to be used. While reliability of the study will be ensured by 1) Broadening of the sample items, 2) Ensuring research consistency for all respondents, 3) Double coding, and 4) Use of Cronbach's alpha coefficiency to establish the internal consistency and stability of the instrument. The study has a finite population of 4974 pharmaceutical sites, so according to Kothari (2002), the following formula shall be used to obtain a representative sample for the study.

$$n = \frac{z2 \cdot p \cdot q \cdot N}{e^2 (N - 1) + z^2 \cdot p \cdot q}$$

where
p = sample proportion (0.5, chosen to provide the maximum sample yield and at least the desired precision)
z = value of the standard variant at 95% (The researcher wants to be 95% confident thathe gets a representative sample). From the table, the area under normal curve for the given confidence level of 95% , is 1.96.
n= sample size
e = acceptable error / desired precision (±0.1) (Based on results from pilot study)
q = 1- p.
N= 4974 (Pharmaceutical population of the study).

Accordingly, a population of 94.2 ≈ 94 respondents will be obtained as the right sample for the study. Crouch &Mackenzie, (2006) observed that qualitative studies deal with fairly large samples because qualitative research is concerned with meaning and not making generalized statements. Although some scholars agree that sample sizes for qualitative researchers are fairly small, they have different views on the size with Morse (1994) quoting sample size at 30 – 85; Bernard (2000), 30 – 70; Creswell (1998), 20 – 30; Roberts et al. (2006), 50 – 100; Charmaz (2006), 25 and Bertaux (1981) suggested that 15 is the smallest acceptable sample size.

The study will use multi-sectional sampling techniques, whereby the sample population is stratified into two strata, based on the level of decision making of the respondents. Purposive sampling will be applied to select the 30 top-level key decision makers for the first stratum. In order to ensure effective representativeness of the sample within the remaining stratum, we shall stratify it into five different strata representing the five regions of Uganda (northern, southern, eastern, western and central). Thereafter, the proportionate allocation method will be employed to determine the number of respondents for each of the five strata. Systematic random sampling is to be used in the selection of the individual respondents from each stratum. Data will be analyzed both qualitatively and quantitatively. The analysis of qualitative data is to be carried out during and after data collection, based on the research questions. Themes and codes will be identified, and quantitative data shall be analyzed using computer packages while doing descriptive, relational and inferential statistics.

ANTICIPATED FINDINGS

Results of the study are to be corrected under two main categories namely; (1) regulation, (2) management and administration of the pharmaceutical sector.

The demographic data shall be obtained from the sample and will be subjected to descriptive analysis in order to determine the percentage age distributions, frequencies, means, standard deviations, variance, minimum and maximum values for gender orientation, marital status, professional profiles, experiences and the major activities of high-level and senior key decision makers, in liaison with how their information management systems for effective decision making in the pharmaceutical sector is modified. For example, elderly and more experienced persons tend to rely more on their experience, so much, so that they would overlook the necessity for new information in making decisions; an activity that is likely to result into ineffective decisions. The young one on the other hand, is so eager to follow the book that they would want to go through all the necessary steps before making decisions. A task that is likely to reduce on the speed with which decisions to save the public are made. A variety of specific measures on the information management process will be used in the research. In this study, information will be obtained from a series of items seeking the respondent's response on the dimensions of information management in their organizations. The dimensions of the research include; Management support & controls, Resourcing, Data Processing, Organization & storage, Distribution & use. The responses are to be recorded on a five – point Likert Scale ranging from 1 = Strongly Agree to 5 = Strongly Disagree. Evaluations, perceptions, or appraisals of how individuals react to situations or events in general have been associated with the process of decision making. This variable is to be measured by asking respondents how they make decisions. Statements in the questionnaire will include:

1. When I make decisions, I tend to rely on my intuition

2. I rarely make important decisions without consulting other people.
3. I double check my information sources to be sure I have the right facts before making decisions.
4. I put off making decisions because thinking about them makes me uneasy.
5. I make decisions in a logical and systematic way.
6. When making decisions I do what feels natural at the moment.
7. My decision making requires careful thought.
8. When making a decision, I trust my inner feelings and reactions.
9. I avoid making important decisions until the pressure is on.
10. I generally make important decisions at the last minute.
11. I make quick decisions.

Responses will then be recorded on a five – point Likert Scale ranging from 1 = Strongly Agree to 5 = Strongly Disagree. Sample results for information management and decision making will then be analyzed descriptively by the chi-square (x^2) statistics, in which the categories are collapsed into, agree and disagree. For inferential statistics, the whole scale is used, and items summed, to obtain an index in establishing the relationship between these variables. Spearman's rank correlation (r_s) will be used to test the hypothesis and establish the extent to which information management and effective decision making relate. Causal analysis is conducted to determine variance in effective decision making which is explained by the moderating variables (Politics, corruption, individual competence and personality).

CONCLUSIONS AND IMPLICATIONS FOR POLICY AND PRACTICE

Most people often make choices out of habit or tradition, without going through the decision-making steps systematically. Decisions are made under social pressure or time constraints that interfere with a careful consideration of the options and consequences. Decisions are sometimes influenced by one's emotional state, experience and expertise at the time a decision is made. When people lack adequate information or skills, they may make less than optimal decisions. However, even in situations with the availability of accurate, timely, reliable, and relevant information, decision making experts may fail to make effective decisions due to a failure in understanding the probabilities of consequences. Sometimes when these experts know the statistics, they are more likely to rely on personal experience than information about probabilities. Therefore the fundamental concerns of effective decision making are towards combining information about probability with information about desires and interests.

To make an effective decision one needs various kinds of information and technical data, including details about the problem for which a decision is needed, actors involved and their objectives and policies, influences affecting the outcome, scenarios and constraints. Different sorts of decisions require different types of information to solve them. In order to gather evidence to support a decision, one needs an idea of what types of information are suitable. In most cases we need information for very specific purposes which might take the following forms; news, ideas and opinions, research results, theoretical analysis, everyday practicalities (train timetables, telephone numbers, and maps), facts and figures, history or background, people's experience, advice or help, technical information, legal information, political information, economical standards and many more.

In looking at the use of information in decision making there is an overriding causal model underpinning the analysis, that data is processed into knowledge used in the making of decisions. The first step in the decision making process as indicated by the conceptual model is the identification of the decision problem. To this effect, Uganda is currently experiencing a low life expectancy and high infant mortality rate believed to result from the problems experienced by the pharmaceutical industry. It has been indicated that the problems include; availability of fake & expired drugs, counterfeit and adulterated drugs, insufficient supply of basic life-saving drugs on the market, engagement of unqualified personnel in the industry, operation of unlicensed pharmacies and drug shops, neglect of stock monitoring, expensive drugs, lack of knowledge about the basic expiry prevention tools, overstocking, self diagnosis and medication among others. The Uganda pharmaceutical industry is also tasked with the responsibility of health technology assessment (HTA). According to Hafizah et al. (2011), HTA broadly includes assessments of cost, effectiveness, safety, efficacy, and cost-effectiveness, as well as covering the industry's, social, ethical and legal implications. It can be applied to equipment, drugs and procedures, as well as organizational and support systems and can include existing as well as new or emerging technologies. The main purpose of HTA is to offer policy makers and funders, health professionals and health consumers essential information to recognize the advantages and comparative value of health technologies and to make informed decisions either on policy, funding or clinical issues. Relevant, accurate, and detailed information concerning the mentioned problems is necessary if the authorities in the regulation, management and administration of the pharmaceutical industry are to make effective decisions in improving its services to the Ugandan population. Such relevant and accurate information on the performance of the pharmaceutical sector in Uganda can be obtained from the main players in the regulation, management and administration:

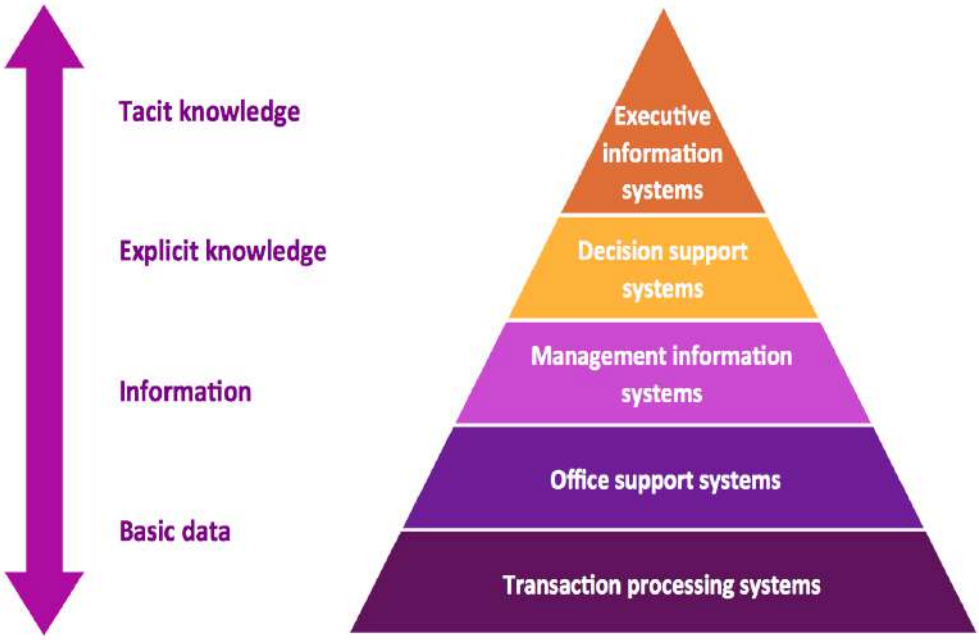

Figure 2. Different information requirements for different levels of management. Source: www.Conceptdraw.com 2015.

National Drug Authority, National Medical Stores, Drug importers & exporters, Drug shops, Manufacturers of Medicines and Drugs, Hospitals, Clinics and the general public. The assumption is that, 'if there is provision of better data, valuable information will be obtained and used to make effective decisions by managers at the different levels of management. Due to the fact that, the management of this industry is handled by people at different levels of operation, the information needed is also provided in different formats using different information management systems. Figure 2 shows the different kinds of information used at the different levels of management in an organization.

The pharmaceutical industry in Uganda, while tasked with the regulation, management and administration, operates like all organizations, with managers working at different levels of functionality: 1) Top level management consist of the Boards of directors (BOD) and the Executive Officers (EO) that mainly determine the objectives, policies, and plans of the industry. They mobilize available resources, think, plan, organize, prepare, and make decisions. They have maximum authority and are directly responsible to shareholders, government and the general public, and so they require more conceptual skills. The success or failure of the organization or industry in this case, largely depends on their efficiency and decision making using the tactical and explicit knowledge they are provided with. 2) The middle level managers consist of Departmental heads (HOD), Branch Managers, and the Junior Executives. They give recommendations (advise) to the top managers, execute (implement) the policies and plans, co-ordinate the activities of all departments, link top management to lower management, and prepare short – term plans. They require and use more managerial and technical skills, and so they are provided with information and explicit knowledge. 3) Lower managers or Operational managers consist of foremen and supervisors. They direct the workers/employees, develop morale in the workers, maintain a link between workers and the middle level management, communicate management decisions to all workers/employees, they make daily, weekly and monthly plans. They have experience, communication, technical and basic management skills, and so, they are provided with basic data for their operations. Many areas of human knowledge have extensively researched the importance of information in decision making, and decision making practices. Literature shows that choice and behavior represent the core characteristics of the decision making phenomena and involves the processes of thinking and reacting based on the acquired information. A decision is therefore an informed response to a situation and comprehends judgment, expectations, and evaluation.

Assuming that in the study the calculated value for x^2 is less than the specified table value, the null hypothesis (information management does not lead to effective decision making) is accepted. But if the calculated x^2 is greater than the specified table value, then the null hypothesis is rejected and the alternative (information management leads to effective decision making) is accepted; indicating that decision makers need to manage their information if decisions in the regulation,

management and administration of the pharmaceutical sector are to be effective. In order to determine the extent to which information management and effective decision making are related, the study applies Spearman's rank correlation (r_s), in which a test of significance of the correlation coefficient is carried out to test the hypothesis. If the correlation coefficient is largely positive (+), the study concludes that information management strongly influences effective decision making. If the correlation coefficient is largely negative (-), the study concludes that information management does not influence effective decision making. Multiple regression analysis results are used to establish whether there is an influence of politics, corruption, individual competence, and personality on effective decision making. In this case if the absolute t-values of the regression coefficients associated with each of the individual moderating variables are greater than the absolute critical t-values, then each of these variables is said to significantly influence effective decision making in accordance with its value.

This study will be significant to both Government and private organizations, who will find it helpful in determining the kind of information that the public needs in accessing the available services. Public institutions would be interested in results of such a study in determining which, how and where relevant information is to be sourced and disseminated, for effective decisions. The study will assist organizations in becoming aware of the decision options available, in order to improve on the delivery of pharmaceutical services in the health sector. The private sector will particularly benefit from the results of the study, because of the improved decisions within the regulation and administration of services, while the public will benefit in terms of improved, better, and quicker services. The researcher will benefit by getting a better understanding on the subject of information management and effective decision making processes, while the academic fraternity will have additional knowledge base added on to the existing one, regarding the subject matter.

Policy makers in the management, regulation and administration of the Ugandan pharmaceutical services sector, need appropriate information for effective decision making. However, according to the World Health Organisation (WHO, 2004), the unfortunate feature of pharmaceutical projects in many parts of Uganda, is that decisions are taken despite the absence of reliable information. In practice, decision making is all too often based on political opportunism, expediency and donor demand, which leads to inefficient and ineffective actions. Individual judgement is also greatly affected by the experience, and management positions of those running the industry. The proposed models and theories put in place by the various scholars in a bid to effectively shape and guide the decision-making process, are sometimes not practical in real world settings.A thorough analysis of the existing studies on information management and effective decision making, does not indicate the existence of similar or comparative studies specifically related to the concept of information management and effective decision making in the regulation, management and administration of the pharmaceutical sector in Uganda. It is on this basis that this study is intended to fill in the gaps not addressed by previous scholars.

Conflict of Interests

The authors have not declared any conflict of interests

REFERENCES

Acemoglu D, Joshua L (2004). Market Size in Innovation: Theory & Evidence from the pharmaceutical industry. *Journal of Economics*, 119(13), 1049-1090.

Africa Development Bank**,** Annual Performance Report (2000).

Arnaldo O (2007). "A Discussion of Rational and Psychological Decision-making Theories and Models": The search for a Cultural-Ethical decision making model. Electronic J. Bus. Ethics and Organ. Stud. 12(2).

Ball P (2006). Neoclassical Theory under Fire from the Sciences: Baroque fantasies of a most peculiar science. Summers: The Global Middle Cries out for Reassurance - The Economist's View. Retrieved 4th April-2015 from, www.economistsview.typed.com.

Bate R (2008). *Local Pharmaceutical Production in Developing Countries: How economic protectionism undermines access to quality medicines*. Available online at:http://www.libinst.ch/publikationen/LI-LocalPharmaceuticalProduction.pdf

Bernard HR (2000). Social research methods. Thousand Oaks, CA: Sage.

Bertaux D (1981). From the life-history approach to the transformation of sociological practice. In Daniel Bertaux (Ed.), Biography and society: The life history approach in the social sciences (pp. 29-45).

Buwule BM (2013, October 29th). Innovator (Europe/Original) Drugs Vs Generic(Asia & Africa) Drugs. National Drug Authority News Letter. Retrieved January 20th, 2014 from http://www.facebook.com/pages/Uganda/National-Drug Authority/101025106711442?fref=ts.

Cengel P, Yunus A, Michael BA (2005). *Thermodynamics – an Engineering Approach*. McGraw-Hill.ISBN 0-07-310768-9.

Charmaz K (2006). Constructing grounded theory: A practical guide through qualitative analysis. Thousand Oaks, CA: Sage.

Chaudhur S **(**2005), The WTO and India's Pharmaceutical industry: Patent Protection, TRIPS and Developing Countries 1,29 (estimating 68%); P.K. Ramachandran and B.V. Ranga Rao, The Pharmaceutical industry in India, 7 Economics and Politics. WKLY, M-27, M-30, (1972) (estimating 75%).

Cheraghali AM (2010), The Iranian Pharmaceutical Industry: Low output and Old Medicines. J. Pharm. Res, 45(7): 11-15.Retrieved February 2nd 2014 from http://www.ijpr.submu.ac.ir.

Choo CW (2006). "Information management for Intelligent Organizations: The art of Scanning the Environment. Journal of American Society for Information Science July2006.

Clement R, Reilly T (2014). *Making Hard Decisions with Decision Tools: An Introduction to Decision Analysis* (3rd ed.). Stamford CT: Cengage. ISBN 0-538-79757-6.*(covers normative decision theory).*

Cooper J., Dayna N (2013). Uganda – Pharmacies and Pharmacists. Pulse Volunteer Partnership, PULSE2014.

Creswell JW (1998). Qualitative Research Inquiry and Research Design: Choosing Among Five Traditions. Thousand Oaks, CA: Sage.

Crouch M, McKenzie H (2006). The logic of small samples in interview based qualitative research. Social Science Information, 45(4):483-499.

Diderot D (1875-1877), Pensèes Philosophiques, Vol. I (LIX).

Doya K, Michael NS (2012). "Decision Making": Current Opinion in Neurobiology. J. Public Admin. 22(6): 911-913.

Eisenhardat KM (1989). Making Fast Strategic Decisions in High-Velocity Environment. Acad. Manage. J. 32(2):543-576.
Elwyn GT, Miron S (2010). Deliberation before determination: the definition and evaluation of good decision making. *Health Expectations,* 13(2), 139-147. Retrieved February 10th 2014 from the Wiley online Library at http://ncbl.nlm.gov/pubmed/19740089.
Glockner A, Betsch T (2011). "Judgments and Decision making."ebscohost.com, 6(2)3.
Goff J (2003). "Drowning in Data: A flood of corporate data, intensified by Sarbanes-Oxley Compliance, threatens to overwhelm business managers", CFO Magazine, November 2010 issue.
Goldrace B (2012). *Bad Pharma*cy! Fourth Estate, p. 345: "In the UK, whistleblowers are sacked and silenced": Petersen, Melody. "Doctor Explains Why He Blew the Whistle", *The New York Times*, March 12, 2003, p. 2.
Goodwin P, Wright G (1998) Decision *Analysis for Management Judgment*, Wiley, 1998.
Goodwin P, Wright G (2004). *Decision Analysis for Management Judgment* (3rd ed.). Chichester: Wiley. ISBN 0-470-86108-8. (covers both normative and descriptive theory).
Gorret L (1997). Betrayal of Trust: The Collapse of Global Public Health. *A.* Heston and R. Lipsey, eds. Chicago: U.Chicago Press, 2000.
Graham G, Jeffrey P (2011). "Decision Making Capacity and Addiction", in Addiction and Responsibility, London England: MIT Press, pp. 139-158.
Greene JA, Scott HP (2009). "Keeping Modern in Medicine: Pharmaceutical Promotion and Physician Education in Postwar America," Bull. History Med. 83:331–77.
Hafizah BS, Stewart D, England I, Parmar N (2011). The Impact of Health Technology Assessment on Decision-Making Processes in Public versus Not-for-Profit Private Hospitals. American Medical Journal Vol. 2, No.2, pp.72-78.ISSN 1949-0070.© 2011 Science Publication.
Hsee CK, Zhang J, Yu F, Xi Y (2003). Lay rationalism and Inconsistency between predicted experience and decision, J. Behavioral Decision Making, 16(4), 257-272.
Icheku V (2011). *Understanding Ethics and Ethical Decision-Making*. Xlibris Corporation. ISBN 978-1-4653-5131-9.
Jamshid SS (2011). Concepts of Decision Making Under Uncertain, Risky & Deterministic Situations. J. Math. Comput. Sci. 2(3): 529-545.
Kahneman D, Tversky A (2000). "The framing of decisions and Psychology of Choice". Science 211:453-458.
Kondepudi D (2008). *Introduction to Modern Thermodynamics*, Wiley, Chichester, ISBN 978-0-470-01598-8.Includes local equilibrium thermodynamics.
Kutty AD, Himanshu KS (2007). "Too much info!"Monash BusinessReview 3.3: 8+.Academic File.Web. 3 Mar. 2013.
Lebon G, Jou D, Casas-Văzquez, J. (2008). Cementing the foundations of thermodynamics: comparison of system-based and surroundings-based definitions of work and heat, J. Chem. Thermodynamics 37: 954–966.
Lee TH. (2004). ""Me-Too" Products — Friend or Foe?"New England J. Med. 350(3) 211–2.doi:10.1056/NEJMp038215. PMID 14724297
Lengwiler Y (2008). The Origins of Expected Utulity Theory: Contribution to the Collective Volume in Honor of the 100thAniversary of VinzezBronzin's "Theorie der Prämiengeschäfte". University of Basel, Dept. of Eceonomics (WWZ), Petersgraben 51, CH-4003 Basel, Switzerland.Published by Springer Verlag.
McLaughlin KE .(2012). "Counterfeit drugs in Africa."The guardian Publication,Publication URL,www.guardian.co.uk/word/2012/dec 23.Retrieved on January 20th 2013.
MoH (1993). Ministry of Health. AIDS Control Programme Surveillance Report, Dec. 1993.
MoH, (2010). Ministry of Health. National Health Policy
MoH (Ministry of Health) (2009a). Annual Health Sector Performance Report 2008/2009. Kampala,
MoH (Ministry of Health) (2009b). *National Pharmaceutical Sector Strategic Plan* (unpublished).Kampala.
MoH (Ministry of Health) (2002). *Uganda National Drug Policy*. Kampala. MoH.
MoH (Ministry of Health) (2011). Preliminary results for Sero-Behavioral Survey, 2011.
Mits TC (2013). A brief History of Decision-Making; Information taken from the abstract of Hadzovic, S (1997). "Pharmacy and the great contribution of Arab-Islamic science to its development". *Medicinskiarhiv* (in Croatian) 51 (1–2): 47–50. ISSN 0350-199X. OCLC 32564530.PMID 9324574.
Monahan G (2000). *Management Decision Making*. Cambridge: Cambridge University Press.pp. 33–40.ISBN 0-521-78118-3.
Morse JM (1994). Designing funded qualitative research. In Norman K. Denzin & Yvonna S.
Muhumuza WN (2013). Research Report on Self-Medication in Uganda: Uganda Allied Health Examination Board. Retrieved on 4th April-2015, from www.scrib.com.
Nahamya D (2012). Counterfeit Medicines from Asia threatens lives in African. The Guardian Publication, Publication URL; www.guardian.co.uk/word/2012/December 23.
Nazeem M (2009). The Role of Local Manufacturers in Improving Access to Essential Medicines: The Case of Uganda. Africa Health CPD Challenge. Retrieved 3rd-February- 2015, from www.medicinestransparency.org.
Nightingale J (2008). Think Smart – Act Smart: Avoiding The Business Mistakes That Even Intelligent People Make..John Wiley & Sons. p. 1. ISBN 9780470224366.
NPA, (2010). National Planning Authority. National Development Plan 2010/11 – 2014/15.
Omaswa FG (2002, September). Uganda Pharmaceutical Sector Baseline Survey. (WHO; HAI 2002 Edition). Retrieved January 24th, 2014 from Ministry of Health Web site: http://health.go.ug/September/pdf.
Ozaki T, Lo MC, Kinoshita E, Tzeng GH (2012). Dissolution of dilemma by newlydefining criteria matrix in anp. *Journal of Intelligence, 56(2)093.pdf. Retrieved February 2nd, 2014, from http://www.orsj.or.jp/.../e.*
Pascal B (1670). Pensèes. Republished several times, for instance 1972 in French by Le Livre de Poche, and in 1995 in English by Penguin Classics.
Schacter DL, Gilbert DT, Wegner DM (2011): Psychology Worth. New York: Oxford University Press.Pp.369.
Serutoke J **(**2002, September). Uganda Pharmaceutical Sector Baseline Survey. (WHO;HAI 2002 Edition). Retrieved January 24th, 2014 from Ministry of Health Website: http://health.go.ug/September/pdf.
Sven OH (1994). Decision Theory: A Brief Introduction. Department of Philosophy and the History of Technology, Royal Institute of Technology (KTH), Stockholm.
Simon HA (1994), 'Decision Making and Problem Solving', in Research briefings 1986: Report of the Research Briefing Panel on Decision Making and Problem Solving by the National Academy of Sciences, National Academy Press, Washington, DC. Available from http:dieoff.org/page163.htm [accessed 25.01.2014].
Thomas H (2012). Change in the Pharmaceutical Industry: Aspects on Innovation, Entrepreneurship, Openness, and Decision Making. Social Science Research Network: Tomorrow's research Today.
Thomas H, Ivor C, Wolf R, Olausson M, Magnus K (2011). Decision-Making in the Pharmaceutical Industry: Analysis of Entrepreneurial Risk and Attitude, using Uncertain Information – Social Science Research Network: Tomorrow's Research Today.
Triantaphyllou E (2000). *Multi-Criteria Decision Making: A Comparative Study*. Dordrecht, Netherlands: Kluwer Academic Publishers (now Springer).p. 320.ISBN 0-7923-6607-7.
Truesdell CA (1980). Sections 8G, 8H, 9A, pp. 207–224.
UBOS (Uganda Bureau of Statistics) (2009). *Uganda Statistical Abstract 2009*. Available online at: www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/2009Statistical_%20Abstract.pdf>
UBOS (2010). Uganda Bureau of Statistics: Statistical Abstracts for 2010.
UBOS (2011) Uganda Bureau of Statistics: Statistical Abstracts for 2011.
Uganda Investment Authority. (2009). *Uganda Pharmaceutical and Health Products Brief*. Kampala, UIA.
UN (2011-2013). Inter-agency Group for Child Mortality Estimation: UNICEF, WHO & World Bank. Retrieved, March, 01, 2014 from www.childmortality.org.

UN (2011).Human Development Report. Retrieved, March, 4th, 2014
UNIDO (2009) Inserting Local Industries into Global Value Chains and Production Networks: What Opportunities and Challenges for Upgrading? UNIDO, Vienna. Unknown Author. The Pharmaceutical Industry. Available online at:www.ugandainvest.com/pharmaceuticals.pdf
Wambi M (2013). Uganda HIV Drugs Out Priced by Imports. Inter Press Service News Agency: December 20th, 2013.Retrieved 07th April-2015, from www.ipsnews.net.
White D, Fanello C I, Hendrik SIC, Gomes E, Seni A, Chharghalal KD, Bonja GK, Olaosebikan R (2010). "ArtesunateVs Quinine in the treatment of severe Faliciparum Malaria in African Children (AQUAMAT): An open-label, randomized trial. Lancet, 376(9753), 1647-1657.
WHO (2004). Information Support for New Public Health Action: Report of WHO expert Committee, World Health Organization.
WHO (2009). The World Health report 2009 –Health systems: Improving drug performance. Geneva: WHO; 2009.
WHO (2010). The World Health Organization Report 2010-The Uganda Pharmaceutical Sector Scan. Part 1 of Component 1 of MeTA Baseline Assessment, June 2010. Geneva.
WHO (2012). "Central Intelligence Agency-The World Factbook Life Expectancy." Retrieved January 22, 2014 from cia.gov.
World Bank (2012). World Bank national accounts data, and OECD National Accounts data files: World Development Indicators. Retrieved February 17th, 2014 from http://www.data.worldbank.org/.../NY.GDP.PCAP.C...
World Research Inc. (1999). Business Intelligence and Data Warehousing (Bi/DW) Program Competitive Analysis. California, USA.