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highlights

- Castor Bean Biodiesel Supply
- Bradyrhizobium Spp. In Cowpea
- Credibility Of Environmental Information
- Micro And Small Companies In Brazil

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From the Chief Author's Desk

We see a drastic momentum everywhere in all fields now a day. Which in turns, say a lot to everyone to excel with all possible way. The need of the hour is to pick the right key at the right time with all extras. Citing the computer versions, any automobile models, infrastructures, etc. It is not the result of any preplanning but the implementations of planning.

With these, we are constantly seeking to establish more formal links with researchers, scientists, engineers, specialists, technical experts, etc., associations, or other entities, particularly those who are active in the field of research, articles, research paper, etc. by inviting them to become affiliated with the Global Journals.

This Global Journal is like a banyan tree whose branches are many and each branch acts like a strong root itself.

Intentions are very clear to do best in all possible way with all care.

Dr. R. K. Dixit
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Assessing The Relationship Between Service Quality And Customer Satisfaction; Evidence From Nigerian Banking Industry

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GJMBR Classification (FOR)
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***Abstract*- It is the performance of service that creates true customers: customers who buy more and who influence others to buy .However, Nigerian Banks have been found to be characterized by poor service quality. This study was therefore carried to examine the relationship between service quality and customer satisfaction. Two hypotheses were formulated in this study and appropriate statistical techniques employed to test the hypotheses were multiple regression and correlation. The study reveals that service quality has significant effect on customer satisfaction. The result also show that there is a relationship between gender and customer service. Conclusion was drawn and it was recommended based on the findings of the study that the banks should focus more on their customers rather than on the products and services, which they sell because customers are the true business of every company.**

Keywords:-Customer Se rvice, Customer Satisfaction, Service Quality, prompt service and Banking.

I. Introduction

The days of a customer adopting one product or company for life are long gone. With easy access and global competitiveness, customers are often swayed by advertising and a chance at a "better deal." Quality levels and features between competing brands and organizations are often comparable. The thing that separates competitors is their level of service. It is not unusual for customers to switch back and forth between products or organizations simply because of pricing, a bad first impression from the organization or lack of quality service. This is sometimes referred to as service churn. (Lucas, 2005)

Satisfaction is the customer's evaluation of a product or service in terms of whether that product or service has met their needs and expectations. (Zeithaml and Bitner, 2003)

Happy and satisfied customers behave in a positive manner. They will buy a lot from you and will give you a large share of their business. Customer satisfaction is derived largely from the quality and reliability of your products and services. (Curry and Curry, 2000)

However, almost every Nigerian bank encounters similar problems in meeting customer's expectation of services and customer satisfaction. For example, the issue of money transfer in banks is one major problem that customers of certain banks have been made to experience. In most cases the customer hardly receives the payment of the money transferred into his account immediately.

The long queues and huge crowds in the banking halls can be highly devastating and discouraging most times, especially when the weekend is near. Most times, this long queues are as a result of the breakdown of the computers used by these cashiers, sometimes it occurs as a result of the cashiers, pushing duty to one another, as to who is to attend to the customers or not.

According to Lucas, (2005), customer service is the ability of knowledgeable, capable, and enthusiastic employees to deliver products and services to their internal and external customers in a manner that satisfies identified and unidentified needs and ultimately results in positive word-of- mouth publicity and return business.

II. Objective Of The Study

It is as a result of all these problems identified above that this study is being embarked upon to examine the effect of service quality on customer satisfaction

The researcher also seeks to analyze the relationship between gender and customer satisfaction.

III. The Significance Of The Study

In Nigeria, not much attention is given to the notion of providing consumers with quality service and satisfaction hence, some banks render weak services and thereby taking customers for granted. However, with the advent of self – service technologies in business and globalization communications, as well as development in information technology including internet, Nigerian consumers will come to know their rights and take necessary actions against companies that infringe upon their rights. This type of study is therefore very necessary to enlighten Nigerian bankers so that they can know how to render effective services that will satisfy their customers

Although many scholars have ascertained the fact that customer service has positive effect on satisfaction but very few have been to explore and highlight the variables that constitute customer service in the Nigerian banking industry

IV. Scope Of Study

This study focuses on the effect of customer service on customer satisfaction. The respondents in respect of this study are the customers and individuals that patronize some three selected banks at Ota, Ogun state.

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V. Limitation Of The Study

This study was geographically limited to Covenant University Community and its environs at Ota, Ogun state. The purposive sampling technique was used because the study was limited to patrons of some three selected Banks located within the geographical area.

VI. Literature Review

With the fast pace of modern-day living, utilization of services has increased tremendously. Marketing practitioners and researchers, likewise, increased their activity momentum in this area of business. However, despite this fast pace and resultant enrichment of service literature, the issue of perceived service quality remains elusive (Parasuraman, Zeithaml, and Berry 1985; Smith 1999).

A review of literature reveals that major efforts have been anchored in the perspectives of Gronroos (1982) and Parasuraman, Zeithaml and Berry (1988). Gronroos Nordic perspective (1982, 1984) viewed service quality in global terms of functional and technical quality. In contrast, the American perspective of Parasuraman, Zeithaml and Berry (1988) zeros in reliability, responsiveness, empathy, assurances, and tangibles, all related to or dependent upon the service encounter process. Carman (1999) found that since service quality evaluations are highly complex processes, they could be expected to be at several levels of abstraction. Service quality construct confirms to the structure of a third-order factor model that ties service quality perceptions to distinct and actionable dimensions (Brady and Cronin. Jnr, 2001).

Parasuraman et al, (1988) who came up with the SERVQUAL model also known as the Gaps model, defines quality as the difference between customer's expectation and their perception of the service delivered. The SERVQUAL instrument provides a method of measuring service quality. It is the most frequently used measure of service quality (Mattson, 1994) and is based on five service quality dimensions (tangibles, reliability, responsiveness, assurance and empathy). Service quality is the result of human interaction between the service provider and the customer. (Liu, 2005).

The relationship between service quality and customer satisfaction has received considerable academic attention in the past few years. . Many researchers have operationalized customer satisfaction by using a single term scale and many others have used multiple item scales. Service quality and customer satisfaction has been investigated, and results have shown that the two constructs are indeed independent, but are closely related, implying that an increase in one is likely to lead to an increase in the other (Sureshchandar, Chandrasekharan and Anantharaman, 2002).

According to Zeithaml and Bitner (2003), satisfaction and service quality are fundamentally different in terms of their underlying causes and outcomes. Although they have certain things in common, satisfaction is generally viewed as a broader concept, whereas service quality assessment focuses specifically on dimensions of service. Service quality is a component of customer satisfaction.

Service quality is a focused evaluation that reflects the customer's perception of elements of service such as interaction quality, physical environment quality, and outcome quality. These elements are in turn evaluated based on specific quality dimensions: reliability, responsiveness, assurance, empathy and tangibles. Satisfaction, on the other hand, is more inclusive: it is influenced by perceptions of service quality, product quality, and price so well so situational factors and personal factors.

According to Parasuraman, Zeithaml and Berry (1988), five principal dimensions that customers use to judge service quality include- reliability, responsiveness, assurance, empathy, and tangibles as shown below;.

Reliability: the ability to perform the promised services both dependably and accurately. Reliable service performed is a customer expectation and means that the service is accomplished on time, in the same manner, and without errors every time.

Responsiveness: the willingness to help customers and to provide prompt service. Keeping customers waiting particularly for no apparent reason creates unnecessary negative perceptions of quality. If a service failure occurs, the ability to recover quickly and with professionalism can create very positive perceptions of quality.

Assurance: the knowledge and courtesy of employees so well so their ability to convey trust and confidence. The assurance dimension includes the following features: competence to perform the service, politeness and respect for the customer, effective communication with the customer, and the general attitude that the server has the customer's best interests at heart.

Empathy: the provision of caring, individualized attention to customers. Empathy includes the following features: approachability, sensitivity and effort to understand the customer's needs.

Tangibles: the appearance of physical facilities, equipment, personnel, and communication materials. The condition of the physical surroundings is tangible evidence of the care and attentions to detail that are exhibited by the service provider. This assessment dimension also can extend to the conduct of other customers in the service

VII. Research Hypotheses

In other to achieve the objectives of this study the alternative form of the two hypotheses tested are as follows;.

$H_{1:}$ There is a relationship between service quality and customer satisfaction.

$H_{2:}$ There is relationship between customer gender and customer satisfaction.

VIII. Participants And Sampling Technique

This study adopted a survey research design in which the purposive sampling technique was used to select 98 participants. Their ages ranged from 18-65 yrs. A total of 110 copies of questionnaire were randomly distributed to the patrons (customers) of these three selected banks. Out of

this number, 98 copies of the questionnaire were successfully retrieved, of which they were all good enough for analyses. This accounted for 89% of the total distributed questionnaires. Table 1 presents the distribution and response rates and as well as the eventual number rate used for the analyses. 41 (41.8%) of the respondents were males, while 57 (58.2%) were females. A further breakdown of the respondents showed that 85 (86.7%) indicated that they were single, while 12 (12.2%) were married and 1 (1.0%) is divorced

Table 1: Response Rate of Questionnaires Administered

Questionnaires	Number	Percentage
Returned	98	89%
Not Returned	12	11%
Total	110	100%

Source: Researcher's Survey Findings (2009)

IX. Measures

The major source of data used in carrying out this research work is the primary and secondary source. The primary data was a more reliable source in this study which includes the use of questionnaire; the secondary data includes journals, library textbooks and non-governmental publications that were used in this study. It was a 14-item questionnaire with a five- point-rating format. Upon administration of the questionnaires to the respondents, we recorded a reliability co-efficient alpha value 0.88. Confirmatory factor analysis (CFA) reveals that there are four major factors that constitute service quality in Nigerian Banking Industry. The data collected on the two hypotheses and research question were analysed using multiple regression and correlation statistical techniques.

X. Results

The multiple regression and correlation statistical techniques were used to test the significance or otherwise of the two hypotheses postulated. This was carried out using the statistical package for social sciences.

In table 2, the first hypothesis was tested using the multiple regression in respect of the impact of service quality on customer satisfaction. The results as shown below indicated that service quality contributed significantly to customer satisfaction at significant level of 0.0001

Table 2: Multiple Regression Table

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	65.058	4	16.265	42.691	.000[a]
	Residual	35.431	93	.381		
	Total	100.490	97			

a. Predictors: (Constant), the employees are polite and friendly., the bank offers prompt services to their customers., the bank renders effective customer service., employees are willing to listen to the complaints.

b. Dependent Variable: i am generally satisfied with their banking.

In table 3 below, the second hypothesis was tested using the correlation method for the relationship between customer gender and customer satisfaction. The significant level of 0.045 indicated that there is a relationship between customer gender and customer satisfaction .

Correlations

		i am generally satisfied with their banking.	sex of respondent
i am generally satisfied with their banking.	Pearson Correlation	1.000	-.203*
	Sig. (2-tailed)	.	.045
	N	98	98
sex of respondent	Pearson Correlation	-.203*	1.000
	Sig. (2-tailed)	.045	.
	N	98	98

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3: Correlation Table

XI. Discussion Of Findings

The banks need to adapt more to technological advancement in order to render more effective customer service, as this would matter a great deal in its future operations.

The automated teller machine services rendered by the banks have not stopped customers from demanding cash at the counter.

The bank equipments and facilities installed to eliminate long queues needs to be more efficient and effective enough to ensure that customers are not inconvenienced when waiting in line This is very important because the study has revealed that a technology that is not properly integrated does not improve customer service.

Management of each bank needs to adopt knowledgeable and capable employees that can ensure that customers are hardly delayed in the banks.

The researcher has discovered that the degree of customer satisfaction can be determined by some identified variables. The researcher, as indicated below, developed a regression model:

$Y= (B_0+ B_1X_1 +B_2X_2 +B_3X_3 +B_4X_4+----------U)$

Where Y= the degree of customer satisfaction

B_0= constant

X_1= prompt service

X_2=employees' willingness to listen to complaints

X_3= effective customer service

X_4= employees' politeness and friendliness

U= slack variable

A regression of the collected data shows the following coefficients

$Y= (0.07761 + 0.449X_1- 0.01821X_2 + 0.188X_3 + 0.321X_4 +----------U)$

The coefficients show that customers place highest value on prompt service, followed by employees' politeness and friendliness. It is therefore necessary to put policies and structures in place in other to promote promptness of service to the employees

XII. Recommendation

The banks that will thrive in the future will be those that are able to focus more on their customers, rather than on the products and services, which they sell. Banks should have the interest of their customers at heart, because customers are the true business of every company.

Banks in Nigeria should not only adapt to technological advancement, but must ensure that the new employed technology makes for a prompt and a stress-free banking.

There is need for each bank to apply the queuing technology to their banking system as this would help them to manage customers waiting in line, and productivity.

Banks should embark on effective training and development skills that can help employees deliver prompt services to the customers.

Banks should always try to engage in overtime banking that is, working extra hours, as this would profit working class individuals who do not have the opportunity to go to the bank during their work hours. Moreover, this would profit the bank maximally, as they would increase the number of individuals that bank with them.

Finally, bank operators should ensure that they avoid puffing promises that will unnecessarily raise the expectations of the customers as against the actual quality of service they are able to provide.

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A Petri nets approach for simulation and control of castor bean biodiesel supply chain

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GJMBR Classification (FOR)
C15 C3 C44 M31 150302 150505 150309

Abstract- **Nowadays many countries present critical problems related to energy demand-supply equilibrium. Petroleum-based reserves are unable to face future demand for more than few decades. So, the search for alternative sources of energy has been strongly directed to biofuels. Several fruit oils can be used as a source for biodiesel production and the castor bean is an example. The castor bean agribusiness is based in a complex commodity chain, making necessary researches for the improvement of the performance of this chain. This paper put forward a new approach, based on the principles of Supervisory Control Theory and Petri nets, aiming the co-ordination of logistics flows in agribusiness chains and focusing the castor bean biodiesel supply chain. A new method for the supervisory control based on colored Petri nets was developed, called Constraints of Control on Decomposed Colors (CCDC). Also, it is proposed a framework for supervisory control in logistics systems which support agriculture chains. Most of the relevant activities in the castor bean biodiesel supply chain were surveyed to support the proposed modeling process. A mathematical model was developed using Petri nets and the control constraints of the model could be determined through computational simulation. Two scenarios could be conceived and the controlled system presented an acceptable performance. As conclusion, it seems clear that the proposed approach is a feasible and useful tool for the modeling, control and analysis of agribusiness chains.**

Keywords- Decision Support Systems, Supply chain management, Operations Management.

I. Introduction

In a near future, it is expected that human society will confront an imminent possibility of an energy supply collapse, as a result of the exhaustion of fossil energy sources, nowadays a prominent element in the energy worldwide sources. The strategy of prioritizing fossil fuel can deplete, in few decades, the deposits of these inputs.

Another inconvenient of prioritizing fossil fuel relates to the environmental issue, once that fossil fuels are responsible for a considerable amount of the emission of pollutants which are harmful to the environment, incurring in damages such as the greenhouse effect and, consequently, the global warming. Therefore, the relevance of the search for other energy sources is noticeable as they will make possible to mitigate such problems..In this sense, other energy sources are biomass, which refers to the plant which accomplish the process of photosynthesis, and animal fats. Both absorb solar energy, being capable of storing it, especially under the oil form, making possible the purpose of moving machines with them.

Many oils originated from biomass today constitute inputs of a new fuel called biodiesel. According to Parente (2003), the biodiesel is a clean, biodegradable and renewable fuel which can replace the mineral diesel with several technical, environmental and economic advantages.

Several vegetable oils can be employed for the production of biodiesel, among which can be reported soya, peanuts, cotton, palm, babassu and the castor bean. The latter is a much disseminated culture in Brazil, especially in the north-eastern semi-arid region.

The seeds of castor bean have high energetic value and, when they are crushed, culminate in the formation of oil and mass residuals. The castor bean oil has several industrial applications, such as the production of biodiesel, while the mass residuals can be employed in the production of animal ration with a high rate of lipids and proteins, as well as compost. Conjointly with the obtaining of oil and mass residuals, it can be obtained from the castor bean cellulose (originated from its stalk and root structure) and silk (originated from the feeding of silkworms with its leaves).

The castor bean agribusiness is constituted of a complex supply chain, involving several inputs, products and sub products (ARRUDA and MENDES, 2006). In this way, efforts directed to improve the performance of this chain become necessary in order to maximize its benefit/cost ratio.

The objective of this paper is to report the conception and application of a simulation and supervisory control model, based on colored Petri nets, which allows the coordination of activities in the context of Castor Bean Biodiesel Supply Chain (CBBSC), aiming to guarantee its effectiveness.

The paper is divided in five sections included this one: in the second section, the CBBSC is reported; in the third section, concepts about supervisory control, Petri nets and a new method of synthesis of supervisors denominated Constraints of Control on Decomposed Colors (CCDC) are presented; in the fourth section, a proposal about architecture of supervisory control for logistical systems and the modeling of CBBSC are described – a proposal about control of such system and the evaluation of its performance; finally, in the

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fifth section, conclusions about the study and suggestions for further research are presented.

II. Castor Bean Biodiesel Chain: Some Relevant Aspects

The castor bean (Ricinus Communis L.) is an oleaginous of relevant economic and social importance, whit several applications in industry and agribusiness, found in many different regions of Brazil.

Its seeds, after being industrialized, originate mass residuals and the oil which, among other several utilities, are employed in the production of plastic, metals, prosthesis, soaps, perfumes, leather, inks and varnishes, and is also an excellent lubricant oil for motors of high rotation as well as a fuel for using in diesel motors. Its oil presents density higher than other vegetable oils. Its density (at 15°C) varies from 0,945 to 0,965 and it starts boiling at 265°C. Due to these properties, allied with its high degree of viscosity, it is a remarkable lubricant for plane motors and has several industrial applications.

Its mass residuals constitute good organic compost and, when it is denitrified, can be exploited as animal ration. Its stem can be utilized in the paper industry and its leaves, when they are added to the ration, increase cow's milk secretion. Also leaves are useful to feed silkworms culture. It is noticeable that every residual in the exploration of the castor bean plantations can be exploited.

According to Parente (2003), what one has been denominating "biodiesel" is a renewable, biodegradable and environmentally correct fuel, a substitute to the mineral diesel oil, constituted of a mixture of methyl ethers or ethylic long chain acids, obtained from the reaction of transestherification of any triglyceride with an alcohol of short chain (methanol or ethanol).

In Brazil, the process of biodiesel production is already consolidated under the technical and the technological perspective. And there are many resources, not only human ones but also machinery ones to this purpose. On the other hand, the productive system as a whole, from the production of the raw materials to the commercialization of the fuel itself is still too scattered.

The Castor Bean Agro industrial System (CBAS) can be defined as the set of inter-related chains which are inherent to the products and sub products of the castor bean, whose focus extends to the production and acquisition of the inputs to the delivery of the finishes goods to the final clients. The Castor Bean Biodiesel Supply Chain, denoted in this work by CBBSC, may be faced as the main product of the CBAS, being divided in the macro-segments (FREITAS and NOBRE JÚNIOR, 2004):

(i) Production of raw materials: relates to the inputs stocklists, whatever they are seeds, composts, machines and equipment, as well as the agricultural producers;

(ii) Industrialization: includes companies which accomplish industrial activities along the chain, such as crushing and refining;

(iii) Distribution: involves the actors having partnership with the final clients of the productive chain, as, for example, exporters, gas stations and logistical operators.

Arruda et al (2005) propose a governing model for the Castor Bean Biodiesel Supply Chain, aiming to integrate the actors which participate in the chain, in such a way to guarantee its competitiveness in the global market. Such model consists of a structure composed of three actors (ARRUDA and MENDES, 2005):

Local Co-operative Societies (LC): consists of a board, elected by the whole set of producers in a given area, who have the function of organizing the commercial and accountant policies and practices of the group, managing the crushing plants and controlling all the production of the area which is covered by the co-operative;

(ii) Central Co-operative (CC): consists of a board formed by the elected directors of the local co-operative societies, and also by the organization in charge of the managing of the productive chain. It has as a goal to supervise the management of the chain as a whole and to control its performance dictating rules to the chain managing organization (chain logistical operator);

(iii) Manager of the Productive Chain (MPC): consists of an public interest civil society organization, composed of a technical body highly qualified. It must manage the chain activities in a way that it would be free of political impositions, aiming to its effectiveness and always prioritizing actions guided by equity and justice in distributing its benefits among its supporters.

Arruda and Mendes (2006) present a diagnosis on CBBSC in the State of Ceará, Northeastern Brazil. The authors identify causes of the decline of the castor bean production and assert that the chain, which is still budding, only can succeed in its objectives if an effective planning would be made, in order to very coordinate the actions of the actors who are involved in the chain processes.

III. Supervisory Control Of Discrete Events Systems

According to Athey (1982), from the decade of the sixties on, researchers developed ideas which turned out to found an area of knowledge known as System Analysis. The Systems Analysis is adopted for characterization and searching solutions of complex problems, involving iterative processes, as well as interactions with the system environment and the kind of inner control of these processes. Concerning the System Analysis there are different modeling paradigms, among which can be reported the Discrete Event Systems. According to Cassandras and Lafortune (1999, p. 36), "A Discrete Event System (DES) is a system of discrete states and directed to events, that is, the evolutions of its states in its totality depends on the occurrence of the discrete events asynchronous along the time."

Applications of DES are various as, for example, manufacturing, robotics, traffic control, telecommunication, transportation, logistics and computer science. These applications require control and coordination of activities aiming to discipline flux of events.

Any system has, in general, a wide variety of events with a probability of occurrence. Therefore, a model of a system of this nature would represent its uncontrolled behavior, that is,

so many desirable events as many undesirable events can occur.

Starting from the premise that this kind of behavior is not satisfactory, it can be modified by control. The modification of the system behavior can be accomplished by the restriction of its functioning to a subset of events possible of occurring in the uncontrolled system.

The Supervisory Control Theory (SCT) was idealized by Ramadge and Wonham at the end of the eighties and it was based on the utilization of mathematic formalisms to limit the occurrence of events in models of DES (RAMADGE and WONHAM, 1989).

The problem of the supervisory control consists of synthesizing a supervisor that coordinates the subsystem activities in a way that the general system satisfies a set of specifications (IORDACHE and ANTSAKLIS, 2006).

According to Sigrimis et al. (2001), the agricultural sector has becoming an industry of great importance and must count on massively on advanced systems of management and control, integrated by computers. Efforts in this direction culminated in the formation of the technological area named as "Agroinformatics" (KOUMBOULIS et al., 2006).

Wolfert et al. (1997) propose a computerized system to control processes in the food production sector. The premise for the application of such architectural control is the development of a model which represents the involved processes to be monitored. The model interacts with two different domains: the domain of business control, which refers to the panning and the control of the company as a whole, including managerial functions such as investments management, allocation of resources, marketing, sales, among others, and the domain of control of processes, which refers to production, involving not only the activities of agricultural production but also the logistical functions of stocking and transportation. Based on Information Technology (IT), data about the managerial physical processes are processed, resulting in interfaces for the supervisory control, the quality control and the processes optimization.

Folinas et al. (2003) present a computerized system, based on the internet, for the integration of data and processes in supply chains in the agribusiness sector. Such a system unifies the agricultural producers, processing industry, retailers, wholesalers, producers' cooperatives and distributors in a system via web, sharing information in real time and coordinating logistical activities along the supply chain, aiming to minimize the service time of requests and costs involved.

According to Koumboulis et al. (2006), the noticeable advancements in the area of agroinformatics concerns the development of Decision Support Systems (DSS), which aims to monitor all the functions of an agribusiness process, supporting the decision making by proposing scenarios and performance evaluation of the system. Such authors propose an architecture for a DSS in the agribusiness sector, based on SCADA (Supervisory Control and Data Acquisition) systems. Information about the agricultural activities supplies three agents: an operator agent, which consists of a system that has artificial intelligence, a monitoring agent of the weather and a logistic agent.

The intuitive graphic representations, as well as its powerful algebraic formulation, show the Petri nets as one of the best methods to the supervisory control of DES (MOODY and ANTSAKLIS, 1998; IORDACHE and ANTSAKLIS, 2006).

According to Murata (1989), Petri nets are a kind of bipartite, directed and weighted graph, which can collect the dynamic of a DES. Petri nets provide a compact representation of a system once they do not represent explicitly all the space of states of the modeled system.

A place can be utilized as an indication of a state of the system (set of the current values of the parameters which define a certain system, in a given instant) to the DES modeled. The tokens indicate that the conditions associated to the places are true. Transitions can represent operations or action accomplished by the system, having the following attributes: identification and time. The attribute "time" exist for the Petri nets with restrictions of time, which indicates the time associated to the firing of transitions (BERTHOMIEU and DIAZ, 1991). An arc which goes from a place to a transition indicates, together with the tokens, the conditions for an action being accomplished.

According to Moody et al. (1994), the invariant places, which are one of the structural properties of the Petri nets which depend only on the topology of the net and are independent of its marking, correspond to the set of places in which the sum of tokens remains constant for all the reachable markings through the net. Control places, that is, places that will submit a net to a pre-determined behavior, can be implemented by the imposition of invariant places to the model.

It is notorious the knowledge about the utility of the Petri nets as a method of support to the decision making in the management of industrial activities. However, considering the limitations of the ordinary Petri nets and the complexity of the systems to be managed, the utilization of the high level Petri nets, and, especially, the utilization of colored Petri nets, facilitates the conception of more compact and robust models, making the analysis of such systems easier. (JENSEN, 1992; DESROCHERS and AL-JAAR, 1995).

The supervisory control is a practical application of the colored Petri nets that can bring remarkable benefits to the management of industrial and logistical activities. The colored Petri nets, due to the complexity of the functions of their arcs and to the exponential growth of the states in the reachability graph, restrict the synthesis of supervisors and make them more difficult.

The idea of analyzing the incidence matrix of the colored Petri nets is not interesting due to the abovementioned reasons. But here we have a question: if the model was treated in a way that the complexity of the incidence matrix is reduced, can such difficulty be overcome?

In the case of functions being expressed in terms of only one variable, it is possible to separate the colors of the net in a way that each function of the arcs can be expressed as an integer number, conforming to the ordinary Petri nets. In this way, the incidence matrix related to each color can be analyzed separately. This is the essence of the method

proposed, denominated Constrains of Control on Decomposed Colors (CCDC). The algorithm of the method CCDC is exposed in Figure 1.

Algorithm CCDC
Start
Step 1
Given a certain DES, one must develop a model in colored Petri nets in a way that the arcs are function of only one variable.
Step 2:
Define the control specifications in a way that its specification does not contain more than one color.
Step 3: Synthesize supervisors utilizing the method of the invariant places, analyzing each color isolated.
Step 4: For each control place inherent to the specification for a color, add the number of tokens correspondent to the initial marking of the other colors.
End

FIGURE 1. ALGORITHM OF THE METHOD OF CONSTRAINTS OF CONTROL ON DECOMPOSED COLORS (CCDC

IV. SUPERVISORY CONTROL OF DISCRETE EVENTS SYSTEMS

Literature treats of the supervisory control as a method for the coordination of activities in flexible manufacturing systems, energy transmission, transportation and telecommunication.

In this way, a contribution of the present work consists of the definition of a framework for the supervisory control of logistical systems. Based on the work of Zhou (1991), involving control architecture for manufacturing intelligent systems, an adaptation for the case of logistical systems is proposed, as is illustrated in Figure 2. The hierarchy of the conceptual model is composed of three levels, defined as follows:

(i) Decision Maker: the decision maker is the stakeholder that, based on his own knowledge, experience and information, specifies the desired behavior for the logistic system;

(ii) Supervisory controller: the supervisory controller consists of a model of the focused logistic system, based on Petri nets, which produces the evaluation of the system performance under the impositions (specifications) proposed by the decision maker;

(iii) Local controller: a computational system that controls local processes, in operational level, not having a general view of the logistic system as a whole.

The stakeholders, denominated actuators, must actuate on the logistic system, aiming for the implementation of the control specifications, and the sensors must collect the answers produced by the system.

There are two paradigms related to the DES supervisory control: one of them is based on the utilization of information systems that are connected to the processes in real time and the other one in which this condition does not occur.

In the case of the utilization of information systems accompanying the logistic system in real time, the decision maker can be a computer which, based on the collected data and on a knowledge system (such as artificial neural networks or another technique of artificial intelligence for the accumulation of knowledge), determines the actions to be taken by the logistic system. The model is connected in real time to the logistic system and accompanies its activities. Local controllers are computerized systems which execute the specifications delegated by the decision maker. It is pertinent to emphasize that the human participation in the process of decision making is limited under this paradigm and it can even not exist.

On the second paradigm, there is no real time consideration in activities of the logistical system, and the human participation in the system analysis determines which the actions to be executed are. The model makes possible a global view of the system by the analyst, as well as his forecast of how the system is going to behave in given scenarios. The local controllers can be workers that will allow the possibility to make operational (via computers system) the concept and the functional specifications established by the decision maker.

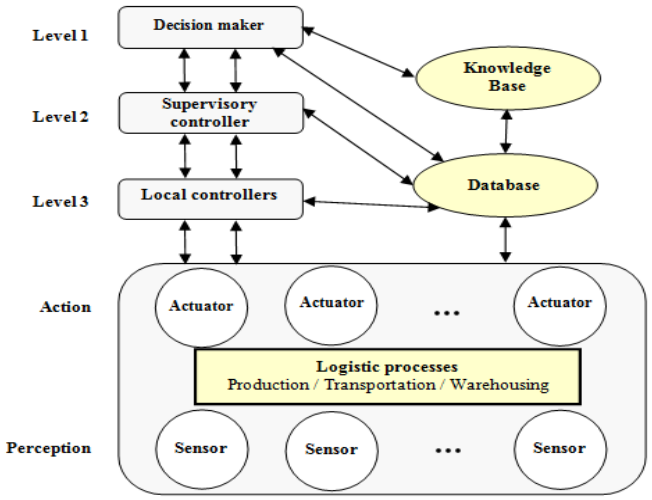

Figure 2 – Proposal of a framework of supervisory control for logistics systems. Source: Adapted from Zhou (1991).

A mapping of the most significant activities of the castor bean biodiesel supply chain was accomplished as a first stage of the modeling process. Such survey was accomplished through bibliographic searches and technical visits to the Secretary of Agriculture Development (SAD/Ceará) and to the Bioenergy Technologies Research Company – TECBIO. Based on that survey, eight main stages of the CBBSC were proposed and described as follows (see, in Figure 3, a scheme of the products and activities along the CBBSC).

The raw material utilized for the production of castor bean are seeds, fertilizers, herbicides and water. The production process is composed of manual activities (fertilizing, liming, plantation and replacement, paring) and mechanized activities (plough). The time of production stage in the tillage, in the Castor Beans Plants (CBP), from the soil preparation to the final growth of the cultures is about three months.

After the harvest, castor bean seeds must be transported to a local of drying and refinement, stages that last, jointly, about four days. After that, the processed harvest must be stocked and then transported from the CBP to the Crushing Plant (CP). This transportation will be feeder, if the CP is located inside the agro industry, or trunk, otherwise.

In the CP harvest will be crushed, thus being divided in oil, net mass residuals and losses. The oil obtained after the crushing of the castor bean is transported to the biodiesel Production Plant (PP), while the net mass residuals is directed to the compost and ration production plants.

The proposed model is restricted to represent the logistical flow inherent to the focused harvest, to the consequent vegetal oil and biodiesel, not considering variants of agricultural, commercial or accounting type. Concerning the supervisory control in agro industrial systems, the present model would contemplate the logistical agent presented in Koumboulis et al. (2006).

Estimated data concerning castor bean production for several cities in the State of Ceará were collected. These data concern the distances on the roads for determination the transport time and also about the equipment's capacity utilized in the focused CBBSC.

Considering the study area and based on castor bean production data, it was possible to realize that the number of producers is quite elevated and, therefore, the geographic dispersion, the capacities of production and its logistical processes are expected to present a great variability. So, the option of modeling the chain using seeds Distribution Centers (DCs) disposed in some places at the study area was adopted.

Then the seeds follow, via highways, to the Crushing Plant (CP), which will transform them into oil. Finally, the oil is transported in trucks to the Production Plant (PP), where the castor bean oil is used as input to biodiesel production. The model do not consider the other sub products of the CBBSC. Figure 4 presents the CBBSC operational model based on colored Petri nets. In tables 1 and 2 the characteristics of the model are described.

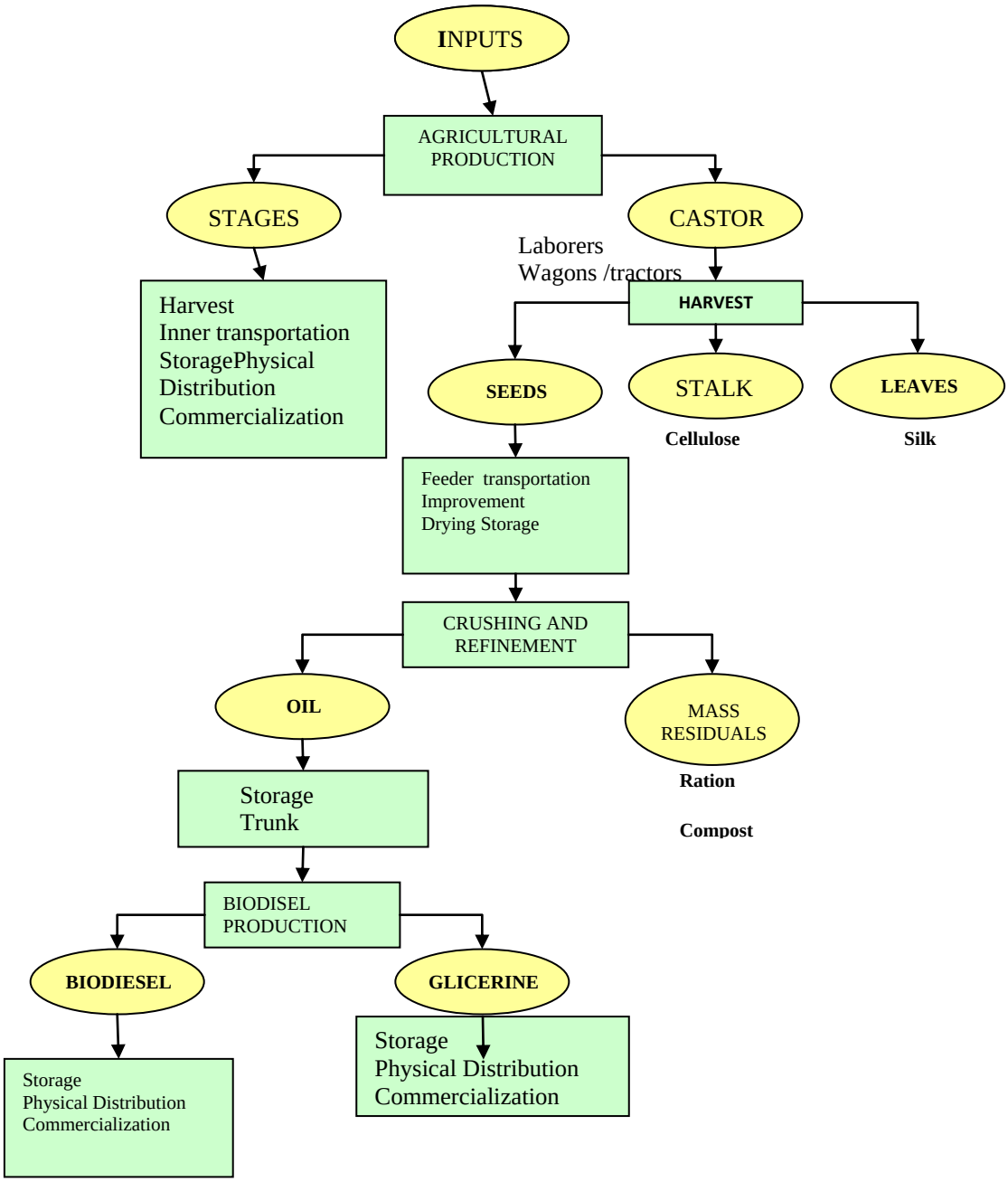

Figure 3 – A simplified diagram of the products and activities in the focused supply chain.

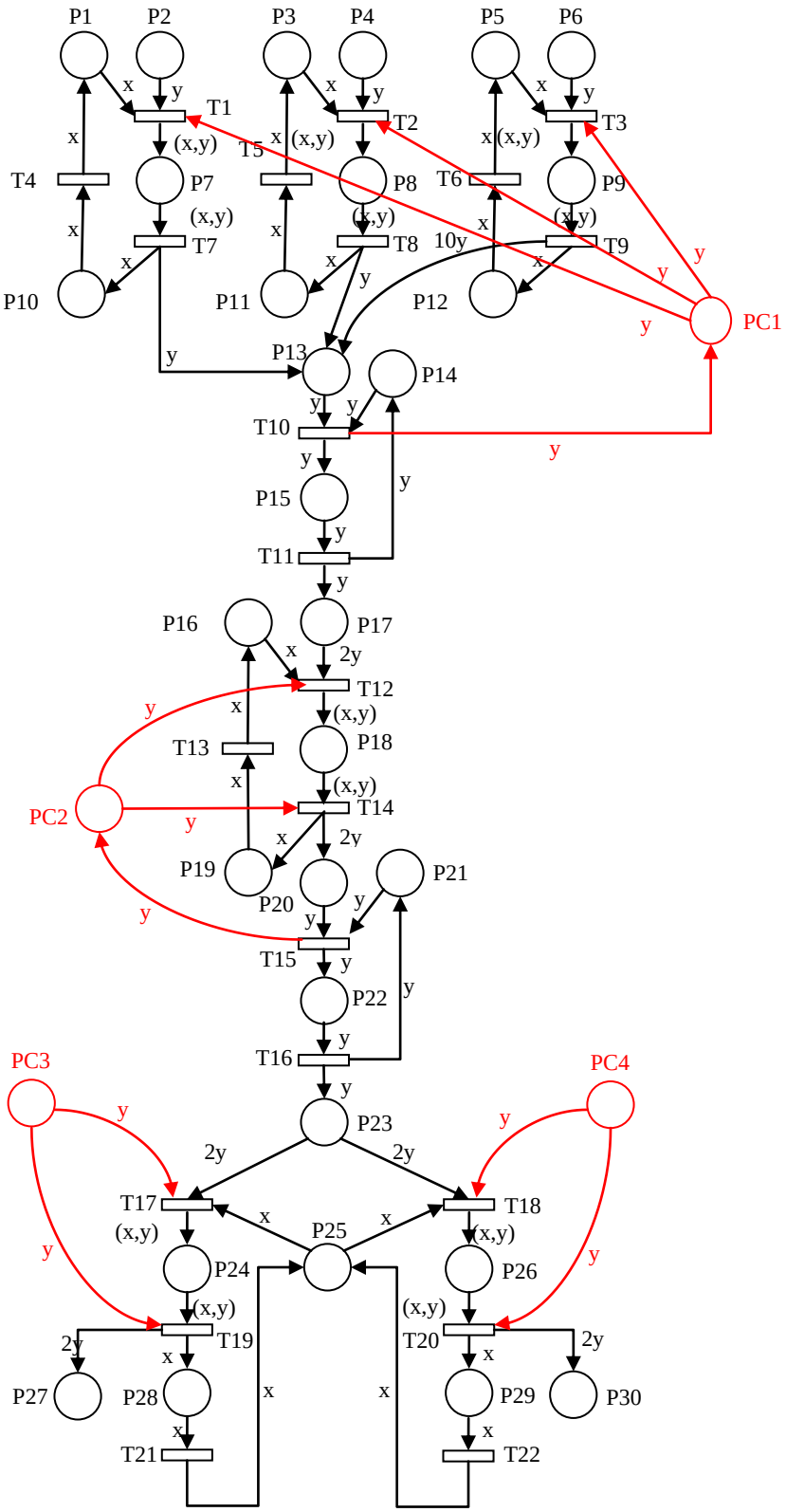

Figure 4. Controlled model of castor

Place	Description	Associated set of colors
P1	Truck available at DC1	C1
P2	Stocked harvest at DC1	C1
P3	Truck available at DC2	C1
P4	Stocked harvest at DC2	C1
P5	Truck available at DC3	C1
P6	Stocked harvest at DC3	C1
P7	Harvest in transit, from DC1 to SP	C2
P8	Harvest in transit, from DC2 to SP	C2
P9	Harvest in transit, from DC3 to SP	C2
P10	Truck ready to return to DC1	C1
P11	Truck ready to return DC2	C1
P12	Truck ready to return DC3	C1
P13	Harvest at SP	C1
P14	Capacity available of the SP	C1
P15	Oil in production	C1
P16	Truck available at SP	C1
P17	Stocked oil	C1
P18	Oil in transit from SP to PP	C2
P19	Truck ready to return to SP	C1
P20	Oil at PP	C1
P21	Capacity available of the PP	C1
P22	Biodiesel in production	C1
P23	Stocked Biodiesel	C1
P24	Biodiesel in transit to the refinery	C2
P25	Truck available at PP	C1
P26	Biodiesel in transit to the port	C2
P27	Biodiesel at the refinery	C1
P28	Truck at the refinery, ready to return to PP	C1
P29	Truck at the port, ready to return to PP	C1
P30	Biodiesel at the port	C1

Table 1. Caption of the places of the net presented in Figure 4.

Transition	Description	Firing Time (min)
T1	Loading of the truck, with berries, at DC1	60
T2	Loading of the truck, with berries, at DC2	60
T3	Loading of the truck, with berries, at DC3	60
T4	Return of the truck to DC1	99
T5	Return of the truck to DC2	231
T6	Return of the truck to DC3	10
T7	Transport and unloading of the truck, coming from DC1	207
T8	Transport and unloading of the truck, coming from DC2	407
T9	Transport and unloading of the truck, coming from DC3	75
T10	Oil production	48
T11	Oil warehousing	5
T12	Truck loading, with oil	5
T13	Return of the truck to SP	231
T14	Transport and unloading of the truck to PP	352
T15	Biodiesel Production	24
T16	Biodiesel Storage	5
T17	Loading of the truck, with biodiesel	5
T18	Loading of the truck, with biodiesel	5
T19	Transport and unloading of the truck to the refinery	517
T20	Transport and unloading of the truck to the port	573
T21	Return of the truck , coming from the refinery, to PP	345
T22	Return of the truck, coming from the port, to PP	382

Table 2. Caption of the transitions of the net presented in Figure 4

The utilized premises in the modeling are: (i) 1 DC in Canindé (DC1), serving Santa Quitéria and Canindé districts and storage of a harvest of 660 tons; (ii) 1 DC in Quixadá (DC2), serving Quixadá and Quixeramobim districts and stocking a harvest of 180 tons; (iii) 1 DC in Tauá (DC3), serving Tauá and Pedra Branca districts and stocking a harvest of 480 tons, (iv) 1 CP in Quixadá, with capacity of 20 ton/day; (v) 1 PP in Tauá, with capacity of 20m³/day; (vi) 1 biodiesel mill in Fortaleza; 1 port in Pecém; (viii) trucks for the seeds transport, with capacity of 10 tons; and (ix) trucks for oil and biodiesel transport, with capacity of 10.000 liters.

The integer type variable "x" (Figure 4) represents trucks utilized in the distribution of the harvest, oil and biodiesel. If, for instance, we add at place P1 six tokens with x=1, we are going to have six trucks that will be distinguished along the simulations, which is a fact that would not occur if the place-transition Petri nets were utilized.

The integer type variable "y" (Figure 4), represents the harvest that, later on, becomes oil and biodiesel. In an analogous way to that one described in the previous paragraph, the fractions of harvest, oil and biodiesel also may be distinguished along the simulations.

In Figure 4, the set of colors C1 is associated with those places that do not contain tokens of distinct variables at the same time. But the set of colors C2 is associated to the places that may contain tokens with the variables "x" and "y" simultaneously.

The marking of the place p1, correspondent to DC1, will be M(p1) = 66'y, in which each token of the group "y" represents ten tons of harvest. Analogously, the markings of the places p2 and p3 will be M(p2) = 18'y and M(p3) = 48'y.

Evaluating the behavior of this uncontrolled model by simulations, it was possible to identify some problems in the chain processes, according to what is shown as follows.

Firstly, once the harvest production is much superior than the capacity of the PE, a waiting to the appropriate processing of the seeds occurs. The trucks can transport fractions of the agricultural production even if the crushing plant is still not capable to process them. This implies in inefficiency, once an unnecessary intermediary stock is formed. The ideal scenario is that where the fractions of the harvest are transported only in the moment in which they are required by the crushing plant. An analogous problem occurs between the crushing plant and the biodiesel production mills.

Another problem is the biodiesel allocation to the internal and external markets. There must be some other instrument of control which designs the allocation of the fleet to its correct destiny, in a way to avoid failure in the delivery. From the analysis of the model, it was possible to establish functional specifications for the functioning of the CBBSC and to put into effect the CCDC method. Control places of the net are presented in Table 3 and in Figure 4.

Place	Description	Associated color set
CP1	Controls the harvest flow between CD and PE.	C1
CP2	Controls the oil flow between PE and PP	C1
CP3	Allocates biodiesel to internal market	C1
CP4	Allocates biodiesel to foreign market	C1

Table 3. Control places of the model

Aiming to the feature of the model as a supporting tool to the decision making in the CBBSC, the option of performance evaluation of the controlled model was adopted.

Concerning the performance evaluation of logistical systems and especially in agro industrial supply chains, Alves (1997, p. 171) highlights that the cycle time is an important measure of logistical performance, which "represents the perception of the client about the period that exists between the request and the reception in the delivery of the product."

In the case of the focused chain, the cycle time will consist of the operational time elapsed considering the transport of the harvest to the Crushing Plant and the arrival of the oil in the biodiesel mill and/or in the port. Such approach is in consonance with the works of Costa (2202), Prata et al. (2006) e Machado et al. (2006).

In the performance evaluation of the system, two scenarios were proposed: (i) Scenario A: 75% of the production directed to the internal market and 25% directed to the foreign market; and (ii) Scenario B: 100% of the production directed to the external market.

Besides both scenarios (A and B) eight operational scenarios were established, aiming to analyze the performance of the system under several circumstances. The values of the markings in the places p_1, p_3, p_5, p_{16} e p_{25}, which correspond to the transport equipment (trucks) employed in the chain, will be the parameters to be varied.

In this context, eight operation systems for propositions A and B were established, aiming to evaluate the behavior of the chain. A summary of the results obtained are presented in Table 4, Table,5 and Figure 5.

Analyzing scenarios A1 and A7, it is noticeable that, allocating only one truck for the transport of oil and biodiesel, the cycle time is much superior compared to the other scenarios. On the other hand, the scenarios in which many trucks are used (A3, A4 and A8), the cycle times tend to decrease.

Scenario	Description of the Scenario	Cycle time (h)
A1	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 1$ e $M(p_{25}) = 1$.	1010,6
A2	$M(p_4) = 2$, $M(p_5) = 2$, $M(p_6) = 2$, $M(p_{16}) = 2$ e $M(p_{25}) = 2$.	546,8
A3	$M(p_4) = 3$, $M(p_5) = 3$, $M(p_6) = 3$, $M(p_{16}) = 3$ e $M(p_{25}) = 3$.	519,4
A4	$M(p_4) = 4$, $M(p_5) = 4$, $M(p_6) = 4$, $M(p_{16}) = 4$ e $M(p_{25}) = 4$.	522,7
A5	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 1$ e $M(p_{25}) = 2$.	680,0
A6	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 2$ e $M(p_{25}) = 2$.	622,9
A7	$M(p_4) = 3$, $M(p_5) = 3$, $M(p_6) = 3$, $M(p_{16}) = 1$ e $M(p_{25}) = 1$.	1007,5
A8	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 3$ e $M(p_{25}) = 3$.	586,8

Table 4. Summary of the results obtained for scenario A.

Scenario	Description of the Scenario	Cycle time (h)
B1	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 1$ e $M(p_{25}) = 1$.	976,2
B2	$M(p_4) = 2$, $M(p_5) = 2$, $M(p_6) = 2$, $M(p_{16}) = 2$ e $M(p_{25}) = 2$.	503,3
B3	$M(p_4) = 3$, $M(p_5) = 3$, $M(p_6) = 3$, $M(p_{16}) = 3$ e $M(p_{25}) = 3$.	430,2
B4	$M(p_4) = 4$, $M(p_5) = 4$, $M(p_6) = 4$, $M(p_{16}) = 4$ e $M(p_{25}) = 4$.	431,7
B5	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 1$ e $M(p_{25}) = 2$.	671,1
B6	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 2$ e $M(p_{25}) = 2$.	592,3
B7	$M(p_4) = 3$, $M(p_5) = 3$, $M(p_6) = 3$, $M(p_{16}) = 1$ e $M(p_{25}) = 1$.	974,3
B8	$M(p_4) = 1$, $M(p_5) = 1$, $M(p_6) = 1$, $M(p_{16}) = 3$ e $M(p_{25}) = 3$.	594,8

Table 5. Summary of the results obtained for scenario B.

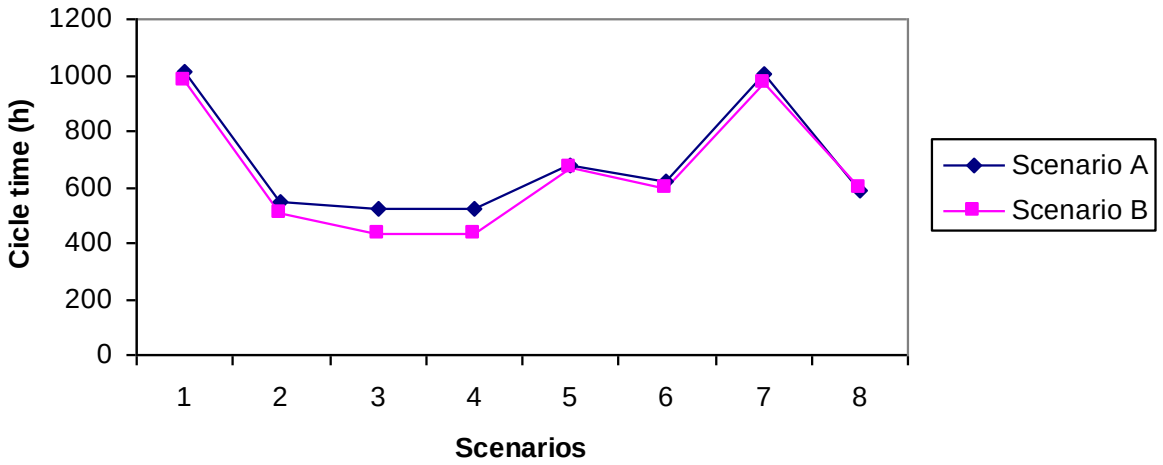

Fig.5. Behavior of the cycle time along the simulated scenarios in alternatives A and B.

Still comparing scenarios A1 and A7, it is noticeable that, when triplicating the number of trucks to the transport of seeds and maintaining the number of trucks to the transport of oil, the reduction in the cycle time is significant. Thus, it is seen that the number of trucks for the transport of seeds have a stronger impact on the cycle than the number of trucks transporting castor bean oil. It is also noticeable that the marginal productiveness, due to the addition of equipments, tends to zero, as it is showed it scenarios A2, A3 and A4. The performance of the system for alternative B was similar to that of the alternative A, considering the variation of the cycle time due to the change in the parameters. However, one can observe that the cycle time for the chain is smaller when the product is directed to serve exclusively the external market.

Distinction between values of cycle times of alternatives A and B is justified by the bigger distance to be covered by the trucks in alternative A, while in alternative B the only destiny is the port. The biodiesel mill, when situated closer to the agricultural supply plants, incurs in smaller transport times. In scenarios 3 and 4, where the value of truck trips is bigger, the discrepancy between the performance of alternatives A and B is bigger.

The system in question has many uncertainties. So, it was decided to build a stochastic model of the focused chain. As field data to the adjustment of probability density functions to the model's transitions were not provided, hypothesis that operational times of the chain are governed by exponential distribution was adopted.

This hypothesis was based on the following considerations:

(i) Exponential distribution has a continuous probability density function and it is normally used in services and operations representations of processes in simulation studies;
(ii) It is a function of just one parameter, which is considered as the firing times of the transitions; and
(iii) According to Bause and Kritzinger (2002), the reachability graph of a colored Petri net is isomorphic to a Markov Chain. Consequently, it is possible to accept that transitions among states are governed by an exponential distribution, in view of its character without memory.
As the model is probabilistic, every time a simulation is made, it will tend to offer distinct results, in terms of cycle time. In this way, after computational experiments, it was decided to turn on the model 100 times in order to obtain a value of mean cycle time that is a good estimator of the system operation time.

V. Conclusion

This work presented a proposal for the coordination of logistical activities in agribusiness supply chains based on Discrete Events System (DES) modeling concepts. For this purpose, the Theory of Supervisory Control was utilized, conjointly with the colored Petri nets.
The relevance and originality of the proposed model must be highlighted. Under the practical point of view, the control of the physical flows in supply chains has great importance to a higher efficiency of a logistical system. Under the theoretical point of view, no study which presented a similar proposal was found in the literature. Also, one must highlight the effectiveness of the proposed supervisory control framework for logistical systems: the new method of supervisory control denominated Constraints of Control on Decomposed Colors (CCDC).
The proposed modeling, implemented in the software CPNTools, constitutes a Decision Support System which permits the building of scenarios aiming to the management of the CBBSC. Concerning the application of the supervisory control framework in a real system, hierarchical levels of the system must be planed, as well as the databases, sensors and actuators.
In case of treating rudimentary chains, involving small producers geographically dispersed, as is the case of the central region of the State of Ceará, in the northeastern Brazil, a fully computerized system could incur in a technical and economic unfeasibility. In such a case, it is up to the Manager of the Supply Chain (MSC) to implement a hybrid system (man-machine) to support the decision making in the CBBSC.
Finally, the proposal of the present work fits in the research field of the agroinformatics which promises many deployments (SIGRIMIS et al. 2001; KOUMBOULIS, et al. 2006). As a suggestion for future studies it is proposed that the presented modeling be applied in a real chain, focused on the evaluation of its logistical performance and testing the degree of articulation of sensors and actuators in agro industrial supply chains, especially at the CBBSC.

VI. Acknowledgements

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The Impact Of Trust And Learning On Firm Innovativeness In Clusters: The Moderating Role Of Environmental Competitiveness

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Abstract- **This paper aims to examine the effects of two aspects of tie characteristics-trust and learning -to the firm's subsequent innovation output. We argue both learning and trust behavior lead to high level of joint problem solving which in turn influence innovation performance. In addition, a'climatic' characteristic, namely environmental competitiveness was also involved in the framework to explore the contingency role of the two relational characteristics on innovation performance. Using survey data from a sample of 194 firms from mainland China, we found that trust and learning both have a positive impact on innovation performance because they facilitate joint problem solving at the firm level and the relationship between trust, learning and joint problem solving was moderated by environmental competitiveness. We also find that trust and learning have a positive interaction effect on the outcome variable. Theoretical and managerial implications are discussed.**

Keywords Learning, Trust, joint problem solving, Innovation performance, environmental competitiveness

I. Introduction

Innovation has continued to become more and more popular research topic on the way of firms sustaining and enhancing their competitive positions. More recent works, building on Marshall's early writings (Marshall, 1890/1916), have switched the focus towards learning, creativity and innovation within regions or local clusters (Porter, 1990 ; Krugman, 1991 ; Saxenian, 1994).Management scholars and practitioners are increasingly concerned with understanding what makes some alliance "out innovate" others. While, to realize an innovative solution represents what Jarillo (1988) describes as first entrepreneurial problem i.e., it requires the accumulation and access to the necessary resources and capabilities. The issue of how collaboration behavior can create innovation performance has become a fundamental research question. Although learning and trust are frequently theorized to be central to the acquisition of innovative capabilities through inter-firm ties (Ahuja, 20002; Gulati, 1999 ; Stuart, 19981), the effects of learning and trust typically are inferred rather than examined directly. Previously few study exams how different elements of inter-organizational ties affect innovation performance, but how resources are combined and codified knowledge was transfer to translate into innovative capability and how the climate of the clusters may influence the role of relational factors is unclear. To address this issue, this study examines a relatively under-explored tension in the literature the path and mechanism of tie features influencing innovation performance in clusters. To understand this, not only important for firms to enhance innovativeness but also enhance the sustainable competitive advantage of the clusters.

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II. Literature Review and Theoretical Hypothesis

Previous research on assessing the effects of a firm's network of relations on innovation in clusters has largely limited to ventures operating in non-cluster markets with relatively "remote" exchange partners. For instance, Ahuja (2000)2 explores the role of direct ties, indirect ties, and structural holes (disconnections between a firm's partners)-to the firm's subsequent innovation output. Tiwana (2008) suggests that strong ties complement bridging ties in enhancing alliance ambidexterity at the project level. While several researchers have demonstrated the importance of network the firm embedded in promoting innovation in clusters. But this line of research mainly focuses on knowledge spillovers and public knowledge as well as adoption or diffusion of innovations in industrial districts not the tie features. This narrow focus limits theoretical completeness and is a significant gap in the literature which highlights the importance of decomposing the buyer and seller relationship into distinct and separate elements and identifying the contents transmitted through each type of tie (McEvily and Marcus, 2005).

Future, what has not been systematically and empirically investigated is the mechanism of how relational recourses facilitate innovation. Since the knowledge underlying innovative capabilities is partially tacit, it is difficult to articulate and transfer, in other words, we claim that the effects of learning and trust typically are inferred rather than examined directly (Uzzi, 1997).The underlying premise is high level of trust and knowledge sharing in the clusters, but they do not address in details the structure and mechanics of relational features' impact on firm level innovation performance in industrial clusters. In particular, we focus on the role of joint problem solving as the mechanism in the joint value creation process and investigate the extent to which joint problem solving between buyer and supplier

firms link key antecedents and outcome variables. Such an investigation is needed in order to advance theory building and empirical testing in supply chain management in clusters. We seek to gain a better and integrative understanding of the strategic importance of this construct within the context close-knit network.

More importantly, the link between relational resources and firm innovativeness is not universal but rather could be context specific. It has long been argued that network ties play an important role in new product innovation (e.g. Gulati, 19994; Marshall, 2004; Ragatz, Handfield, & Scannel, 1997), because of their facilitative role in various inter-organizational contexts (Teece, 1989).But, environmental competitiveness in a proximate region lead to similar resources and similar strategy, which can influence the roles of relational resources in firm innovativeness and the cooperative behavior in inter-firm relationship. So far, however, little theoretical or empirical work has addressed this issue (Bengtsson and Solvell, 2004).

In this study, we aim to address the above gaps in the literature by examining the roles and mechanism of trust and learning on firm innovation performance. Inter-organization trust was defined as the extent of the willingness to rely on a party in whom one has confidence (cf. Ganesan, 1994). Inter-organizational learning was defined as the extent to which knowledge and information transferred between buyer and seller (Geoffrey & Onno, O, 2003). Specifically, three research questions will be addressed: (1) How the two relational characteristics relate to innovation performance from both buyer and seller perspective. (2) Do the two types of relational characteristics complement each other? In other words, do they have interaction effects on the innovation output. (3) How the 'climatic' characteristic (i.e. environmental competitiveness) to influence the efficiency of the two relational characteristics?

III. Joint problem solving and innovation performance

Solutions to complex innovation problems require more integration and synthesis of diverse, complementary knowledge and capability (Henderson and Clark, 1990 ; Nickerson and Zenger, 2004 ; Tiwana, 200812). To acquire an innovative capability a firm must comprehend it (Mcevily and Marcus, 200513). Previous study suggests that joint problem solving is critical to internalize capability and fostering value-enhancing inter-organizational relationships in supply chain management and relationship marketing literature (e.g., Mohr and Nevin, 1990 ; Mohr et al., 1996 ; Prahalad and Hamel, 1990). In empirical studies, researchers have typically considered joint problem solving as a facet of a broader construct, such as relational governance (e.g., Heide & Miner, 1992 , Lusch & Brown, 1996). Joint problem solving is defined as the degree to which the parties to an exchange 'share the responsibility for maintaining the relationship itself and for problems that arise as time goes on' (Heide & Miner, 1992: 275) Such arrangements typically involve routines for troubleshooting problems as they arise and negotiating the mutual adaptations required to resolve the difficulty.

Joint problem-solving arrangements promote the transfer of complex and difficult-to-codify knowledge to enhance innovative capability (Mcevily and Marcus, 200513). Through joint problem solving, relationship-specific procedure and language for transfer tacit knowledge may be developed to reach a mutually satisfactory new solution for every contingency (Hansen, 1999). Such arrangements provide learning opportunities by creating a forum conducive to interaction and the transfer of tacit knowledge about innovative capabilities. In innovation-seeking partners, it is often initially difficult to clearly envision the intended performance outcome. For example, different firm managers might have different perspectives on what they view as the ideal solution and things may changed differently from what expected (Dougherty, 1992 ; Tirana, 200812). These perspectives must be reconciled by joint problem solving arrangements to arrive at a shared conceptualization of the envisioned solution. Therefore, although partnership provide possibilities for gaining access to complementary know-how (tacit, sticky, and noncodifiable knowledge) and technological capabilities (Kale, Singh, and Perlmutter, 2000 ; Mowery, Oxley, and Silverman, 1996), their coordinated utilization at the firm level is necessary to translate them into practice. By providing a forum, joint problem solving arrangements allows a firm to draw on the insights, experience, and ability that customer and supplier firms have to create forms of dealing with disagreements and other contingencies of the business relationships and in turn to be more innovative(Marshall, 2004 ; Dyer & Singh, 1998).The greater the extent of joint problem solving is, the greater the recognition and integration of new information about new needs and constraints that arises in progress are. Therefore, we propose the following hypothesis:

H1: Joint problem solving will be positively related to firms' innovation performance.

IV. Trust, joint problem solving and innovativeness

Inter-organizational trust reflects the level of relational embeddedness and cohesiveness in buyer-seller relationships (Kale et al., 2000 ; Uzzi, 199714; Tiwana, 200812), which facilitates information flowing (Danny, Geoffrey & Onno, O, 2003), and also enhance the efficiency of joint actions in buyer-seller relationships (Paulraj, Lado, & Chen, 2008). Because the resources and information are more likely to share if a firm have confidence in the information and advice provided by an exchange partner and to believe that the recommendations made are in its own best interest (Das and Teng, 1998 ; Mcevily and Marcus, 2005.). In addition, trust also makes it possible for a firm to be more open with its exchange partners (Dore, 1983 ; Ouchi, 1979). In order for transaction partners to provide information and guidance useful for solving problems and develop new products and operational process, it is necessary for the firm to reveal certain details about its operations and the challenges the partner faces to. For this reason, if problem come up or market environment changed, they may sharing their specific knowledge to help

each other jointly solve the problem and find new solutions jointly.

Moreover, trust provides a context conducive for joint actions because the buyer and seller are less likely to discredit each other's perspectives in attempting to solve problems. By virtue of their reciprocal relationships, buyer and seller are also less likely to engage in cost-benefit calculus before contributing proprietary or valuable knowledge to a collaborative project (Molm, Peterson, and Takashaki, 1999). Exchange partners that trust each other are willing to make extra efforts beyond the letter of a contract in order to overcome difficulties and help each other solve problems. Therefore, such trust is a critical antecedent to joint problem solving in alliances (McEvily and Marcus, 2005), which in turn promote innovation performance of the focal firm as we discussed above. Hence, it is primarily because in such synergistic action process, information and resources are recombined, unique new solutions can be generated and relational rents (Dyer and Singh, 1998) can be realized. Without joint problem solving, the latent potential of inter-organizational trust for enhancing innovation performance cannot be realized. These ideas are summarized in the following hypotheses.

H2: Inter-organizational trust will be positively related to joint problem solving in buyer-seller relationship.

H3: joint problem solving will mediate the relationship between inter-organizational trust and firm's innovation performance

V. Learning, joint problem solving and innovativeness

For joint problem solving to occur, it is necessary for the exchange partners to share information relevant to the problem. Inter-firm trust is needed but not sufficient, inter-firm learning also needed to guarantee more tacit knowledge and capability for innovative solution processed by partners and can be transferred and absorbed (Danny, Geoffrey & Onno, O, 2003).Inter-organizational learning is the ability to share and transfer knowledge with other partners (Lorenzoni and Lipparini,1999). Because the information conveyed through ties that are more highly embedded is situation-specific and 'holistic,' in the sense that it consists of a composite of related details, it is both meaningful and instructive to promote joint problem-solving arrangements that allow exchange partners to engage in experimentation, observation, and search for solutions. More over, since such knowledge is difficult to codify and articulate, which makes it challenging to transfer (Teece, 1977; Zander and Kogut, 1995 ; Szulanski, 1996), The information shared in the learning process is often face to face, which help the exchange partners to jointly and effectively solve the common problem (McEvily and Marcus, 2005). Hence, inter-organizational learning provide new know-how, that is, new ways of doing things to jointly solve problem effectively and also provide face to face communication opportunities to jointly solve problem efficiently. Therefore, the higher the level of learning in a given buyer-seller relationship, the greater probability of innovation is engendered from diversity of accessible knowledge, capabilities, and perspectives. Since knowledge sharing in inter-organizational learning influence innovation only if it is employed in joint problem solving to improve production and respond customer needs, we expect their influence on the focal firms' innovation performance mediated by joint problem solving. Therefore, we propose the following hypothesis:

H4: Inter-organizational learning will be positively related to joint problem solving in buyer-seller relationship.

H5: joint problem solving will mediate the relationship between inter-organizational learning and firms' innovation performance.

VI. Complementarities between trust and learning

Complementarities are said to exist when having more of one thing increases the returns of having more of another (Milgrom and Roberts, 1995). Statistically, this represents a positive interaction effect. Viewed at firm level, it is plausible that a given partner can simultaneously be high on trust and on learning. Exchange partners that simultaneously possesses trust and learning will have access to a diverse array of specialized knowledge, perspectives, and skills and meanwhile easy to communicate and react jointly for the rising problem. Since relational capital based on mutual trust, respect, and friendship at the individual level between alliance partners created a basis for learning and know-how transfer across the exchange interface (Kale et al., 2000; Inkpen and Wang, 2006). Trust can affect both the extent of knowledge exchanged in alliances and the efficiency with which it is exchanged. A high level of trust contributes to information sharing and learning because decision makers do not feel that they have to protect themselves from the other's opportunistic behavior (Child and Faulkner, 1998). Without trust, however, the information exchanged between the parents directly or through the alliance may not be highly accurate, comprehensive, or timely because the parents are unwilling to take the risks associated with sharing more valuable information. Therefore, partnerships built will support learning. Further, the willingness of inter-firm leaning and history of successful knowledge transfer also enhance the trust between firm represented by more transparency or openness.

Therefore, we expect trust and learning ties to exhibit complementarities, i.e., a positive interaction effect on joint problem solving. However, such complementarities influence innovation only because they facilitate joint problem solving in firm level. Without joint problem solving, valued information and knowledge will not engender innovation in terms of either products or process. Therefore, we propose the following hypothesis:

H6: Inter-organizational learning complements trust in enhancing joint problem solving in buyer-seller relationship.

H7: The influence of the complementarities between Inter-organizational learning and trust on the focal firm's innovation performance is mediated by joint problem solving.

VII. The Moderating Role of Environmental Competitiveness

Environmental competitiveness refers to the degree of competition reflected in the number of competitors and the number of areas in which there is competition (Miller, 1987). Environmental competitiveness always characterized as high efficiency and low cost oriented. In competitive and hostile environments, firms intend to conserve their resources with intensive pressures for higher efficiency and lower prices (Matusik and Hill, 1998). And also imitators may take the innovation rent of the original inventors, and the threat of substituted products and their potential innovation which makes any extensive risk taking, forceful proactiveness, and strong emphasis on investing inter-firm learning with uncertain outcomes can be hazardous when competitive conditions become more demanding. To joint act with firms with high level of inter-firm trust may reduce the risk and more efficient.

Moreover, high level of competitive environments leads to less organizational slack (Zahra, 1996). The function of slack resources is to absorb and react to the new changes in the environment to guarantee the stability and sustainable development of organization. Inter firm learning related tacit knowledge demonstrate long term strategic commitment and uncertain revenue and such investment may harm the viability of organizational units (Zahra and Bogner, 1999) and the flexibility of both organizations. Hence, environmental competitiveness usually reduces available resources for inter-firm learning (Miller and Friesen 1983; Zahra, 1996). Therefore, we propose the following hypothesis:

H8: Environmental competitiveness negatively moderates the relationship between inter-firm learning and joint problem solving.

H9: Environmental competitiveness positively moderates the relationship between inter-firm trust and joint problem solving.

VIII. Method

A. Sample and Data Collection

We developed a questionnaire on the basis of literature search and previous case studies (Bell, 2005 ; McEvily and Marcus, 2005; Hiede and Minner, 1992; Halikas et al, 2005 ; Doney and Cannon's, 1997 ; Bengtsson and Solvell, 2004 ; Claro, Hagelaar and Omta, 2003). In order to test for content validity of the scales in the questionnaire, a panel with four experts was conducted. We then carried out a pretest at five suppliers in which managers and/or owners were asked to fill out the questionnaire and raise questions as problems and ambiguities arose. This information was used to further improve the questions and scales. Finally, we collect data in Wenzhou area of mainland China from the early May of 2007 to the late November of 2007. 600 questionnaires were sent to the firms' managers from the city of Rui'an and Yueqing. When responding all questions about the business relationship, informants were asked to consider their relationship with a specific partner with whom the informant has done business regularly over the previous year. After sending a reminding message to all the potential respondents, we received 280 responses; this resulted in a response rate of 46.7%. Among them, 86 pieces of returned questionnaires were incompletely filled or with self-evident mistakes, which were considered as unqualified questionnaires. Hereby, the returned valid questionnaires are 194 pieces, resulting in an effective respond rate of 32.3%. There were no significant differences between responding ventures and non-responding ventures in terms of venture size and age.

Table 1 provides an overview of the relative distribution of respondents in terms of the following three relevant variables: industry, sales revenues and business characteristics.

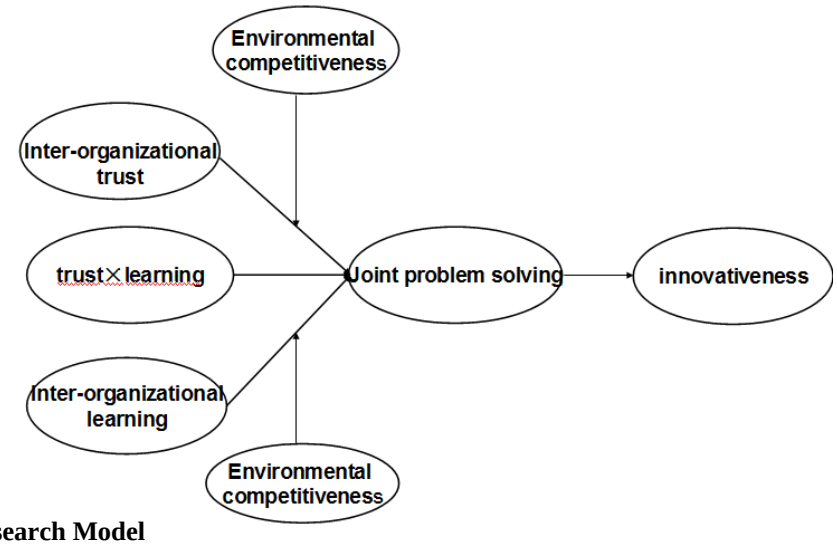

Fig. 1 Research Model

Table 1 Distribution of respondents

	N	%
Industry		
Automobile	32	16.5
Electric Appliance	39	20.1
Machine and equipment manufacturing	16	8.2
Clothes and shoes	23	11.9
Consumer products	9	4.6
foods	3	1.5
Communication	7	3.6
service	12	6.2
Total	194	100
Sales revenues (in million RMB)		
Less than 1	3	1.5
1-5	6	3.1
5-10	12	6.2
10-30	38	19.6
30-100	83	42.8
Above 100	52	26.8
Total	194	100
Business Types		
Manufacture	97	50.0
Manufacture and Distribution	63	32.5
Wholesale and Distribution	16	8.2
retailing	7	3.6
Other Services	11	5.7
Total	194	100

B. Measurement

Five-point Likert response format was used from "1=totally disagree" to "5=totally agree" for all items in this study to ask respondent to choose the answer that most consistent with their recognition and feelings. We measured innovation performance with three items adapted from Bell, 2005). Three items were used to measure joint problem solving (McEvily and Marcus, 2005; Hiede and Miner, 1992). They indicate the behavior of the relationships that captures the degree of joint solutions to problems a supplier demonstrates toward the selected buyer (Heide & Miner, 1992; Lusch & Brown, 1996);Trust comprises multi aspects including ability, benevolence and integrity (Mayer et al 1995), based on this viewpoints, we employed Doney and Cannon's (1997) scale to asses trust in buyer–seller relationships. Following McEvily and Marcus (2005) and halikas et al. (2005), inter-organizational learning was measured with three items that reflect the extent to which interaction between buyers and sellers in knowledge sharing and integration. We measured competitiveness with three items adapted from Bengtsson and Solvell (2004) & Claro, Hagelaar and Omta (2003) in terms of "Competition in our local market is intense, Many similar firms in our local market and Product can be easily imitated".

Harman's one-factor test was used to check for the presence of common method variance (Podsakoff and Organ, 1986). We subjected all the key measures to a factor analysis and then determined the number of factors accounting for the variance in the measures. The first factor captured only 17.2% of the variance in the data. Since a single factor did not emerge and the first factor did not account for most of the variance, we concluded that common method variance might not be an issue. We also assessed the reliability of the multi-item scales with Cronbach's alpha. As can be seen, all scales had reliabilities above the 0.60 threshold (Crobanch, 1951; Nunanlly, 1978).

Prior to testing the hypotheses, I conducted a confirmatory factor analysis to estimate the measurement model and to further establish uni-dimensionality and construct validity, which included all variable factors. The ratio of list wise sample size to estimated parameters of the measurement model was 11:1, exceeding the threshold level of 5:1 (cf. Hair, Anderson, Tatham, & Black, 1998).As shown in Table 2, all factor loadings were significant. he values for CFA model fit indices including goodness of fit (0.91), normed fit index(0.94), non-normed fit index(0.96), Root mean square error of approximation(0.064), normed $\chi 2$ (142.64) and df (80) indicate that the data fits the model well and hence establish the uni-dimensionality. Carr and Pearson(1999) suggests that to test convergent validity, t-values of the standardized coefficients between each item and variables should be up two(i.e. T>2) and also Squared Multiple Correlations for Variables should be above thirty percent(i.e. R2>0.3).According to this, we dropped items with R2 value below 0.3(which was marked with * on the top right corner).The standardized coefficients and t-values for the

individual paths show that all the indicators are significantly related to their underlying theoretical constructs and, hence, exhibit convergent validity. The result of this analysis is provided in table 2. Table 3 presents means, standard deviations, correlations, and reliability coefficients (Cronbach alpha) of variables examined in this study.

Table 2 items and confirmative factor analysis results

Variables And Items	Loading	Standardized Loading	Cronbach's Alpha (A)
Dependent Variables			
Buyer Innovativeness (Bell, 2005) BIP			.794
BIP1 We Often Leads The Industry At Introducing New Products	Λy_{11}	.70	
*BIP2 W*e Often Leads The Industry At Introducing New Services	Λy_{21}	.68	
BIP3 We Often Leads The Industry At Adopting New Technologies	Λy_{31}	.84	
Joint Problem Solving (Mcevily And Marcus, 2005;Hiede And Minner, 1992; Halikas Et Al, 2005) JPS			.863
JPS1 We Are Jointly Responsible With The Supplier For Getting Things Done	Λy_{73}	.86	
JPS2 We Develop Our Operation Modes Even If Problem Not Exists	Λy_{83}	.87	
JPS3 We Try To Solve Problem So That They Will No Longer Appear	Λy_{93}	.44	Dropped
Independent Variables			
***Inter-Organizational Trust (Doney And Cannon's ,1997) IOR Doney And Cannon's ,1997*i**			.665
RCL1 This Supplier Keeps Promises It Makes To Our Firm.	Λx_{11}	.55	
RCL2 We Believe The Information That This Supplier Provides To Us	Λx_{21}	.64	
RCL3 This Supplier Is Trustworthy.	Λx_{31}	.56	
*RCL*4 This Supplier Or Is Honest With Us	Λx_{41}	.63	
*RCL*5 This Supplier Considers Our Welfare When Making Decisions Regarding This Market*	Λx_{51}	.48	Dropped
Inter-Organizational Learning (Halikas Et Al, 2005) IOL Halikas Et Al, 2005*ii *Mcevily And Marcus, 2005; 1992;			.900
RCA1 Lot Of Mew Knowledge Has Been Developed For Us During The Relationship	Λx_{62}	.84	
RCA2 Our Main [Customer/Supplier] Shares Proprietary And Sensitive Information With Us	Λx_{72}	.91	
RCA3 We Develop Manufacturing Method Together With The Supplier	Λx_{72}	.85	
Control Variable	Industry, Business Type, Firm Size, Total Asset, Sale Revenues Per Year, District		
Goodness Of Fit	X2=142.64(P<0.001); Df=80; X2/Df=1.78; RMSEA=0.064; GFI= 0.91; CFI=0.97; NNFI= 0.96		

Note: All t-values are significant at P < 0.05 level.

Table3 Correlation matrix and summary statistics

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Industry	1										
2 business type	.372**	1									
3 firm size	-.147*	-.193**	1								
4 sale Revenues	-.032	-.156*	.546**	1							
5 total asset	-.025	-.097	.470**	.637**	1						
6 district	-.185**	-.114	.201**	.228**	.124	1					
7 Trust	.019	.062	-.007	.008	.081	.067	1				
8. Learning	-.013	.014	.060	.031	-.063	.163*	.432**	1			
9. Joint problem solving	-.093	-.044	.042	.073	.009	.172*	.419**	.515**	1		
10. Buyer innovativeness	.059	-.062	.007	.188**	.140	.167*	.340**	.341**	.354**	1	
11. Environmental Competitiveness	*.006*	*.058*	*.044*	*-.089*	*-.078*	*-.065*	*-.082*	*.067*	*-.073*	*.035*	*1*
Mean	4.82	1.85	2.71	4.82	5.88	3.34	3.81	3.38	4.08	4.20	3.40
S.D.	3.16	1.20	1.56	1.17	2.25	1.69	.533	.97	.73	.60	.80

a N=194
b Numbers in diagonal are reliabilities.
**p < 0.05; **p < 0.01*

We controlled for the following variables. First, Industry referred to the industry the firm belongs to, including Automobile, Electric Appliance, Machine and equipment manufacturing, Clothes and shoes, Consumer products, foods, Communication, and service industry. Second, Business type referred to the main business the firm is engaged on to distinguish the position of the firm in the supply chain, including Manufacture, Manufacture and Distribution, Wholesale and Distribution, retailing, and Other Services. Third, Firm size referred to the natural log of the number of full-time employees. Fourth, Previous research suggested that R&D spend and innovation performance might vary by sale Revenues and total asset, which were added to the framework. Finally, because the sample was from different areas and district, culture and education level may vary, we coded the cases according to the district.

IX. Model Testing Result

According to Baron and Kenny (1986) procedure for testing mediation, IV should be significantly related to DV in Step 1. Mediating variable (M) should be significantly related to DV in Step 2. When IV and M are considered simultaneously in Step 3, the relation between M and DV should remain significant. Kenny, Kashy, and Bolger (1998) and MacKinnon et al. (2002) have more recently recognized that this approach of also requiring direct effects (step 1) is overly restrictive. In other contexts where the more proximal IV to M and M to DV associations are larger than the distal IV to DV association, it seems unwise to defer considering mediation until the bivariate association between IV and DV is established (Shrout & Bolger, 2002). In practice, researchers have begun to relax the Step 1 precondition in estimating the mediation models (e.g. Schneider, Ehrhart, Mayer, Saltz, & Niles-Jolly, 2005, Tiwana, 2008). In keeping with these updated notions for testing mediation, the hypothesized relationships were tested following the mediated regression guidelines outlined by MacKinnon et al. (2002). This required establishing a relationship between the independent variables with the mediator (joint problem

solving), and the mediator with the dependent variable (buyer innovativeness and seller innovativeness).

Three stepwise regression models were used to test the hypotheses, one with firm innovativeness as the dependent variable (Model 1), and then with joint problem solving as the dependent variable (Model 2). The results of the analyses are presented in Table 4 (with the standardized regression coefficients related to the hypothesis tests italicized). A summary of the results in the context of the research model is presented in Figure 3.

To test Hypothesis 1, which proposed a positive relationship between joint problem solving and firm innovativeness, we used a stepwise regression model in which the control variables, the predictors, the interaction term (trust x learning), and finally the mediator (joint problem solving) were sequentially introduced in the model. The results are summarized as Model 1.In Table 4. Joint problem solving had a significant and positive relationship with buyer innovativeness ($\beta = 0.185$; $p < 0.05$), supporting Hypothesis 1. The R^2 value increase attributable to adding joint problem solving to the model was statistically significant at the 5 percent level (Fchange = 5.27, $p < 0.05$), thereby suggesting the predictive relevance of joint problem solving to the model. Two other patterns are noteworthy in Model 1: (a) the direct effects of the predictors on the dependent variable remain significant across all model steps and (b) the direct effects of interaction term on the dependent variable remain non-significant.

Model 2 is used to test Hypotheses 2, 3, 4and 5, in which using the independent variables predict joint problem solving (the mediator). Hypothesis 3 predicted a positive relationship between trust and innovation performance that is mediated by joint problem solving. As Step 1 in Model 3 shows, the relationship between trust and joint problem solving was positive and significant ($\beta = 0.246$; $p < 0.001$), which supports hypothesis 2. Since the relationship between Joint problem solving and firm innovativeness was also positive and significant (Model 1, Step 2). Furthermore, the direct effect decreased from trust to firm innovativeness. ($\beta = 0.155$; $p < 0.5$) when considering the mediator, suggesting that the relationship is partially mediated. This result supports Hypothesis 3. Hypothesis 4 predicted a positive relationship between learning and Joint problem solving, which was also supported ($\beta = 0.381$; $p < 0.001$). The results also support the mediating relationship through Joint problem solving proposed in Hypothesis 5 (see table 3).

Hypothesis 6 proposed that trust and learning ties in buyer and seller relationship complement each other in enhancing innovativeness, i.e., trust and learning exhibit positive interaction effects. We therefore first created an interaction term (trust x learning). We used Lance's (1988)[iii] residual-centering technique to overcome distortion of the main effects due to the tendency of main effects and interaction terms to be highly correlated. This interaction term was added to Model 2 in Step 2 to test Hypothesis 5. The interaction term had a positive and significant relationship with joint problem solving ($\beta = 0.129$; $p < 0.05$), and its addition to the model led to a statistically significant ($p < 0.05$) increase in explained variance, supporting Hypothesis 6. Furthermore, as the relationship between the interaction term and the mediator was positive and significant as just discussed; the relationship between the mediator and Innovation performance was also positive and significant ($\beta = 0.185$; $p < 0.05$) as previously described. And also, the direct effect from this interaction term (Step 3, Model 1) was non-significant. This suggests that the influence of the interaction between trust and learning on the dependent variable is fully mediated by joint problem solving, supporting Hypothesis 7. Figure 2 depict the summary of results.

Model 3 shows that the interaction between learning and environmental competitiveness is negative and significant ($\beta = .148$, $p < 0.1$), to plot this interaction, exploitation relationship and environmental competitiveness took the values of one standard deviation below (i.e., low level) and above (i.e., high level) the mean. The plot of the interaction is shown in Figure 3, which identical with H9. But H8 was not supported.

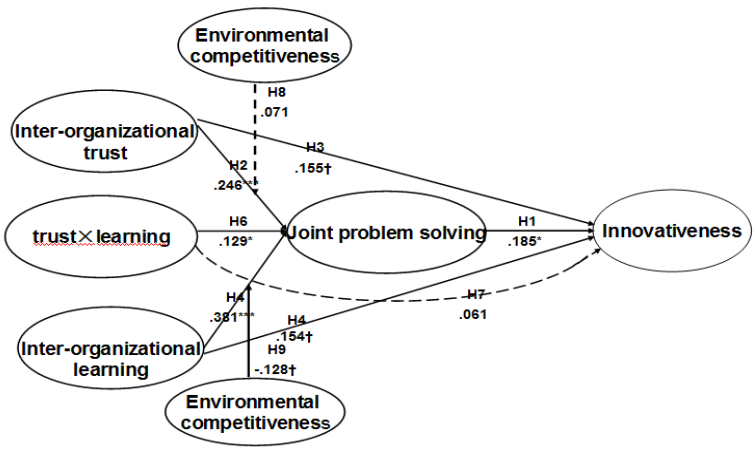

Fig.2 Summary of results for buyer innovation performance

Table4 Results of regression analyses

variables	Model 1 firm Innovation performance				Model 3 Joint problem solving				
	Step1 controls	Step2 IV(main effect)	Step3 Interaction term	Step4 mediator	Step1 controls	Step2 IV	Step3 Interaction	Step4 moderator	Step2 Interaction
	Std. β	Std. β	Std. β	Std. β	Std. β	Std. β	Std. β	Std. β	Std. β
Industry	.072	.071	.068	.080	-.071				
business type	-.081	-.102	-.100	-.094	.002*				
firm size	-.175*	-.182*	-.178*	-.167	-.028				
sale Revenues	.199*	.194*	.191*	.175	.096				
total asset	.082	.085	.085	.090	-.048				
district	.176*	.11†	.117†	.103	.161				
Trust		.216**	.207**	.155†		.246***	.268***	.241***	.238***
Learning		.229**	.226**	.154†		.381***	.420***	.412***	.405***
Trust× Learning			-.037	-.061			.122*		
Joint problem solving				.185*					
Environmental competitiveness								-.069	-.088
Trust x EC									. 071
Learning x EC									-.128†
R^2	.063	.196	.193	.212	.042	.319	.334	.324	.335
Increase in R2	—	.137***	.001	.023*	—	.277	.015*	.005	.011†
F-value	3.05**	6.55***	5.83***	5.91***	1.29	10.25***	9.70***	9.25***	7.89***

† $p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (two-tailed test)

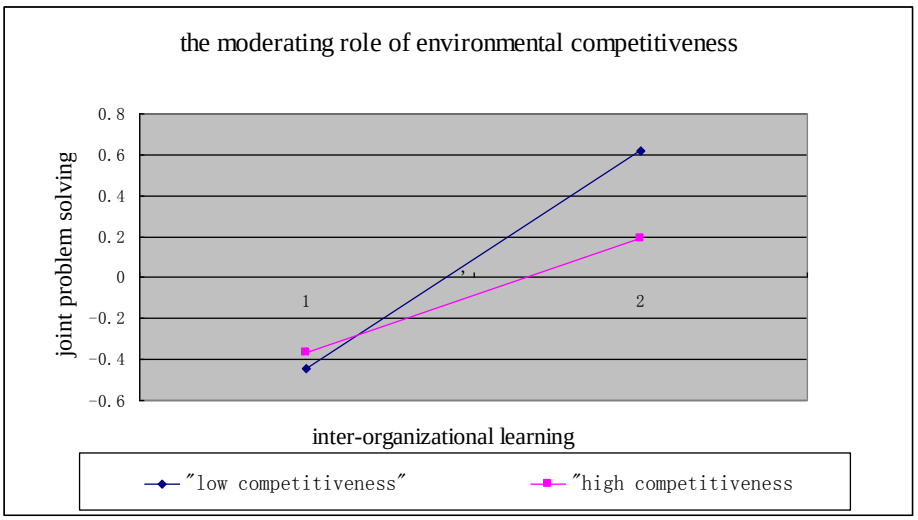

Fig.3 Inter-organizational learning in Environmental Competitiveness

X. Explanation and Conclusion

The objective of this study was to examine the tensions and complementarities between inter organizational trust and learning in influencing innovativeness in buyer-seller relationships. We found that trust and learning both have a positive impact on innovation performance because they facilitate joint problem solving at the firm level and the relationship between trust, learning and joint problem solving was moderated by environmental competitiveness. We also find that trust and learning have a positive interaction effect on the outcome variable.

A. Theory implications

The present study makes several important theoretical implications for the research stream of supply chain management, strategic alliances, and for the broader strategy literature.

Firstly, this paper builds on previous work by explicitly examining the underlying mechanisms that facilitate the acquisition of innovative capabilities from external sources. The results showed that joint problem solving partially mediate the influence of trust and learning and fully mediates the complementarities effect on innovativeness. A significant mediating role of joint problem solving illustrates that external ties facilitate integration of a broad repertoire of specialized knowledge from collaborating alliance partners at firm level, which in turn influences the successful realization of innovation, which is consistent with the finding of Tiwana (2008) at the project level. The joint problem solving perspective therefore offers a theoretical explanation for *how* tie characteristics and tie contents influence innovativeness.

Second, this research is to reveal the heterogeneous influence of different features of embedded ties on the acquisition of innovativeness in deferent environment conditions. We have further developed some intriguing arguments that the moderating effect of environmental competitiveness differs for the two types of tie features.

Third, another contribution of this research is to reveal the heterogeneous influence of different features of embedded ties on the acquisition of innovative capabilities. Inter-firm collaborative linkages are associated with two distinct kinds of network benefits. First, they can provide the benefit of resource sharing, allowing firms to combine knowledge, skills, and physical assets. Second, collaborative linkages can provide access to knowledge spillovers, serving as information conduits through which news of technical breakthroughs, new insights to problems, or failed approaches travels from one firm to another. As for the role of learning and trust, on the one hand, the successful accomplishment of novel solution requires the knowledge-spillover benefits provided by learning, but on the other hand, collaboratively joint problem solving with resource-sharing requires high level of trust. It may be described as the tension between 'the idea problem' versus 'the action problem. (Obstfeld, 2005iv).Therefore, a buyer-seller relationship is high on both trust and learning may be described as the ideal configuration (Tiwana, 2008; Burt, 1992).

B. Managerial implications

The two issues raised above have important practical implications for modeling the impact of tie characteristics on organizational outcomes.

Firstly, the relative value of trust versus leaning is likely to depend on the degree to which the benefits provided by trust and learning. To the extent that inter-firm trust and learning provide different types or amounts of benefits, the possibilities of substitution between "trust" and "learning" ties may be limited. Besides considering about the internal environment of the firm to choose the partner, the external condition is a key factor to be considered especially in transition market.

Secondly, to realize the impact of the relational recourses engender by inter-firm ties on firm innovativeness, joint problem solving is very critical. In this study, joint problem-solving arrangements is the more prominent driver of innovative capability acquisition and acts as a critical linking mechanism between ties features and the acquisition of innovative capabilities.

Especially, two-way repeated interaction over time based on trust is very important for transferring the tacit knowledge underlying an innovative capability since the recipient rarely assimilates the knowledge completely in a single interaction, but requires multiple interactions. For this reason, establishing an effective joint problem solving mechanism can be considered a relatively immobile resource that is difficult to acquire quickly, which represent a network resource that is somewhat inimitable and sustainable source of competitive advantage.

C. Research limitation

This study has several limitations that also suggest directions for future research. First, his use of self report data may pose such potential problems as the limited recall of the respondents, biased perceptions of past realities, and common method issues. However, although our post hoc examination and validation analysis indicated no serious common method problems, Further study should try to collect data from different parties (e.g., supplier or customer) to investigate the antecedents and outcomes of joint problem solving from multiple viewpoints. Since the supplier also plays a significant role in affecting the quality of the dyad, there is a need to examine the exchange relationship from the supplier's perspective as well. Second, we assessed tie characteristic from leaning and trust, those are central and important factors in inter-firm relationship, but still imperfect proxy for tie features. Future work should attempt to add other variables that may influence joint problem solving arrangement like commitment, interdependency to the model.

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Instruments That Are Need To Ensure The Credibility Of Environmental Information

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Abstract: **The main objective of the paper is to bring to the forefront the environmental audit, the environmental risk when auditing financial statements, in order to obtain an image on what environmental aspects represent in the field of audit. Objectivity of environmental information can be achieved only by means of the management control and audit process. In order to reflect an accurate image on the environmental impact within a company, we have tried to supplement the accounting model for environmental information presentation with the mechanism meant to ensure the objectivity of information provided. The paper supplements previous studies regarding environmental management and audit and brings a model for environmental accounting and management of information**

Keywords:-environmental reports, environmental management, environmental audit, financial audit

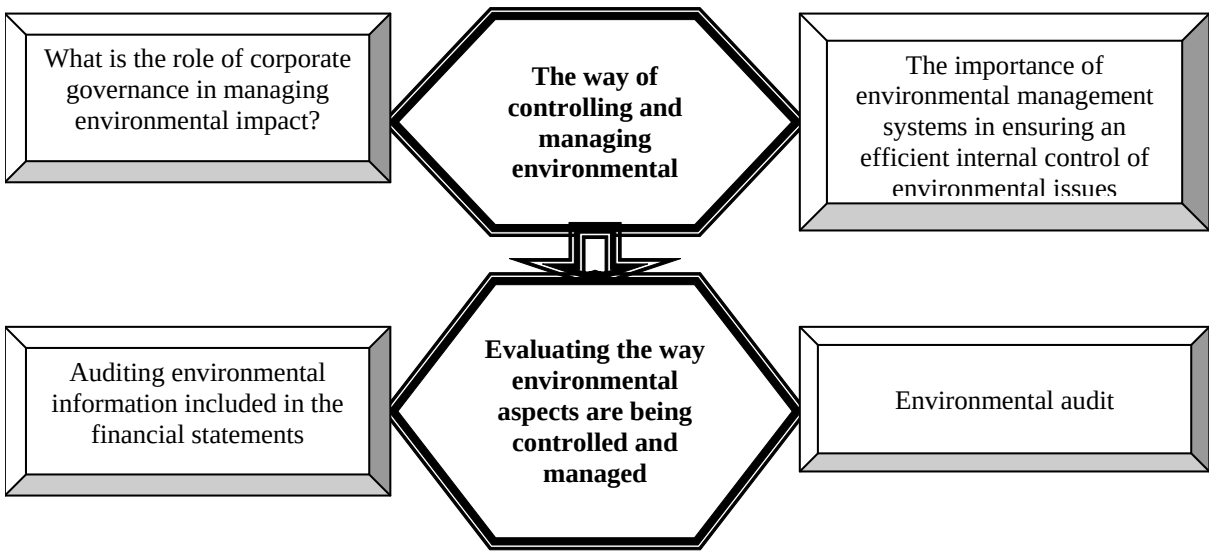
I. Introduction

The deficit and degradation of natural resources, as well as the accidents related to environmental pollution emitted by multinational corporations have incited economical, political and social debates concerning these issues and generated significant concerns from many companies and governments. The industrial development, sustained by the economic and technological progress, has been criticized for its devastating impact on the environment, these companies having been urged to become responsible as far as their impact on the environment is concerned. In response, many companies have begun to report ecologic activities and environmental performance and these aspects fall under the attention of the company's management, accounting professionals, researchers, regulation bodies and media. Large scale use of environmental reporting for a variety of purposes poses the problem of whether this information is objective or not. Checking the objectivity of such information can be performed by means of audit process. The same as for environmental information included in the financial statements the information presented in the environmental reports and sustainable reports are also the subject of audit process. In a study conducted by KPMG regarding the publishing of environmental information, it has been proven that most companies audit the environmental reports independently from the financial reports and that the number of companies auditing their environmental reports is increasing (Bențianu and Georgescu, 2008).

II. Research Methodology

The objective of the research paper is represented by the presentation of environmental management, environmental audit and environmental risk when auditing financial

Figure1. Scheme for the research undertaken



Source: representation created by the author

statements, in order to have an image of what environmental aspects mean in the audit sphere. The research undertaken could be represented as follows (Figure 1.):
The presentation of environmental management, the role of financial and environmental audit in reflecting the objectivity of environmental information supplied is based on a fundamental, theoretical research.
During this research we have raised questions which we tried to answer to:
What is the role of corporate governance in managing environmental aspects? How do environmental management systems influence the environmental performance? Which are the environmental aspects that an auditor must have in view when auditing financial statements? What is the role of environmental audit in evaluating the way environmental aspects are being controlled and managed? Which are the similarities and differences between environmental and financial audit? What is the involvement of accounting profession in the performance of an environmental audit?

III. Environmental Management

The financial scandals connected to the bankruptcies of certain British companies listed on the securities market, the Asian economic crisis of 1978 and the withdrawal of investors from Asia and Russia, have raised issues to the international business community in relation to the consequences that investors' mistrust might have on the companies management. They resulted in mobilizing the governments, control authorities and investors and also the large public attention towards the fragility of the companies' governing regime and the need to rethink this system.

The main objective of this subchapter is to cover the influence management has on handling environmental impact. For this we have considered the corporate governance concept and its role in the management and control of environmental performance and reporting, respectively the utility of environmental management systems in promoting environmental performance.
The substance used to define the concept of corporate governance has changed in time, moving from a functional and economical approach of agency's issues to a more private, enclosed framework, seeking to protect both investors and other users. From our point of view, the corporate governance is most representatively defined from the user theory perspective, as it represents a mechanism able to ensure the supervision and control of actions taken by the management in order to secure the company's legitimacy (Brennan and Solomon, 2008). The user theory creates a link between the corporate governance concept and the social responsibility concept, social responsibility being the determinant factor for management to consider ethical aspects to a wider extent.

The growing importance given to social responsibility at global level has influenced the relations between owner and manager expressed by the agency theory and has expanded the corporate governance concept beyond such relations (Tuttle et al., 1997; Booth and Schulz, 2004). Nowadays social responsibility became a profitable management strategy to the extent it generates, on the long run, the credibility and trust necessary for a company in her relations with everyone depending upon, shareholders, business partners and clients. The increasing importance of social responsibility makes us state that it has become difficult to differentiate corporate governance and social responsibility in the world economic landscape (Gill, 2008). Corporate governance, based on ethical codes of conduct, social responsibility and commitment to the society, represent an essential factor of environmental performance, management of company's environmental impact, as well as the company's environmental reporting.

Aside from the corporate governance, another important element environmental management uses to control and manage the environmental impact is the implementation of environmental management systems witch should be seen more likely as an organizational approach than a technical instrument. Such a system could be defined as a component of the company's management system, handling environmental aspects management as well as meeting the highest standards with regard to environmental performance.

From the point of view of standards evolution in the field of environmental management systems, the most known are the European standard EMAS (Eco-Management and Audit Scheme) and the international standard ISO 14001 (The Environmental Management System) standards that help improving the company's image, increase its credibility before investors, authorities and other interested parties (Biondi *et al.*, 2000; Rojanschi *et al.*, 2004).

IV. Financial Audit And Environmental Aspects

The parties that are interested in a company's financial statements need to be certain that these reports reflect a clear and complete image of the company's performance and position. Auditing financial statements or financial audit provides such assurance, thus playing an important part in providing credible and objective information to interested parties.

The specific role of financial audit process is to evaluate and report the conformity of information included in the financial statements to a series of preset criteria. The objective of financial audit is to give the auditor the possibility to express an opinion regarding the degree in which financial statements are being elaborated in conformity, under all significant aspects, to an identified accounting reference system. When environmental aspects are significant to a company, there is a risk for occurrence of significant misrepresentations or inadequate or incomplete presentation of information within the financial statements. In such cases, the auditor must pay proper attention to environmental aspects during audit of financial statements.

After having brought environmental aspects to the forefront of financial audit and the importance of financial audit related to environmental performance management, we have

analyzed the aspects an auditor must have in view in order to discover the risk of significant misrepresentations in the financial statements due to environmental aspects: getting to know the client, evaluating the risks and the internal control, the role of valid legislation and regulations, the basic procedures.

As shown in our previous researches, the financial statements are incomplete or insufficient in order to reflect an accurate image of the company's environmental impact. Environmental management accounting and the environmental reporting represent the two pillars supplementing the shortcomings of the traditional financial accounting system as far as company's environmental impact is concerned. If the environmental aspects included in the accounting standards and regulations are certified by means of financial audit, as presented above, we have questioned ourselves: who handles the certification of information provided by environmental management accounting and information included in the sustainable reports, more precisely the environmental reports, in order to offer environmental information users an assurance regarding the accuracy of such information? The response to this question is the environmental audit.

V. Environmental Audit

The increasing number of voluntary environmental reporting by the developed countries companies, as well as the legal requirements related to reporting certain environmental aspects in many European countries (Denmark, Holland, Norway, Sweden etc.) and more (USA, Canada, Australia etc.) raised issues regarding the certification of information included in these reports. The *environmental audit* is the response to such issues, becoming more and more accepted in various sectors of activity, because its greatest benefit is the gradual reduction of the company's environmental risk (Unhee, 1997; Stanwick and Stanwick 2001, Mishra *et al.*, 1997).

Environmental audit represent a basic pillar for ensuring an accurate image on the environmental impact of a company. From our point of view, environmental audit represents an evaluation of how environmental aspects are managed within a company, with the purpose of improving environmental management and securing a certain level of credibility for the environmental information provided. Therefore, environmental audit can be performed either for internal reasons, representing an instrument for evaluation, control and improvement of environmental management, or for external reasons, in order to ensure a reasonable level of assurance that environmental information evidence a clear and complete image regarding the company's environmental impact. No generally accepted principles have been issued to a similar purpose as the accounting-financial regulations to the financial audit because of the character of environmental audit which is regulated to a very small extent (Dittenhofer, 1995; De Moor and De Beelde, 2005).

Even if environmental audit is not profitable from a financial point of view, the non-financial benefits it brings (increase of company's public image, competitive advantages, assurance of credibility before clients and investors, sense of security given to the management with regard to the environmental aspects management) turn it into a profitable process or activity especially for the companies operating in industries or sectors regarded as heavy polluting or within companies that due to the activities performed or products supplied are subject to highly significant environmental laws and regulations.

There is a large number of purposes environmental audit can be conducted for. The types of audit mentioned before are not performed in full by internal or external auditors. They can be conducted individually or in combinations, as they are useful to the operating units, management and individuals using environmental reporting, in order to ensure credibility of environmental information. In the context where sustainable reports and especially environmental reporting have experienced a particular development lately, there's the question of objectivity for the data included in such reports. Thus, a distinct importance in ensuring the objectivity of environmental information is given to auditing environmental reporting, mostly conducted by external auditors, to increase interested parties confidence.

We have also conducted a comparative approach of environmental and financial audit. The regulatory status of environmental audit is quite different momentarily to the financial audit, for which most countries have elaborated sets of standards. Although focused on financial audit, some of these standards are directly relevant for environmental aspects as well. As a result of lacking a set of general set criteria and the complex nature of environmental information users creating a multitude of purposes and objectives for the report, auditing an environmental report, respectively a sustainable report, is a much more difficult of a process compared to auditing financial statements, which makes the accounting profession to avoid involvement in the performance of environmental audit. From what we mentioned above, it appears that, in case of environmental report auditing, it is almost impossible, or at least inefficient from a financial point of view, to supply a high degree of assurance regarding the quality of the environmental report taken as a whole. The auditor's opinion can include several degrees of assurance for different sections of the environmental report (Wallage, 2000; Karapetrovic and Willborn, 2001).

By means of two questionnaires applied to financial auditors in Romania and individuals certified to elaborate evaluation studies for environmental impact (EEI) and environmental balance sheets (EB), we have analyzed the involvement of accounting professions in the performance of environmental audit. Following the conducted study we can conclude that in the financial auditors' opinion, Romanian companies give an insignificant importance to environmental aspects, the information they provide being general, insufficient and unclear to be able to reflect the company's environmental impact. The Romanian financial auditors, although they would wish to get involved in such missions, very few of them take part in certification of sustainable reports, environmental balance sheets or other environmental audits. Perhaps this is due tot the very small demand for

certification of sustainable or environmental reports (such reports in Romania are not mandatory), as for the other types of environmental audit, the accounting profession and financial auditors feel that non-existence of a guide on how to perform an environmental audit, as well as the lack of certain necessary technical knowledge are the biggest impediments to their involvement in performing environmental audits. The poor involvement from financial auditors in the performance of environmental audit is also confirmed by the persons certified to elaborate evaluation studies of environmental impact (EEI) and environmental balance sheets (EB). Certified evaluators consider that engineers are the most justifiable profession to perform the environmental audit, because of their technical knowledge, financial auditors failing to possess such knowledge. Nevertheless, 30% of the certified evaluators feel that financial auditors should be involved in these environmental audits; probably because despite of their lack of technical knowledge, their expertise regarding the organization and leading of an audit would represent a significant gain for the environmental audit performance. The involvement of financial auditors alongside with engineers, physicists, biologists, ecologists and other professions in the performance of environmental audit would represent a significant gain especially when it comes to auditing environmental information of financial nature, like environmental costs, environmental debts, provisions and environmental contingent debts. The conclusion was that both nationally and internationally, only a small portion of accountants and financial auditors are effectively involved in environmental audit as a result of the accountants reserve with regard to the uncertainty coming from lack of a mandatory general framework. Lacking regulations and general reporting frameworks for environmental information determine auditors to avoid the fields where their expertise might prove useful. This can also explain why professional bodies focus this much on developing general frameworks and standards in their publications. An environmental audit requires different types of abilities and as a result, the most reasonable way to organize this type of audit appears to be teamwork, by involving auditors, accountants, engineers or other experts in environmental aspects.

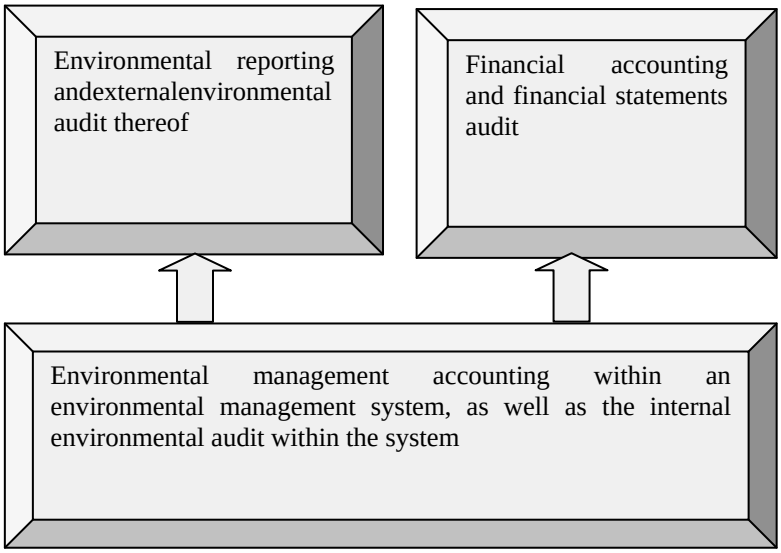
VI. Results And Conclusions

Objectivity of information can be achieved only by means of the audit process. Thus, we have tried to supplement the accounting model for environmental information presentation with the mechanism meant to ensure the objectivity of information provided, in order to reflect an accurate image on the environmental impact within a company. As a result, we have created *the responsible model for environmental impact presentation* represented as follows (Figure2):

The model is based on environmental management accounting, functioning within an environmental management system, on which an internal environmental management should be adequately performed;

The second pillar, within the model, should be represented by traditional financial accounting, financial statements being subject to financial audit;

The third pillar should be represented by environmental reporting and auditing thereof within the external environmental audit.



Source: representation created by the author

To be mentioned that the corporate governance, based on codes of ethical conduct, social responsibility and commitment to the society, represent an essential factor for environmental performance, management of company's environmental impact as well as the environmental reporting within a company.

Following a comparative analysis between financial and environmental audit, we were able to point out that, due to non-existence of generally set criteria as well as the complexity of environmental information users, creating a multitude of objectives and purposes for the report, the process of auditing an environmental report and a

sustainable report respectively is a much more difficult process by comparison to the auditing of financial order to be able to reflect how much the accounting profession respectively the Romanian financial auditors involve into the performance of environmental audit, we have utilized the questionnaire as research method, applied to financial auditors on one hand, and legal and natural statements, which determines the accounting profession to avoid involvement in conducting environmental audit. In persons certified by the Ministry of Environment and Sustainable Development to elaborate evaluation studies on environmental impact (EEI) and environmental balance sheets (EB) on the other hand.

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Emotional And Partnership Intelligence Of The Team's Members In The Administrative Activities Of The Public Entities Or Institutions

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GJMBR Classification (FOR)
150304 M13 M14

Abstract- **The questions the manager has to answer taking into account the conditions in administrative activities of public entities, in the practice of forming and making functional a truly competitive team, are those concerning the way in which he will manage to select the members of a relatively homogeneous team and adequate to the future programme, followed by what type of responsibilities will be assigned to the team, then the way through which the responsibilities will be communicated to him and, finally, the way in which the tasks will be awarded individually. The principles of functioning of a competitive team in public entities or institutions are the principle of the refusal of the identity, of the primacy of the project or of the administrative activity, of choosing the team's manager as the center of the relational network within the team, of multidimensional thinking and of systemic action of the team, of the quality of the team's spirit. The creative manager can possess multiple types of intelligence, ranging from the verbal-linguistic or visual-spatial one, to the kinetic or rhythmical-musical one, from the category of interpersonal or intrapersonal one, to the social intelligence, from the naturalistic one, to the academic or intellectual intelligence, supplemented by the emotional and partnership intelligence. This paper details and quantizes the main types of intelligence which co-operate with the aggregation in the final competitive intelligence of the team in administrative activity.**

I. Introduction

The first four questions to which the manager has to answer taking into account the conditions of conditions in administrative activities of public entities, in the practice of forming and making functional a truly competitive team, are those concerning the way in which he will manage to select the members of a relatively homogeneous team and adequate to the future programme, followed by what type of responsibilities will be assigned to the team, then the way through which the responsibilities will be communicated to him and, finally, the way in which the tasks will be awarded individually. Administration's reality signals and identifies five principles considered vital for the "team spirit approach of any type of project or administrative activity in the economic and social field. A first principle of the" functioning of a team is that of the refusal of the identity, expressed already recognized formula "two identical people can never constitute a real team capable to solve a complex project". We must also carefully evaluate the extreme situation according to which they are so different that there is no common language between them. The aggregation of the qualitative diversity of the team's members has definitively replaced their mere quantitative aggregation, in the entire cycle of life of the administrative activity, from initiation to implementation or its putting into practice. The refusal of the identity couples irremediably through project with the heterogeneity of the team's members.

A second important principle is recognized under the assertion of the primacy of the project or of the administrative activity.

Thus, a project or a administrative activity exists and resists as long as the members of the team understand that the spirit of the team is subordinated, as the whole team itself, to the spirit of the project or of the administrative activity. As a consequence, the modern society through generalization, will encourage the competitive projects, and not eternal or "rigid" public teams or public institutions.

A third principle is summarized in the formula it is recommended that the team's manager be the center of the relational network within the team. Giving practical details, we can say that any team has a relational center, identical with the manager "de facto" of the project or administrative activity, to whom the whole team should be subordinated. Normally, this manager "de facto" will become the formal manager, being the person within the team's network who has the maximum number of real connections with the team's members. The team which does not cultivate, but denies or reduces the center, cancels the project or the administrative activity and sentences itself to disappearance.

A fourth principle is the principle of multidimensional thinking and of systemic action of the team. According to this principle the team's thinking way differs qualitatively and essentially from the thinking way and individual action of the team's members, these achieving the project or the administrative target through a multidimensional, systemic or "whole" approach and not as a result of the reunion of the partially individual approaches (mono-dimensional). As it can be easily noticed the analogy with the difference between the mere totalization and the statistic type aggregation is evident.

The fifth principle, that of the quality of the team's spirit states that the team spirit in achieving the project or administrative activity is also from a qualitative point of view fundamentally different from the individual spirit of

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those who make up the team and set as a target the project or administrative activity.

The co-operation, solidarity and cohesion spirit or, in public or administration terms, the partnership spirit, the partnership intelligence and the evolution towards a total partnership, can all be educated, acquired and accumulated.

In modern competitive economies, public projects, public entities or public institutions, the efficient management of the team centers on, among others, three successful criteria of its structure:

1. it is recommended that the team's manager does not come from the scientific or professional field characteristic to the project or administrative activity,
2. the success of the project or administrative activity is inversely proportional to the value disappearances of the intelligence level of the team's members,
3. the close individual practical performance of a team's members raises the chance for the project or administrative activity to be finally declared competitive or successful.

The inefficient management of a team is caused, among other things, by the manager's over-implication in technical details of the projects or administrative activity, by the team's polarizing heterogeneity and by inequalities of individual practical performance of the team's members.

2. Emotional and Partnership Creativity and Intelligence of the Team's Members, Factors for Influencing the Efficiency of Public Administration

The concept of creativity was introduced in the scientific language by the psychologist Allport G. W., being associated to other people who showed a capacity, ability and intelligence over the usual or common level. The creative person was thus considered over gifted as compared to the medium intelligence level. A creative individual is original, innovator and adequate to the reality. The creative person can possess many types of intelligence, ranging from the verbal-linguistic or visual-spatial one, to the kinetic or rhythmical-musical one, from the category of interpersonal or intrapersonal one, to the social intelligence, from the naturalistic one, to the academic or intellectual intelligence, supplemented by the emotional and partnership intelligence.

A modern vision on the competitive type of human intelligence is generally considered three-dimensional, comprising synthetically the academic or intellectual intelligence (theoretical), defined as aggregate capacity to reason, to express oneself and calculate together with cognitive abilities, emotional intelligence, synthesizing people's capacity to solve problems and to face challenges and difficulties, as well as partnership intelligence, reuniting the ability to build relationships with that of developing trust, simultaneously with achieving some predetermined objectives through association with someone else.

Academic, intellectual or theoretical intelligence can be measured with the help of the IQ (Intelligence Quotient), which actually represents an indicator, an index of the development level of intelligence, established by reporting the mental age to the real or chronological age. A person is considered over gifted or creative when he/she obtains in the IQ specific test for "academic or intellectual" intelligence a general score over 140 points. A male person with a high IQ is ambitious, persevering, productive, calm, imperturbable, predictable, critical and condescending, difficult and inhibited, and in the case of a female person the prevailing features are those of confidence in the intellect, in the force of knowledge of the reason, in appreciating the intellectual and aesthetical values, as well as the tendencies towards introversion and anxiety. The quotient which measures the inborn intelligence is relatively the same during lifetime. Such an understanding leaves unexplained various situations in which people with a medium or relatively low IQ has successful results. On the other hand, what makes other people, with a high IQ, have failures or stagnate in their careers? The answer to this apparent paradox is the way each of them uses his/her emotional intelligence. The term of emotional intelligence was used for the first time in 1985 by Wayne Leon Payne in his PhD thesis with the meaning of ability which implies a creative relation with states of fear, pain and desire. The definitions of emotional intelligence are quite different. Starting from their authors we can distinguish a number of no less than three categories of significances relatively different. According to the first conceptual delimitation belonging to Professor Peter Salovey from Yale Univesity and Professor John Mayer from University of New Hampshire, emotional intelligence implies the abilities to perceive emotions as correctly as possible and to express them, to accede to or generate feelings when they facilitate thinking, to know and understand the emotions in order to promote intellectual and emotional development .

In his studies, Reuven Bar-On, PhD Professor at the University from Tel Aviv, defines emotional intelligence as a reunion of the intrapersonal aspect (defined through optimism, respect and being aware of self emotions, self-achievement, emotional interdependence), of the interpersonal aspect (empathy, positive inter-relations, social responsibility), of the adaptability (testing the reality, flexibility), of the stress control (stress tolerance, impulse control) with the general state (self-satisfaction). The most popular and attractive conceptualization of emotional intelligence belongs to Daniel Goleman and it contains as substance elements the following: self-knowledge (self-trust), self-control (adaptability, desire for truth and innovation), motivation (initiative, self-abnegation, optimism, desire to conquer), empathy (understanding others, politic capacity), and social aptitudes (conflict management, communication, showing interrelations, collaboration, co-operation). Emotions are important as they ensure survival, making decisions, establishing limits, communication and harmonization with the environment and with ourselves. After 1995, Daniel Goleman practically changed the coordinates of the concept into the "success in life", including the success of a team, of a partnership or of a project, he revealed the way in which we relate with ourselves and with the others. Emotional intelligence

guarantees to a higher degree the success in life rather than accumulating titles and diplomas. Daniel Goleman explored the role played by emotional intelligence in management, including project management. Starting from the connexions demonstrated by neurology between the success / the failure of a team or of a partnership and management style, the authors state that the health of the project (of the promoter organization) greatly depends on the capacity of project management or of the team's manager to "administer his/her emotions". If the manager shows energy and enthusiasm especially in difficult situations, the promoter organization of the project prospers, and if the manager transmits negative emotions or discord, then the team, the partnership, the project or the administrative activity will suffer together.
Managers can learn how to evaluate, develop and perpetuate the competences belonging to emotional intelligence, as empathy or opening towards the states, thoughts, feelings and actions of the other and self-knowledge, becoming thus a source of inspiration for the others and cultivating the resonant methods of forming and leading teams. Any person who acts as a manager "de facto" and exercises a real leading function in the team he/she is part of, becomes directly interested in the knowledge which will increase individual performances and, obviously, those of the team, generating the satisfaction of a successful relationship with oneself and with the others, either within the limited framework of the team or within the large framework of the partnership or project. The "Goleman" test, bearing its author's name, Daniel Goleman, a test which has been conducted among 6 year-old children, who have been asked to choose as a reward, among other things, either to eat a sweetmeat "immediately" or two sweetmeats "later on", revealed through correlations made a few years later, that the majority of those who "put off" the reward had more successful professional and personal relationships as compared to those more opportunist and individualistic. The psychological profile of people as compared to the their level of emotional intelligence polarizes, in Daniel Goleman's view, in two distinct limiting affective typologies: the passionate, whose emotional reactions are exaggerated and, the indifferent, who tends to ignore completely the seriousness of a problem, female persons being generally capable to reach some limits placed in a much larger field of variation as compared to the male persons. The relationship between emotional intelligence and team management is very strong. Selecting a project or administrative activity manager, as well as that of a team manager, will always be performed by one of the people with a very high EQ (appendix no. 1).
Management performed with the help of a high emotional intelligence presupposes that the leader "de facto" capitalizes:

1. the ability to use emotions as source of positive energy in the project's or administrative activity' team,
2. the ability of not getting over conflicts and of using them as source of feed-back,
3. considering the feelings and emotions of the team's members important variables in insuring the success of a project or of a administrative activity,
4. knowing and ameliorating the emotional difficulties of the team's members,
5. creating a productive, stimulating, motivating, special and safe working environment in the team, in which its members should feel important and respected.

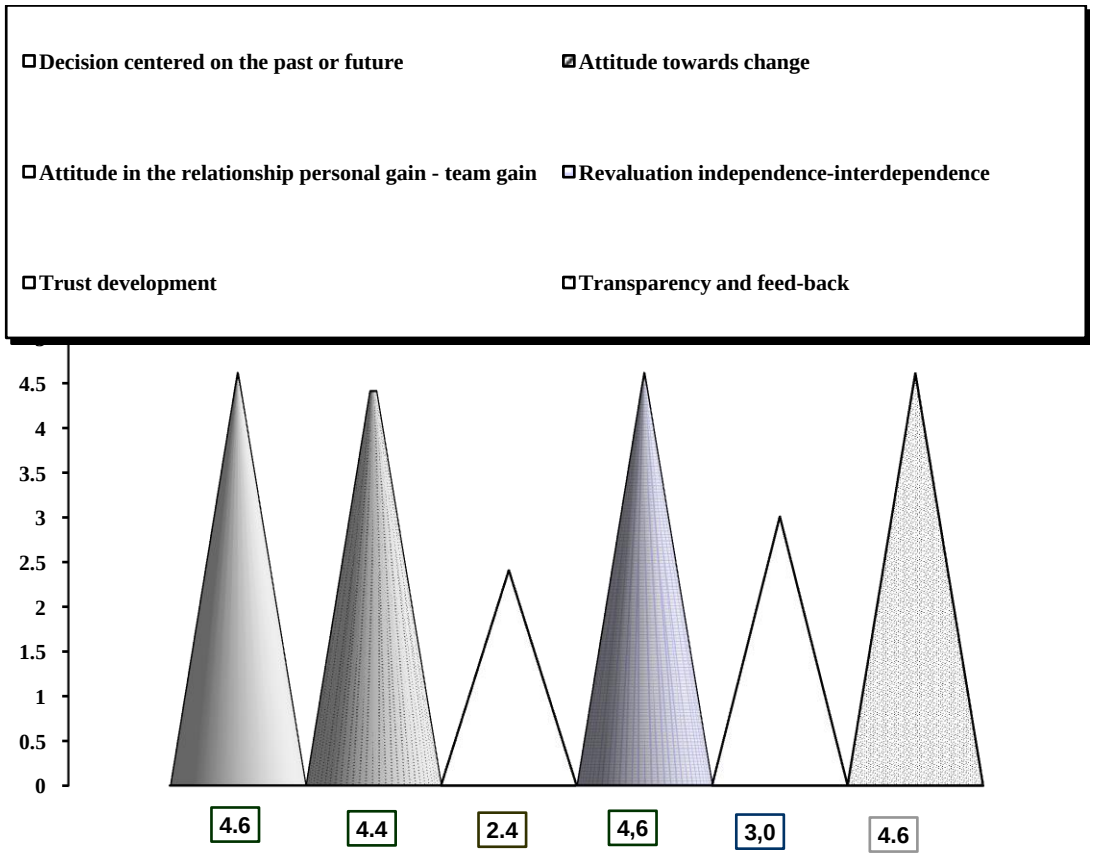
A team manager in the case of a partnership or project, or in a competitive administrative activity cannot be successful if the level of his/her emotional intelligence is low or, even worse, if he/she does not show a *metadisposition* of a high level, respectively a special capacity to be aware of his/her emotions and states: "I think well and I lead well when I am joyful, and especially when I am in good spirits, so necessary to the others". One of the major problems of the project or administrative activity competitiveness is forming a homogeneous team, capable to perform on time the project or administrative activity. If both academic and intellectual intelligence, and the emotional one are relatively stable, being genetically or innate printed ever since the individual's beginning of life, the third form of intelligence, respectively the partnership one is the only one which can be greatly improved and in a relatively short period of time.
Compared to the individual results of the tests, the IQ and EQ level confirm the things related previously concerning the fact that these change relatively little during human lifetime, the test of partnership intelligence (PI) through specific PQ evaluates an acquired intelligence which oscillates in time, improving continuously as a final result, through a careful self-knowledge.
For the example of test filled in appendix 2, with the mentioned total score of 118 points, which means a high partnership intelligence, one can determine the values of the specific vectors (the general medium value of a question being high, respectively of 118 /30 = 3,93 points). These values are detailed as follows, and in the end each of the medium values calculated explicitly are shown in a graphic, for the person tested within the table below

Cassette no. 1
Vector I – decision centered on the past or future (questions 1; 11; 17; 19; 25), medium value = 23 / 5 = 4,6 points
Vector II – attitude towards change (questions 2; 5; 12;18; 27), medium value = 22/5 = 4,4 points
Vector III – attitude in the relationship between personal gain and team gain (questions 3; 13; 20; 23; 30), medium value = 12 / 5 = 2,4 points
Vector IV – complex revaluation independence-interdependence (questions 4; 6; 10; 14; 29), medium value = 23 / 5 = 4,6 points
Vector V – trust development (questions 7; 9; 15; 22; 26), medium value = 15 / 5 = 3 points
Vector VI– transparency and feed-back (questions 8;16; 21; 24; 28) medium value=23/5=4,6 points.

The analysis of values emphasizes the two directions which will be improved in order to raise the level of partnership intelligence, the

attitude in the relationship between personal gain and team gain, at the present the situation being obviously in the disadvantage of the team (2,4 points) and the capacity to develop trust among the members of the team (3 points).

Graphic no. 1



Source: Data generated by the answers marked X within the test from appendix no. 2

A partnership intelligence through the high level of the final score, respectively a PQ situated over 110 points, presupposes at least a medium development of all specific vectors. A partnership intelligence through a low level of the final score, in other words a PQ situated below 71 points, can endanger a partnership and even the whole project as itself, presupposes a development below medium level of the majority of the specific vectors, which will impose its urgent improvement. The problem of determining the values of individual PQ of the team's members presents the greatest importance as global analysis, as homogeneity of data series of these vectors.

A team made up of members with similar individual values as level, but also as values will manage to finish a project, whereas a heterogeneous team or completely polarized one will certainly break up, turning the project or administrative activity into a failure. As each project or administrative activity is unique, in the same way each team of performing it cannot be but unique and unrepeatable and there are not safe "networks" to ensure the survival in time. The tests presented allow the building up of homogeneous teams whose risk or probability of breaking up is low.

II. Final Remark

21st century management has widened the already quite various typology of intelligence specific to the leading act, yet with another form for which we foresee an exceptional future, "*existential intelligence*". This type of intelligence amplifies the empathetic character of management (politic, economic or social) of major projects or administrative activity, evaluating a special talent, a very rare ability, respectively that of answering convincingly the most delicate of the questions of the team's members, concerning the existence and meanings of their common activities, cultivating the feeling of common belonging, simultaneously with the praise of the individuality. This type of intelligence will certainly characterise the leader or the manager of governmental institutions and multinationals.

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APPENDIX 1

The test used in Romania concerning emotional intelligence, in its specific variant for adults, was adapted by Mihaela Roco as a mixed solution for the Bar-On test with Goleman. The author imagined ten hypotheses (scenarios), leaving the respondent the freedom of choosing from the four variants of answer:

THE TEST FOR EMOTIONAL INTELLIGENCE, ADAPTED FOR STUDENTS AND MASTER DEGREE STUDENTS AFTER THE ROCO VARIANT
Answer by choosing what you would do concretely (actually)and without thinking about how the ”proper” answer should be according to the dominant social mentality.
1. Imagine you are having a class and the earth starts quaking strongly, with a frightening sound. What will you do? a.) You continue to stay still and listen to the professor’s lecture, paying practically little attention to the event and waiting for it to stop as soon as possible; b.) You become very aware of the danger listening to the professor and to the instructions given by him/her; c.) A little bit of a.) and of b.); d.) You do not notice anything.
2. You are in the university courtyard during a break, among students. One of your classmates, not being accepted in the dialogue by the others, gets angry and then mad in an obvious way. What will you do? a.) You do not get involved, you leave him/her alone; b.) You talk to him/her and try to offer your help; c.) You go over to him/her and tell him/her not to be upset; d.) You try to tell him/her a joke or anything else to make him/her forget about it.
3. Imagine you are midway your last term, hoping to get a scholarship, but you discover that you do not have a desired grade in a subject, but a much lower one than you expected. What will you do? a.) You make up a plan to prepare yourself to get a bigger grade, making up your mind how to pursue the plan until you can pass your exam again; b.) You decide to learn better for the next exam session; c.) You tell yourself you are no longer interested in the respective subject and you focus on others where your grades are or can be bigger; d.) You go to the professor and you try to talk to him/her in order to get a bigger grade.
4. Considering the hypothesis that the chief of your group is missing and you are his/her replacement, you discover that as a consequence of lack of discipline five students have already been warned by the professor during class and you are discouraged because of this situation. What will you do? a.) You write down the names of the undisciplined students and you hand in the list to your adviser the next day; b.) You consider you could not take this responsibility; c.) You try to talk to the students suggesting solutions for keeping discipline and making the situation right; d.) You want and you give up your position of chief replacement and you become responsible for anything else.
5. You are a member of an association which fights against ethnical and racial discriminations and you found out that starting the next day you will have a gypsy (rrom) group mate. You catch somebody saying malicious words about him/her. What will you do? a.) You ignore him/her thinking it was a joke; b.) You call your malicious colleague outside and you scold him/her for his/her deed; c.) You talk to him in front of the others saying that his/her deed is inappropriate and will not be accepted in your group; d.) you firmly advise your colleague to polite and respectful with all the colleagues.
6. You are on the stairs of the lecture room and you try to calm down an angry colleague with another one who has tripped him/her up, risking thus to break his/her leg. What will you do? a.) You tell him/her to forgive him/her because it was only a joke; b.) You tell him/her a funny story and you try to make him/her forget about what happened; c.) You agree with him/her, thinking that the other colleague ”put on a show”; d.) You tell him/her that something similar happened to you too and that you felt as furious as him/her, but that afterwards you realized that the guilty one could have fallen and broken his head.
7. You and your best friend are fighting and it seems that the dialogue becomes a violent one. What is the best thing to do? a.) You take a 20 minute break and then to start talking again; b.) You stop fighting and say nothing more; c.) You say you are sorry and you ask your friend to apologize too; d.) You stop for a while to calm down and then each, in his turn, says what he/she is thinking about the incident and its solution.
8. During the academic year there is a student theatre festivity. Imagine you are the leader of a group of students and you want to invent and participate with a funny scene. What do you in order to accomplish that fast? A.) You make a schedule and you make time for each detail; b.) You suggest meeting after classes and to get to know each other better: c.) You ask each student separately to come up with ideas; d.) You all meet in a group and you encourage the others to suggest different themes.
9. Imagine you have a three year elder brother who is always shy and a little terrified by foreign places and people. What attitude will you have towards him? a.) You accept the fact that he has ashy behaviour and you try to protect him against

situation which can trouble him; b.) You present him to a doctor asking for a piece of advice; c.) You intentionally take him in from of some strangers and foreign places so that he might overcome his fear; c.) You take part together with him in a continuous series of games and competitions easy to perform which will teach him that he can get in touch with people and walk in new places.
10. Imagine you like caricature very much. You start preparing yourself for drawing caricatures in your free time. How will you do it? A.) You limit your time for drawing caricatures to an hour a day; b.) You choose more difficult faces or human characters for your caricatures which can stimulate your imagination; c.) You draw caricatures only when you feel like it; d.) You choose models you have already caricatured or know how to draw.

The grading system of the emotional intelligence testis synthetized in the table below and its interpretation is according to the evaluation system of the final score obtained:

Table no. 1

Number of the interrogative hypothesis	Grading the answers		Number of the interrogative hypothesis	Grading the answers	
1	a, b, c	20 points	6	b, c	5 points
				d	20 points
2	b	20 points	7	a	20 points
3	a	20 points	8	b	20 points
4	c	20 points	9	b	5 points
				d	20 points
5	c	20 points	10	b	20 points

Finally, we add up the points obtained for the ten questions, the meaning of the final score obtained being the following: an EQ below 100 points means an emotional intelligence below the average, between 100 and 150 points we can identify an average emotional intelligence, over 150 points we can reveal an emotional intelligence above the average, and the level very close to or equal to 200 points emphasizes a an exceptional emotional intelligence.

The psychological profile of a male person with a high level of emotional intelligence (an EQ over or equal to 150 points), reveals a well-balanced personality in interhuman relationships, responsible, fully dedicated to noble causes, moral, sympathetic, comfortable with oneself and with the others. In the case of female persons who possess a high EQ, the prevailing features are the well-balanced, sociable, direct, positive character, having a high degree of adaptation to stress.

Actual PI evaluation *Proposed by Stephen M. Dent in the work „Partnership in business", Curtea Veche Publishing House, Bucharest, 2004, p. 37-39 and to which a Likert scale has been adapted (the score being between 1 and 5)*	**Total Agreement**	**Partial Agreement**	Indifferent	**Partial Disagreement**	**Total Disagreement**
1. I believe that over time a person's fundamental behaviour stays unchanged.				X	
2. I like to do the things I have got used to.					X
3. People say I have the tendency to enter competition.	X				
4. When I am with other people, I always make sure my desires are satisfied first.					X
5. I like everybody to obey the rules.		X			
6. I prefer to count only on myself to solve the problems.	X				
7. People have to prove themselves worthy of my trust.					X
8. I feel ill-at-ease when I have to share my feelings to other people.					X
9. I believe that deeds say more than words.		X			
10. I feel frustrated when I am part of the team.					X
11. I have the tendency to judge a person taking into consideration what he/she did in the past.					X
12. When I am in a new situation I am very stressed.					X
13. I get upset if I do not win a debate.					X
14. When I have to get some place, I prefer to depend exclusively on me.				X	
15. I like people to really show they are right.				X	
16. I believe it is good to be discreet with my personal life.					X
17. The past is a better source of predictions than a future plan.				X	

18. I am very stressed when I meet new people.					X
19. I prefer using techniques I have used before in order to carry out new tasks.					X
20. I often give up my point of view in favour of a better one.	X				
21. I rarely offer information to others about my family.					X
22. I believe it is important to supervise people, in order to see if they do what they said they would do.				X	
23. In order to reach a compromise I accept to give up something important.	X				
24. I get upset when people say offensive things about me.				X	
25. I am more interested in the real situation than in possibilities.					X
26. I prefer a signed contract to a handshake.				X	
27. I like my daily program to be planned and organized and the situation in which I have to change something bothers me.					X
28. I believe I am rather an interiorized person than an expansive one.				X	
29. I'd rather be alone than with other people.					X
30. In a discussion it is more important to be right than to protect the other person's dignity.				X	
TOTAL ANSWERS = 30	4	2	0	10	14

Determining the PQ individual level as final score to this questionnaire is performed by adding up the score of each 30 statements, checking first the presence of an answer to each statement. The lowest possible final score is 30, and the highest is 150. the proposal of using a Likert scale in the questionnaire belonging to *Stephen M. Dent*, is justified in the case of students, enterprisers, managers and partners from the new East-European market economies, first of all because of their lack of habit with state self-evaluations and then thanks to the clearer distribution of equal intervals on this specific scale, as compared to the mere presentation of a score, on any other scale (even comparatively to a differential of a semantic type, which would lead to a maximum score of 210 points and three different final intervals of self-evaluation, respectively 30-90, 91-150 and 151-210).

Table no. 2

Statement	Score	Statement	Score	The result according to the final score obtained, expressed in points (PQ) *30–70-low partnership intelligence *71–110-medium partnership intelligence *111–150-high partnership intelligence The score reveals an intelligence self-evaluated in the present, but capable of continuous amelioration. There is no correct or wrong level, good or wrong in the scores obtained. Nevertheless, we must identify how faithfully the final score reflects the present status of one's abilities as a partner. What must be done next is to gradually move towards an attitude of change and with that an increase of the score will appear.
1	4	16	5	
2	5	17	4	
3	1	18	5	
4	5	19	5	
5	2	20	1	
6	4	21	5	

The evaluation of partnership intelligence, through the level of the final score – PQ, made with the help of the Stephen Dent test offers through this general score an overall future (questions 1; 11; 17; 19; 25), the attitude towards change (questions 2; 5; 12; 18; 27), the attitude in the relationship between personal gain and team gain(questions 3; 13; 20; 23; 30), complex revaluation independence – evaluation, and through the six specific values transposes in as many graphical attributes, it also reveals in details its components: the decision centered on the past or on the interdependence (questions 4; 6; 10; 14; 29), trust development (questions 7; 9; 15; 22; 26), transparency and feed - back (questions 8; 16; 21; 24; 28).

Strategic Framework For Supply Chain Management

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GJMBR Classification (FOR)
150309 150313 150503

***Abstract*-The relevance of Supply Chain Management (SCM) strategies is much more in this competitive world, where there is fluctuating market. The theme is given by a structured model framework. There are different types of strategies in supply chain management. Some of them are sourcing strategy, inventory strategy, warehousing strategy, transport strategy, customer satisfaction strategy etc. The Strategic decisions are very crucial for an organization. Here different types of supply chain strategies are discussed.**

Keywords: Supply chain management, Strategies, Uncertainty

I. Introduction

The role of marketing cannot be ignored in successful supply chain implementation. Min and Mentzer (2000) exclusively studied the role of the marketing in effective supply chain management, marketing concept, marketing orientation, relationship marketing and its impact on supply chain implementation. They hypothesized that marketing function promote individual firms' coordinated activities inside and outside the firm to achieve customer satisfaction. Effective supply chain management requires partners to build and maintain close long-term relationship. Ellram and Cooper (1990) asserted that a successful business rely on farming strategic partnership a long lasting inter firm relationship with trading partner. Better relationship helps in inventory and cost reduction and joint planning to impart agility and success to the supply as a whole. Marketing plays an important role in implementation and success of supply chain at strategic and tactical level. It provides valuable market information and success of supply chain at strategic and tactical level. It provides valuable market information about customers, competitors, potential channel partners, and emerging business avenues and information is the key in managing supply chain agent. The management consulting industry contributes with new buzz words to stimulate and sustain interest. "Supply chain thinking" is a better characterization. It infers a gradual infusion of new mindset and methods into traditional task. Supply chain thinking brings a new perspective for managers to deal with the issues relating to products, markets, people and skills, operations and finance. Supply Chain Management (SCM is an integrative business philosophy and implementation action to manage materials information and cash flows from raw material excavation to ultimate end use. The objective of implementing Supply chain management is to reduce) Inventory level, increase customer satisfaction and build competitive advantage to create customer value. Supply chain management presents an integrated approach to resolve issues in sourcing, customer service, demand flows and distribution.

The results derived by applying SCM are as follows:

1. Reduced operational cost.
2. Improved flow of supplies.
3. Reduction in delays in distribution and increased customer satisfaction

II. Reltaionship Strategies In Supply Chain Management

In the present scenario of globalization, customer service and supply chain management is becoming significant to the corporate world. Companies are dealing with consumer through suppliers, distributors, and retailers. They want to deal with their customers directly. On the other hand consumers' demands are increasing. So companies must acquire suitable strategies for immediate flow of product and information throughout their supply chain network. The main theme is to manage customer service in order to attract, enhance and retain customer. It acts as an antidote for building long term relationship with potential customer. Customer relations help to operate the front office functions of sales, marketing and customer services. Customer relations are marketing function and target the profitable customer (Sheth and Parvatiyar, 1995). Marien (2000) lays out the four key enablers like organizational infrastructure, technology, strategic alliances and human resource management which are the key aspect of supply chain management effectiveness. Customer Relationship is technology driven. The main components include ways of customer contact like telephone, mail, personal selling, after sales service etc, call centers, automatic complaint handling, electronic point of sales and integrated information system for digital world. The major thing is to gather and segment information in order to develop customer insight for effective business. The objective of supply chain management and customer relations is not different. The purpose of implementing supply chain management is to ascertain higher customer satisfaction, increasing profit, expanding revenue base, reducing inventory, lowering product cost and increasing reliability of products. This trend confirms the finding at global level by many scholars (Cooper et al. 1997, Lambert & Pagh, 1998; Bowersox & closs, 1989).

The main objective of SCM is to fulfill the demand at a right place at the right time with right quality at the lowest possible cost. The movement of materials, intermediates and

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the final product from the producer to the consumer is called logistics. Logistics is an integral part of SCM. The relationship between supplier and company on the basis of cost, quality, speed and flexibility is given in (Table-1).

III. Managing Supply Chain To Customer Needs

Customer oriented companies need to build leading edge supply chain management system. For this, five areas must be addressed.

(i) Understanding customer service need

- Which customer-servicing elements are important to customer?
- What performance levels are acceptable?
- What value added capability can give the company a distinctive edge?

(ii) Structure and operating policies

- How many distribution centers should a company have? Where should the location be?
- What are the costs and customer service implications of supply chain network design?
- What types of supply chain network configuration make the best strategic sense:

Hence Integrated supply chain management requires careful design of three elements. They are organization structure, customer need and culture of each company.

IV. Supply Chain Redisgn Strategies

In today's uncertain environment new products are launched and businesses are born everyday. Customers are increasingly difficult to keep and costly to replace. Companies face intense competition from traditional powerhouses and new players and must continue to find new opportunities and increase efficiencies. The effect of September 11 2001 has made the global market environment even more volatile, with added security concern for global travel and logistics. So Companies increasingly focus themselves as a part of supply chain rather then a single firm competing against other individual firms (Christopher, 1998). This holds true especially in food supply chain because of self-life constraints of food products and increased customer attention for safe and environmental friendly production methods (Boehlje et al; 1995). Recent event have increased interest in supply chain management (SCM) as a means of improving the strength of supply chain. The development of SCM appears to start along the line of physical distribution and transport (Croon et al. 2000), based on the theory of industrial Dynamics, and derived from the work of Forrester (1961). The term Supply Chain Management was originally introduced by consultants in the early 1980s and has subsequently gained tremendous attention (La Londe 1998). A typical supply chain is a network of information's, materials and services possessing link with the characteristics of supply, transformation and demand.

More over Supply Chain Management (SCM) is the integration of activities relating to supply chain and management of supply chain organization and activities through co-operative organizational relationships, effective business processes and high levels of information sharing to create high performing value systems that provide member organizations a sustainable competitive advantage. The beginning of a supply chain can be traced back to "Mother Earth", that is the ultimate original source of all materials that flow through the chain (eg. iron ore, coal petroleum, wood etc). Supply chains are essentially a series of linked suppliers and customers; every customer is in term, a supplier to the next down stream organizations until a finished product reaches the end user.

Since 1980s, literature on SCM has emphasized the need for collaboration among successive actors from primary producers to final consumer to satisfy consumer demand at lower costs. As defined by the Global Supply Chain Forum, SCM integrates business processes from end user to original suppliers; and it provides products, services and information that add value for customers and stakeholders (Lambert et al. 1998). A driving force behind SCM is to optimize its own results rather than optimize the performance of the chain by integrating its goals and activities with other organizations. Now SCM is the planning, co-ordination, and control of all business process in an integrated way in order to deliver superior customer value at minimum cost to the end customer keeping in view of other stakeholders (Cooper et al. 1997).

The following questions among many others were identified by Lambert and Cooper as potential research opportunities:

- How should a firm decide which internal process to link with which customers and suppliers?
- How should a firm analyze the network to determine if there is a better configuration?
- What decision criteria determine whose internal business processes prevail across all or part of the supply chain?
- What are the barriers to implement and how should they be overcome?

Academics first described SCM from a theoretical stand point to clarify how it differed from more traditional approaches to manage the flow of materials and the associated flow of information (Ellram & Cooper, 1990). According to Bechtel & Jayaram (1997), the emphasis was on facilitating product movement and coordinating supply and demand between a supplier and buyer. Competitive advantage can be derived through the management of materials through inbound and outbound channels. SCM literature provides little information on how to redesign supply chains and evaluate these designs qualitatively and quantitatively (Beamon, 1998).

V. Strategic Role And Responsibilities

In a stable environment, each function manages independently. In an uncertain or dynamic environment a close working relationship among functions is needed and operated in an integrated way.

Performance measure: Performance is measured according to desired result. It is determined taking into consideration several inputs and its outputs.

- *Information System:* Three aspects of this system are important.
- Timely and accurate information.
- Integrated applications software with full functionality.
- Advanced decision support system which allow a "what if "simulation of the cost and customer service.

Channel Integration: The efficiency will increase by integrating the supply chain management system with the suppliers and customers.

Creating the perfect order:

The perfect order is designed to measure the effectiveness of a defined function. It measures the percentage of orders that proceed through every step of order management process without any fault. Each step must go smoothly for the order to consider as a perfect one.

These steps are as follows:

1. Order entry
2. Credit clearance
3. Inventory availability
4. Accurate picking
5. On time deliver
6. Correct invoicing

VI. Decision Policy And Complexity

Decision policies applied in a supply chain may result in bad performances. In the supply chain for fresh fruits and vegetables, the purchasing department of the exporting firm aggregated customers' orders over time to be able to buy large batches, thus reducing responsiveness. Furthermore, customers demand on different products in one delivery but each product may have a different lead-time. Hence decision complexity is a major source of supply chain uncertainty.

A. Supply chain Information system

Timely data and applicable data are prerequisite when exchanging information. In information is not up to date and will managed in order to provide current information on stock levels and stock availability, the total time frame of considerations i.e. Order forecast horizon becomes larger.

B. Supply Chain organization structure

The final sources of uncertainty were identified in the company culture and division of responsibilities and authority. Specific human behaviour in decision-making processes resulted in different outcomes because of cognitive or political influences.

VII. Strategic supply chain performance

Integrated SCM will only increase the importance of logistic activities. SCM provides supply chain members with the opportunity to optimize logistical performance at the inter-organizational level. This represents a major departure from current logistic practices that are often characterized by independent efforts with limited co-ordination with organizations. Logistic professional will continue to be challenged to manage the movement of product across the supply chain in a timely and cost effective manner that meet customers' required service levels. In order to meet this challenge, a supply chain wide logistics strategy is required which will be the primary driver for the specific logistics strategy with in each supply chain member organizations. Distribution networks, transportation modes, carrier management, inventory management, warehouse. The scope of the logistic strategies is now the entire supply chain. It is no longer necessary for each supply chain member organizational to manage its logistic activities on an independent basis

VIII. Conclusion

Supply Chain Management is an integrated concept. Traditional approaches to maximize efficiency, utilization and productivity and to minimize costs and wastages are not adequate. Today's world of competitive environment requires focus on customer. It requires perfect alignment between the business strategy and the supply chain strategy. So decision-makers must realize the importance of arranging inputs to manufacturing. Vendor relations must be improved for better management. Logistics problems require multiple solutions depending on the industry. So only joint efforts can solve the supply chain related problems. Results of transformation are encouraging and the can look forward to sustain growth in future. For this the company has to develop new strategies as new challenges come up.

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Financing Industrial Development In Nigeria: A Case Study Of The Small And Medium Enterprises In Kwara State

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Abstract **- The study was designed to address the financing of industrial development in Nigeria (especially on the Small and Medium Enterprises (SMEs) sub-sector in Kwara State). Hence, the ownership structure, entrepreneur's capacity development, sub-sector type of the SME, source of start-up (seed) capital, and source of business/financial information and membership of business/trade organization formed the core indices that were examined.**

The analyses of the data collected including the testing of the hypotheses were carried out using simple descriptive statistical tools and the chi-square.

The major findings of the study concluded that the ownership structure, entrepreneur's capacity development level, Small and Medium Enterprises sub-sector type, source of seed capital, source(s) of business/financial information and the membership of trade/business organization significantly affect the financing of Small and Medium Enterprises in Kwara State. The sole proprietorship type of ownership, low capacity development level of entrepreneurs, low size of annual revenue and the emphasis placed on Small and Medium Enterprise sub-sector type constituted a clog in the financing of the SMEs cum industrialization process in Kwara State. Also, the recourse to owner's savings as source of seed capital, usage of unreliable information source(s) and the non-membership of business/trade organizations by SMEs greatly impaired their financing.

Keywords: Small and Medium Scale Enterprises; Industrialization; Entrepreneur; Sub-sector; Chi-square; Kwara State.

I. Introduction

Western economies realized long ago that Small and Medium Enterprises are the main drivers of the economy. While big businesses are necessary to preserve and maintain structure within the economy, they have considerable problems of their own. Mega corporations of the earlier era increasingly lost their edge to smaller organizations which have spouted all over the western landscape.

Nigeria, like any other nation has witnessed dramatic changes in its industrial landscape. These changes are largely due to the efforts of the government to convert the economy from agricultural to an industrialized one. Thi arises from the belief that industrialization besidess

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Minimizing dependence on the developed economies, increases the country's national output, generates funds for the government, and leads to the conservation of foreign exchange earnings.

The path towards industrialization in Nigeria has not been easy because of the disparity in resources endowment of the economic units and the low level of investment in the economy. While some units have resources beyond their immediate needs, others may have need for resources beyond what they can presently generate. Pass and Pike (1983) opined that the level of investment in an economy is one of the major elements in determining its future productive capacity and ultimately the growth in the real living standards of its people. Also, other authors (Ekpenyong and Nyong, 1992, Adeyemi and Badmus, 2000) argued that shortage of finance is a critical limiting factor in industrial growth and the realization of an entrepreneur's dream.

In the light of the above and in realization of the fact that industrialization is required for rapid economic development, successive government in Nigeria formulated many policies and sometimes reversing earlier ones to ease industrialization. To solve the financing problems, particularly of Small and Medium Enterprises (SMEs), a number of specialized financial institutions like the Nigeria Industrial Development Bank (NIDB), the Nigerian Bank for Commerce and Industry (NBCI) and the newly introduced Microfinance Banks have been established besides the formulation of many favorable credit policies.

It is pertinent to state that Nigeria like many Less Developed Economies (LDEs) has an economy that is characterized by many micro firms. Micro, small and medium enterprises in Nigeria account for 95 percent of non-oil productive activities outside agriculture (Jamodu, 2001). Thus, the Small and Medium Enterprises are accorded high priority and resource commitments by government.

The SMEs are well suited to the factor endowment of the Nigerian economy. This is because they promote the use of local raw materials, low technologies, light industries that employ greater number of persons per unit of capital employed than Large Scale Enterprises (LSEs), serve as entrepreneurial development centers and can facilitate balanced development since they can be operated at remote and rural areas in addition to having short gestation period.

As a result of the immense potential contributions of the SMEs to the industrialization of a country as seen in the middle east especially, the Gulf region led by Dubai which

has become a role model and reference point in industrial and trade development to many nations of the world. Nigeria is not left out in the scheme of activities aimed at developing the Small and Medium Scale Enterprises.

In the light of the above and contributing to the various insights and knowledge of the factors that militate against the success of the SMEs, the following objectives ensued for this study

a. To find out if the type of ownership of the SME affects its financing and hence the successes of the enterprises in Kwara State.
b. To determine the extent to which the entrepreneur's capacity development level affects the finance and hence the success of the Small and Medium Enterprises.
c. To ascertain the relationship (if any), between the sub-sector type and the financing of the SMEs in Kwara State.
d. To find out if the source of the start-up (seed) capital has any significant effect on the financing of the SMEs in Kwara State.
e. To examine the effect of the source(s) of business/financial information on the financing of the SMEs.
f. Make some recommendations that will enhance the success of the SMEs and enable them contribute positively towards the industrialization of the country and on particular, Kwara State.

As stated earlier, the SMEs sub-sector is highly important and is accorded high priority in the challenges posed by industrialization in many emerging economies. To enable these enterprises meet the objectives of industrialization, their problems are given the desired attention by policy makers.

This study is highly important to the extent that the results will be beneficial to policy makers both in the private and government circles. In addition, the study will:

a. Assist and lead to the expansion of SMEs and hence reduce unemployment due to the fact that these enterprises are labor intensive and use relatively light technologies.
b. Bring about even and balance development of the country and Kwara State in particular. The SMEs are easy to operate and can be operated from remote and rural areas.
c. Lead to the development, growth of a healthy and balanced entrepreneurial class that is wholly indigenous.
d. Assist the financial facilitators to enable them package products that will increase the efficiency of the operations of the SMEs. In this way, the objectives of the facilitators and entrepreneurs are accomplished.
e. Further, this study is necessitated by the fact that the current form of information dissemination (marketing, finance and trade) is inadequate largely due to the underdeveloped infrastructure in the telecommunications sub-sector. Hence a research of this nature will attempt to provide some insights into how firms (SMEs-particularly in Kwara State) obtain their information and respond to changes in the environment.

II. Research Hypothesis

This study is primarily concerned with the financing of industrial development through the SMEs in Kwara State and will try to identify some factors that serve as advantages and or disadvantage to the considered SMEs in Kwara State.

It is important to state that the following hypotheses have been formulated to the focus of this research. The hypotheses include:

Ho.1. The type of ownership of the SME does not significantly affect the financing of the SMEs in Kwara State.

Ho.2. The entrepreneur's educational capacity or development level does not significantly affect the financing of the SMEs in Kwara State.

Ho.3. The sub-sector type does not significantly affect the financing of SMEs in Kwara State.

Ho.4. There is no significance on the source of the start-up (seed) capital and the financing of the SMEs in Kwara State.

Ho.5. The source(s) of business/financial information does not significantly affect the financing of SMEs.

Ho.6. The membership of business/trade organization does not significantly affect the financing of SMEs in Kwara State.

III. Literature Review

This division of the study presents relevant research and findings by other scholars under the following sub-headings:

a. Small and Medium Enterprises Development in Nigeria.
b. The Role of Small and Medium Scale Enterprises Development in the Industrialization of a Nation.
c. The Definitions of Small and Medium Enterprises.
d. Overview of Government Support Programmes to SMEs in Nigeria.
e. Problems of SMEs in Nigeria

IV. The Definitions Of Small And Medium Enterprises

While Okonkwo (1996) believes that the definitions of Small and Medium Enterprises is a heterogeneous and relative concept, Osoba (1987) accepts numerous definitions of small scale enterprises exist and they vary from country to country, within and between continents. On the other whole, Oshagbemi (1982) highlights some major criteria used in the definitions of Small Scale Enterprises (SSEs) to include:

i. Number of employees.
ii. Financial strength
iii. Sales value
iv. Initial capital outlay
v. Relative size
vi. Independent ownership
vii. The type of industry

The above criteria have been used (at various times) to define some of these SME in Nigeria. It is therefore pertinent to state some of these definitions.

The Federal Ministry of Industries in 1973 defined a small scale manufacturing outfit as one that had a total capital investment (land, building, machinery/equipment and working capital) of up to N60,000 and employee up to 50 persons. This was later revised to include any manufacturing or service industry with a capital not exceeding N150,000 in machinery and equipment. In 1978, the Industrial Research and Development Unit of the University of Ife (now Obafemi Awolowo University, Ile-Ife), defined a small scale industry as one with total assets of less than N50,000 and that employed less than fifty full-time persons while a medium scale industry was defined as a factory industry that operated with motive power and invested between N50,000 and N500,000, which employed between 50 and 250 persons.

The NBCI defined small-scale enterprises in terms of total capital investment but excludes cost of land in the computation of a ceiling of N300,000 in total capital investment (including land) and that of N500,000 in annual sales turnover.

For the purpose of lending to small scale enterprises, the Central Bank of Nigeria (CBN) defined small-scale enterprises as those enterprises with turnover of up to N500,000 only.

The National Council of Industry in 2001 defined SMEs in accordance with their scale of operation:

Micro/Cottage: enterprises with capital investment of not more than N1.5m, excluding land but including working capital and maximum of 10 workers.

Small-scale: enterprises with capital investment of over N1.5m but not more than N50m, excluding land but including working capital with work force that ranges from11-100.

Medium scale: enterprises with capital investment of over N50m but including working capital, work force ranges from 101-300.

Considering other definitions given by some international financial bodies, the World Bank in 1988 classified SMEs as enterprises with fixed assets, excluding land and working capital which do not exceed N10million. The European Economic Commission in 2000, defined an SME as a small scale business with the exclusion of agriculture, forestry and fishing with employment capacity of not more than 500 workers.

Not minding the various definitions and the lack of consensus in these definitions, there is the need to point out that the definitions correspond to parameters considered adequate for policy formulation and the promotion of the sub-sector in the country

For the purpose of the Small and Medium Industries Equity Investment Scheme (SMIEIS), set up in 1999 by the federal government, a small or medium industry is defined as any enterprise with a maximum asset base of N200million, excluding land and working capital.

This study upholds the definiti on of the small and medium enterprises by the National Council of Industry. This definition, based on the size of the workforce is highly applicable to this study.

V. The Importance Of Small And Medium Enterprises In The Development Of A Nation

The general characteristics of less developed regions indicate the nature of the needs and these include: unemployed and underemployed labor, a small or negative rate of growth of real per capital income, grossly unequal income distribution, low investment rates and scarce capital and political and economic instability (Lebell et al, 1974). This gives a vivid picture of Nigeria's industrial landscape which like any less developed country, is littered with many micro, small and medium enterprises. They are expected to provide the driving force for the industrialization and overall development of the Nigerian economy. This explains the increasing policy attention accorded the SMEs in addition to the fact that they play significant roles in meeting some basic economic and industrial developmental objectives. Few among the significant roles played by the SMEs are as follows:

First, the SMEs provide the training ground for the development and growth of indigenous entrepreneurs (Kilby, 1988). Casson (1982) opines that by acting as a seedbed or nursery, usually for the indigenous population, they serve as vehicles for the propagation and diffusion of innovative ideas for far reaching dimensions. They are more flexible and can easily adapt to changes in the external environment.

A second social contribution of SMEs according to Owualah (1987) is the transformation of traditional industry. In both developed and developing countries, the traditional sector has served and continues to serve as the springboard for launching into a vibrant modern sector. Thus a fledging SMEs sector can be a means of achieving a smooth transition from the traditional to the modern industrial sector (United Nations, 1984).

Third, SMEs due to their labor intensively and usage of low-level technology are able to garner and use the widely available local labor supply. This is consistent with the nation's income distribution objectives (Steel and Takigi, 1983). Also, it is opined that SMEs create more jobs per unit of energy consumed than large scale ones (Vankataraman, 1984).

Fourth, SMEs assist in the dispersal of economic activities through encouraging the development and modernization of these activities outside the major metropolitan areas. Thus, they are able to stem the tide of rural-urban drift. Another economic role of the SMEs is their ability to mobilize financial resources, which would otherwise be idle or untapped by the formal financial sector (Central Bank of Nigeria, 1985).

Fifth, SMEs facilitate the conservation of foreign exchange and the development of the scarce resources of management in developing countries. This is mainly due to their size or scale of operations and unsophisticated management structure. A high percentage of the profit of SMEs, most of which are locally owned is known to be ploughed back to

ensure a higher rate of future growth (Committee of Inquiry on Small Firms, 1971)

Also, Kamaluddin (1982) opined that the SMEs provide the desired linkage effects, especially agro-industrial linkages.

It is pertinent to highlight the contributions of SMEs to the economic of some countries and also, that of Nigeria.

A study carried out by the Small Business Research Unit in the United Kingdom between the periods 1982-1988, showed that SMEs created between 8000,000 and 1,000,000 new jobs. Also, Gibb (1996) opined that small and micro enterprises were by far the most common form of enterprises in Europe and constitute over 98 percent of all registered companies.

In Japan, the industrial strength of the nation is premised on SMEs. They employ more than 82 percent of the total labor force and account for more than 50 percent of the total manufacturing value added.

In Nigeria, Kasimu (1998) opined that the SMEs have through NIDB assisted projects created more than 300,000 jobs and through the Nigeria Agricultural and Co-operative Bank (NACB), created more than 700,000 jobs.

VI. Small And Medium Scale Enterprises In Nigeria

The path towards industrialization differs from one country to another. However, the objectives for industrial development include the following

i. To expand the range of economics and choices to individuals by giving them independence from other people and nations.

ii. To raise standards of living.

iii. To expand the availability and distribution of basic life-sustaining goods.

In line with the above, Maizels (1963), agrees that industrialization is the key to economic progress in most countries because it tends to increase physical output per head. The ripple effect of this is the increase in the share of manufacturing in the national output. Similarly, a country is said to be industrialized if her industrial output is at least 25 percent of her Gross Domestic Product (GDP), 60 percent of this output is contributed by the manufacturing sub-sector and of the population, at least 10 percent are engaged in manufacturing.

The Nigerian industrial scene is characterized by a wide diversity of industrial structures, technologies, factor intensities, input requirements and product qualities. Also, the industrial scene shows different levels of organization, administration/managerial and technical skills. This is because Nigeria adopted the classical approach to industrialization. However, the industrial development of the 1960s and 1970s concentrated on Large Scale Industries (LSI). These industries subscribed to by the government and foreign multi-nationals had a dramatic turnaround in the early 1980s as a result of the collapse of the oil boom. The reduction in the foreign exchange allocated for the importation of raw materials and spare parts for these LSIs, led to the general shut-down or reduction in capacity utilization of these firms between 1983 and 1996. Accompanying this economic downturn was massive retrenchment by the industries, scarcity of basic goods and services and the subsequent devaluation of the nation's currency (the Naira).

The above economic scenario led to the adoption of the Structural Adjustment Programme (SAP) in 1986 and a change in the industrial policy in 1988. This change shifted the priority focus from LSIs to SMEs. The change was highly necessary. According to Ogun and Anyanwu (1999), the biased strategy towards large scale production activities invariably undermined the growth and development of indigenous industries most of which are small and medium scale on sizes. Eleazu (1988) opines that the public sector preoccupation with public sector investment led to the neglect of and inadequate attention to development of infrastructural facilities – roads and railways, water and human resources development, telecommunications and lastly electricity and other energy supplies. Also, the SMEs are widely accepted as having greater capacities to utilize locally available raw materials, technologies, manpower and promote even and balanced industrial development.

The major activity in the SMEs development occurred between 1987 and 1989 with the establishment of several institutions to provide financial assistance to small and medium enterprises. Such institutions include: The Nigeria Industrial Development Bank, The Nigerian Bank for Commerce and Industry, Nigerian Agricultural and Cooperative Bank and the National Economic Reconstruction Fund (NERFUND).

However, by the mid 1990s, the funds being made available by these institutions had dried up and most of the SMEs had collapsed as a result of the debt burden (inflated foreign exchange) and the value of the Naira. In addition to the above, the contributions made by the SMEs to the economy were low.

The above scenario necessitated the formulation of new policies and attitudes towards the growth and development of SMEs in Nigeria.

VII. Overview of Government Support Programs to the Small and Medium Enterprises in Nigeria

In realization of the vital contributions of SMEs to the attainment of the nation's economic development objectives, the government (at the federal and state levels) in Nigeria continues to make a number of schemes to support this sub-sector. A review of some of these programme are considered under the following broad sub-headings:

a. Credit financing schemes and institutions.
b. Technical/managerial development.
c. Policy framework to support SMEs.

VIII. Credit Financing Schemes and Institutions

The access to institutional finance by SMEs has remained a problem to the development of the sub-sector in Nigeria. More importantly in the area of working capital (short term finance), the larger industries edge out the small enterprises. The SMEs are classified as high risk ventures by financial market operators and therefore remain unassisted. By and large, this problem led the government to establish specialized institutions and credit schemes to support SMEs development. These agencies are mainly Development

Finance Institutions/Banks (DFIs), which Kasimu (1997) considers to be having a three-tier structure in Nigeria. The first-tier includes the National Development Banks i.e. the NACB, NIDB, Urban Development Bank, NBCI and the Nigerian Export-Import Bank. The second-tier consists of Inter-State DFIs i.e. the O'dua Investment Limited and the New Nigeria Development Company Limited (NNDC). The third-tier consists of the state-owned Development Finance Institutions i.e. the Kwara State Property and Investment Company and the Oyo State Agricultural Development Programme (OYSADP).

Apart from the conventional banks (Commercial and Merchant), the main Development Finance Institutions and Credit Schemes set up to assist the SMEs in Nigeria include the:

a. Nigeria Industrial Development Bank (NIDB)
b. Nigeria Bank for Commerce and Industry (NBCI)
c. World Bank Assisted SME Loan Scheme
d. Nigerian Agricultural and Co-operative Bank (NACB)
e. Federal Ministry of Commerce and Industry's Small-Scale Industries Credit Scheme
f. Micro Finance Bank
g. National Economic Reconstruction Fund (NERFUND).

IX. Policy Framework to Support SMES

Various governments have at various times promulgated a number of policies in support of the development and growth of the SME sub-sector. A categorization of these policies ensues: **i.** Tariff **ii.** Fiscal and **iii.** Infrastructure

The government has used tariffs that have been adjusted periodically at various times to reduce production costs and thus support the SME sub-sector. Also, the introduction of a second-tier window on the capital market, to provide long-term finance for enterprises that cannot satisfy the requirements in the first-tier window has left meaningful mark in the development of the SME sub-sector.

In terms of fiscal incentives, a number of tax measures aimed at ameliorating the problems of SMEs have been put in place. This include, among others:

a. Tax relief to all small and medium enterprises during the first six years of operation and;
b. Pioneer status involving non-recoverable tax relief for firms.
c.

In the area of infrastructure, the activities of the Directorate of Foods, Roads and Rural Infrastructure (DFRRI), National Directorate of Employment (NDE), Petroleum (Special) Trust Fund (PTF) and the various poverty alleviation programmes of the governments have been set up at various times to address the socio-economic problems in the country.

X. Problems of SMEs in Nigeria

In spite of the invaluable contributions of SMEs to economic development, they are beset with a plethora of problems in Nigeria. Thus, their contributions to the industrialization process are still generally low when compared with other countries of South East Asia. The development of the SME sub-sector has been constrained by a number of factors, both internal and external, despite the efforts of successive governments to promote the sub-sector. These factors include:

i. Inconsistence policy measure
ii. Unstable macro-economic environment
iii. Poor infrastructural facilities i.e. roads/railway system, water supply, electricity, telecommunications, etc. This is in line with Giwa (2001) on the problems of the Nigerian industrial sector.
iv. Inefficiency and effectiveness in the institutional support systems for SMEs.

In addition to the above, internal factors that handicap the SMEs in the industrialization process in Nigeria include:

i. Low levels of skills: technical and managerial. To buttress the above, Lewis (1977) opined that what Nigerian entrepreneurs lack most is managerial competence.
ii. Inability to effectively compete in the local, domestic and the international export markets because the home market is saturated with cheap imported products, poor quality of products or the unfamiliarity with the vagaries of export procedures. In line with the foregoing, Giwa (2001) opined that the influx of fake and sub-standard products, under-invoicing, dumping and malpractices at our ports, placing imported goods at undue advantage over local manufacturers, are some of the most damaging issues affecting the manufacturing industry.
iii. Low levels of process technologies
iv. Lack of productive resources. With respect to resources, Ogun and Anyanwu (1999) consider inadequate funding (finance) to be paramount.

According to Daodu (1997), the most intractable of these problems is poor access to capital. So wide is the credibility gap that most banks prefer to pay the stipulated government penalty rather than carry out government directive that a percentage of their funds be set aside to finance SMEs.

It is pertinent to reiterate that Nigerian SMEs are usually of sole ownerships (very little are limited liability companies) with limited (though intensive) labor force, centralized administration and management, little access to finance (long term and medium term) and high failure rate.

XI. Reserch Methodology

For the purpose of this research, we conducted some interviews and served questionnaires on the Chief Executive Officers of Small and Medium Enterprises in the state, finance facilitators and some government agencies concerned with the operations of Small and Medium Enterprises.

XII. Methods Of Data Collection

The method of data collection in this study has been divided into two major groups' source: The primary and secondary source.

A. Primary Sources of Data

The primary data for this research work was collected from several sources including the:

i. Kwara State Ministry of Commerce, Industry, Mines and Agriculture.
ii. Other trade and industry associations in Kwara State taking to consideration the size and their capacity to provide information relevant to the research.

A structured questionnaire was developed in line with previous conversation with some owners and staff of some small and medium enterprises. This questionnaire was structured according to factors that was considered advantages and or disadvantages to their various businesses.

a. Ownership/structure of the enterprise
b. Educational level of owners.
c. Area of operations
d. Size of the enterprises
e. Educational level of employees
f. Sources of finance
g. Sources of business information
h. Membership of industry/trade associations and the services obtained.

B. Secondary Sources of Data

The secondary information was obtained from:

- Academic institutions
- Agencies (state and federal) responsible for industries, agriculture, commerce and the SME sub-sector.
- Business and trade associations like the Nigeria Association of Small and Medium Enterprises (NASME), National Association of Small and Medium Scale Industries (NASSI), Raw Materials Research and Development Council and Manufacturers Association of Nigeria (MAN).

XIII. Methods of Data Analysis

The collected data were analyzed using simple descriptive statistical tools including tables and percentages.
The chi-square test (X^2) was also used to determine the relationship (if any) between some variables. The chi-square is defined as follows:

$$X^2 = \Sigma \frac{(O-E)^2}{E}$$

where X^2 = Chi-Square
O = Observed frequencies
E = Expected frequencies or theoretical frequencies.

Note that X^2 is the value of Chi-Square, which has a probability of 0.05 of being exceeded (.05 is the level of significance and hence the rejection area will be the upper 5% of the distribution). A value of X^2 which exceeds the appropriate value will fall in this rejection area and thus, the null hypothesis can be rejected i.e. the sample data do not come from the specified population.
However, a non-significant result does not prove that the specified distribution does apply, merely that the sample data could have come from such a distribution. In practice, however, a non-significant result is taken as enough justification fro assuming that the specified distribution does apply.

XIV. Data Presentation and Analysis

As stated earlier, the research was carried out in the form of a survey using questionnaires.
In order to motivate the respondents to complete the questionnaires, due confidentiality was promised in addition to a copy of the research findings upon completion of the study.
A total of 300 questionnaires were distributed to the Small and Medium Enterprises (SMEs) in Kwara State and 175 (representing 58.3%) were returned. Out of the returned questionnaires, 170 (representing 56.7 percent) were found useful.
Due to the many aspect of questions asked, the questionnaire will be divided into three sections namely demographics, finance and information means.
The demographic section of the questionnaire was divided into several parts i.e. the ownership structure, age of promoters, sex distribution, educational qualification of owners, type of industry, number of employees, and educational qualification of employees and year of establishment.

Table 1: Ownership Structure Table

Type of Ownership	Frequency	Percentage
Sole Proprietors	105	61.8
Partnership	45	26.4
Limited Liability	20	11.8

Source: Questionnaire administered Oct., 2008

As shown above, the ownership structure of the Small and Medium Enterprises (SMEs) surveyed varies widely. More than 60 percent (61.8% precisely) of the SMEs were of sole proprietorship, 26 percent were partnerships and approximately 12 percent were Limited Liability Companies.

Table 2: Educational Qualification of Owners of SMEs

Educational Status	Frequency	Percentage
No Formal Education	21	12.3
Primary Education	43	25.3
Secondary Education	95	55.9
Tertiary Education	11	6.5

Source: Questionnaire administered Oct., 2008

As shown above more than half of the promoters/owners of SMEs in Kwara State have some form of formal education. About 56 percent had secondary education, 25 percent completed primary school education while about 12 percent did not have any formal education. Some 6.5 percent of the owners were graduates of tertiary institutions and above.

Table 3: SME by Industrial Type

Type of Industry	Frequency	Percentage
Agro-based/Food Processing/Beverage	13	7.6
Pharmaceuticals	8	4.7
Timber/Woodwork/Furniture	22	12.9
Chemicals/Soap/Plastics/Paints	15	8.8
Textiles	12	7.1
Confectionery/Biscuits	8	4.7
Footwear/Leather	7	4.1
Glass/Clay/Stoneware	9	5.3
Metal Fabrication/Iron & Steel	28	16.5
Repair Works/Services	48	28.2

Source: Questionnaire administered Oct., 2008

The Small and Medium Enterprises in Kwara State are widely distributed among the sub-sectors of the economy. A significant proportion of the SMEs surveyed (about 28 percent) belong to the repair works/services while 16.5 percent belong to the metal fabrication/iron and steel sub-sectors. The timber/wood work/furniture sub-sector has 22 SMEs (about 13 percent), agro-based industries have 7.6 percent, pharmaceutical approximately 5 percent, chemicals/soaps/plastics/paints sub-sector contains 15 SMEs (about 9 percent) and the textile sub-sector has 12 SMEs (about 7 percent).

Table 4: Employees in Sampled SMEs

Number of Employees	Frequency	Percentage
Less than 10	111	65.3
11 to 100	43	25.3
101 to 300	9	5.3
Above 300	7	4.1

With respect to the number of employees, the SMEs surveyed showed remarkable differences. As shown, a greater percentage of the SMEs (about 65 percent) employ less than 10 persons, 25.3 percent employ between 11 to100 persons while 16 percent employ above 101 persons.

Table 5: Employees by their Educational Qualification

Educational Status	Frequency
No Formal Education	44
Primary Education	65
Secondary Education	50
Tertiary Education and above	11

Source: Questionnaire administered Oct., 2008

With respect to the educational qualifications of the employees in the SMEs, 44 of the workforce did not have formal education. Further, 65 had primary education, 50 attained the secondary school level while 11 had tertiary education.

The finance section of the questionnaire has such indices as the source of initial/start-up capital amount of the initial capital, the asset level/capitalization, current sources of finance, the number of loans received in the last two years, purpose of such loans, collateral securities that SMEs have or can afford to use to obtain loans from credit agencies and the importance of different sources of funds.

Table 6: Source of Start-up Capital

Source	Frequency	Percentage
Personal Savings	76	44.7
Family	13	7.6
Friends	9	5.3
Co-operative Society	12	7.1
Bank	54	31.8
NERFUND	6	3.5

Source: Questionnaire administered Oct., 2008

The start-up capital is often the most difficult for would-be entrepreneurs, whether the entrepreneur is drawn from the pool of unemployed, the retrenched or the fresh graduate bubbling with ideas. The frequency analysis in Table 6 shows that 44.7 percent of the SMEs surveyed obtained their start-up capital from their own savings while 31.8% percent obtained theirs from the banks. This attests to the fact that the government has doubled its efforts at the provision of finance for the SME sub-sector. However, less than percent used the National Economic Reconstruction Fund (NERFUND) window for their start-up capital. It is pertinent to state that the NERFUND though a government scheme, has not been of particular interest to SMEs promoters due to the stringent eligibility criteria. Further, Table 7 shows that 7.1 percent obtained seed capital from the co-operative societies; approximately 8 percent used capital from family and 5.3 percent obtained seed capital from friends.

(Table 7: Current Source of Finance

Source	Frequency	Percentage
Personal Savings	65	38.2
Friends	7	4
Family	5	2.9
Co-operative Society	35	20.6
Bank	58	34

Source: Questionnaire administered Oct., 2008

The Small and Medium Enterprises surveyed explore multiple sources for the financing of their enterprises. The analysis of Table 7 indicates that 38.2 percent source capital currently from their own savings while the bank is responsible for the financing of 34 percent of the SMEs. Further, the co-operative societies handle the financing of 20.6 percent of the SMEs while 2.9 percent and 4 percent of the SMEs use family and friend's resources respectively.

Table 8: Number of Loans Received in the Last Two Years

Number of Loans	Frequency	Percentage
Zero	119	70
One	17	10
Two	14	8.2
Three	12	7.1
Four or more	8	4.7

Source: Questionnaire administered Oct., 2008

The data in Table 8 shows that 70 percent of the SMEs surveyed did not obtain any loan in the last two years. A number of questions arise: Did these enterprises not have the need for loans during the period? Or that the loans were not available for them? Another angle to this is that of the position of the management to external financing and its ability/inability to meet the loans requirements. Further analysis in Table 9 shows that 10 percent of these SMEs received one loan, 8.2 percent received two and 11.8 percent had received more than two loans.

The purposes of the loans obtained by the SMEs include the financing of inventory/working capital, starting of other businesses that relate to the present one and the purchase of buildings, working equipment/machinery.

Table 9: Constraints to Obtaining Loans

Factor	Frequency	Percentage
Collateral Security	24	14.1
Interest Rate	22	12.9
Bureaucracy	46	27.1
Economic Station	10	5.9
Inadequate Information	58	34.1
Absence of Government Support	10	5.9

Source: Questionnaire administered Oct., 2008

Table 9 presents the data on the constraints to obtaining loans/financing for the Small and Medium Enterprises in Kwara State. Inadequate information (with a frequency of 58 and 34.1 percent) is considered to be the most severe constraint to obtaining debt financing. This constraint has to do with the absence of information on the loan sources, types, eligibility, requirements, etc. Further analysis of Table 10 indicates that bureaucratic bottlenecks come next in importance. It has a frequency of 46 (27.1 percent). However, 24 SMEs (14.1 percent) believe collateral security is a constraint while 22 (12.9 percent) accept that interest rate is a constraint to obtaining loans/financing. The economic situation of the country and the absence of government support have the least values (10 each) i.e. they are considered to be the least of the constraints to obtaining loans/financing by the Small and Medium Enterprises in Kwara State.

Table 10: Sources of Information

Source	Frequency	Percentage
Friends/Neighbours	110	64.7
Mass Media	34	20
Government Agencies/Ministries	17	10
0Trade Associations	9	5.3

Source: Questionnaire administered Oct., 2008

With respect to the source of information (financing information), the Small and Medium Enterprises surveyed (as shown in Table 10) shows that 64.7 percent obtain information from friends or what can be termed as "word of mouth" information. Thirty-four (20 percent) of the respondents make use of the mass media – the radio, television, newspapers and magazines. Ten percent of the respondents obtain information through the government agencies/ministries. The trade/business association is being utilized by 5.3 percent of the respondents to obtain information.

Table 11: Membership of Trade/Business Organization

Membership/Non-Membership	Frequency	Percentage
Membership of one or more organizations	74	43.5
Non-membership of any organization	96	56.5

Source: Questionnaire administered Oct., 2008

Among the Small and Medium Enterprises surveyed in Kwara State, 74 (43.5 percent) belong to one or more business/trade/industry associations and the remaining 56.5 percent do not belong to any organization. This is as shown in Table 11.

Furthermore, the answers to questions in relation to membership of trade/business organizations (Appendix III) indicates that 70% of the SMEs accept that the government is not efficient in the implementation of SME-financing programs, 73.5 percent agree that the major inputs into government financed – SME support schemes are not obtained from the SME promoters, 63.5 percent accept that the membership of trade/business associations guarantee adequate information and 65.9 percent accept that the trade/business associations are not well organized and efficient to handle the various SME financing schemes.

XV. Testing of Hypothesis

The results of the data obtained and the data presented above were used to test the hypotheses formulated for the study as follows:

Hypothesis Ho.1

The ownership type of the SME does not significantly affect the financing of the Small and Medium Enterprises in Kwara State.

The result of the frequency analysis with respect to the ownership structure of the SMEs surveyed (Table 1) shows that 105 of the SMEs are of sole proprietorship, 45 are partnerships and 20 are limited liability companies.

Further investigation of the hypothesis using the above data shows that the calculated Chi-square value is 67.35 while the critical value of the Chi-square at 2 degrees of freedom and 0.05 level of significance in 5.99.

Since the calculated X^2 value is greater than the critical value of the Chi-square, the null hypothesis Ho1 is rejected. This implies that the type of ownership of the SMEs in Kwara State significantly affects its financing.

Null Hypothesis Ho. 2

The entrepreneur's capacity (educational) development level does not significantly affect the financing of the SMEs in Kwara State.

The results of the data with respect to the educational qualifications of the owners of the SMEs surveyed in Kwara

State, as presented in Table 2, shows that 21 owners have no formal education. The Table also shows that 43 of the owners have primary education, 95 attained the secondary education level while 11 have tertiary education.

Further investigation of the null hypothesis Ho.2 using the above data shows the calculated Chi-square value to be 99.09 while the critical value of the Chi-square at 3 degrees of freedom at the 0.05 level of significance is 7.82. Since the calculated Chi-square, the null hypothesis Ho.2 is rejected. This implies that the entrepreneur's capacity (educational) development level significantly affects the financing of the SMEs in Kwara State.

Null Hypothesis Ho.3

This stipulates that the sub-sector type does not significantly affect the financing of the SMEs in Kwara State.

The results of the data with respect to distribution of SMEs surveyed according to industry type (Table 3) indicate the distribution of the SMEs into ten sub-sectors. This distribution indicates 13 SMEs in the Agro-based/Food processing/Beverages, 8 in the pharmaceuticals, 22 in the Timber/Woodwork/Furniture, 15 in the Chemicals/Soap/ Plastics/Paints, 12 in the Textiles, 8 in the Confectionery/Biscuits, 7 in the Footwear/Leather, 9 in the Glass/Clay Products, 28 in the Metal/Fabrication/Iron and Steel and 48 in the Repair Works/Services sub-sectors.

Further analysis of the above data with respect to the null hypothesis Ho.3 shows the calculated Chi-square value is 86.93 while the critical value of the Chi-square at 9 degrees of freedom and at the 0.05 level of significance is 16.92. Since the calculated Chi-square is greater than the critical Chi-square, the null hypothesis Ho.3 is rejected. This implies that the sub-sector type significantly affects the financing of the SMEs in Kwara State.

Null Hypothesis Ho.4

There is no significant difference in the source of the start-up (seed) capital and the financing of the SMEs in Kwara State.

The results of the data in Table 7 indicates that of the 170 SMEs surveyed in Kwara State, 76 of the promoters obtained seed capital from their own personal savings, 13 promoters obtained seed capital from friends, 9 promoters obtained seed capital from friends, 12 promoters obtained seed capital from co-operative societies, 54 obtained their seed capital from the banks and 6 promoters obtained seed from the NERFUND scheme.

Further analysis of the above data indicates that the calculated Chi-square value is 151.97 and the critical value of the Chi-square at 5 degrees of freedom and at the 0.05 level of significance is 11.07. Since the calculated value of the Chi-square is greater than the critical value of the Chi-square, the null hypothesis Ho.5 is rejected. This implies that there is significant difference in the source of the start-up (seed) capital and the financing of the SMEs in Kwara State.

Null Hypothesis Ho.5

The source(s) of business/financial information does not significantly affect the financing of SMEs in Kwara State.

The data in Table 11 clearly shows that of the 170 SMEs surveyed, 110 obtain trade/financial information through friends/neighbors i.e. word of mouth communication. Further, 34 of the SMEs utilize the mass media to obtain information, 17 SMEs obtain information from government agencies/ministries and 9 SMEs rely on their membership of trade associations to obtain information. It is important to state that information is very vital to the success of the SMEs not only in respect of their financial needs but also with respect to marketing needs.

Null Hypothesis Ho.6

The membership of business/trade organization does not significantly affect the financing of SMEs.

The data in Appendix II clearly indicates that while 51 of the respondent SMEs owners consider the government as being efficient in the implementation of SMEs financing programs, 119 SMEs promoters think otherwise. Also, 125 SMEs accept that the major inputs into government financed SME support schemes are not obtained from the SMEs promoters while 45 SMEs accept that the inputs are obtained from the promoters. The data shows that 111 of the SMEs accept that membership of trade/business associations guarantee adequate information while 59 SMEs do not accept the proposition and 112 SMEs consider the associations as incapable of handling the various SME financing schemes while 58 SMEs believe the associations are highly organized and capable of handling the SME support sheme.

Further analysis of the above data indicates the calculated Chi-square value is 68.14 whereas the critical value of the Chi-square at 3 degrees of freedom and at the 0.05 level of significance is 7.82. Since the calculated value of the Chi-square is greater than the critical value of the Chi-square, the null hypothesis Ho.7 is rejected. This implies that the membership of business/trade organizations significantly affects the financing of the SMEs in Kwara State.

XVI. Discussions and Findings

This research has concentrated on the financing of industrial development in Nigeria with particular emphasis on the Small and Medium Enterprises sub-sector in Kwara State. The details of the findings on each of the variables used in the study are given below.

The findings, with respect to the analysis of the ownership structure, shows that the null hypothesis was rejected. This is because the type of ownership of the SME has significant effect on the financing of the Small and Medium Enterprises in Kwara State. This is clearly evident from the fact that the majority of the SMEs surveyed are of sole proprietorship (Adeyemi and Badmus, 2000; Ogun and Anyanwu, 1996).

The findings also indicated that the entrepreneur's capacity (educational) development level has significant effect on the financing of Small and Medium Enterprises in Kwara State. Also, the results showed that employees of these SMEs are of low educational qualifications. The findings of Akeredolu-Ale (1977) become important in respect of the above. He opines that education is a vital determinant of a projector's feasibility. He goes further to conclude that most of the entrepreneurs who find it hard to obtain necessary credit facilities do so mainly because they could not convince the prospective lender of their own personal

feasibility as projectors and that this is a result of their low educational level and relevant technical-managerial qualifications.

The sub-sector type, as revealed by the findings, also significantly affects the financing of the SMEs in Kwara State. The SMEs surveyed are not evenly distributed in the sub-sectors. The implications of this are that some SMEs in some sub-sectors are able to generate more financing than others. This is largely due to some structural defects in the nation's economic scene.

The source of the start-up (seed) capital also significantly affects the financing of the SMEs surveyed in Kwara State. The findings indicated that more than half of the SMEs surveyed obtained seed capital from personal sources. Such entrepreneurs are expected to be more prudent in handling their finances (i.e. being less extravagant, not taking money out of the enterprise, etc) and hence unable to get external financing. This relationship certainly deserves more detailed analysis than the present study has data to offer.

The source(s) of business/financial information as revealed by the study, also significantly affects the financing of SMEs in Kwara State. Information, no doubt, is a vital aspect of business. Information that will be utilized by the SME sub-sector must of necessity is appropriate, accurate, understandable, timely, and specific. The absence of such information is detrimental to the development of SMEs. Ekpenyong and Nyong (1992) also add credence to the above.

Finally, the results of the study also showed that the membership of business/trade organizations significantly affect the financing of the SMEs in Kwara State. Most of the SMEs in Kwara State do not belong to any organization and the SMEs that belong to one or more have not made tangible contributions in the organization. However, it is pertinent to state that the organizations are useful instruments for the training and growth of entrepreneurs and hence contribute positively towards development and growth of the Small and Medium Scale Enterprises sub-sector.

XVII. Conclusions and Recommendations

The industrial landscape in Kwara State is highly saturated with the small and medium enterprises. This accounts for the increasing levels of attention being accorded the sub-sector by various governments.

The indices that affect the financing of the sub-sector formed the basis of this study. This chapter therefore presents the summary of the research findings, conclusions, recommendations and the contributions of the study to knowledge and practice.

XVIII. Summary of Findings

This study, as stated earlier, concentrated its efforts on the financing of industrial development in Nigeria. Solid emphasis was placed on the small and medium enterprises sub-sector in Kwara State. This is in realization of the fact that the SMEs, as in many emerging economies, play a significant role in the industrialization process.

The specific objectives of this research include:

a. To find out if the type of ownership of the SME affects its financing and hence the success of the enterprises in Kwara State.
b. To ascertain the degree to which the entrepreneur's capacity development level affects the financing of the SMEs in Kwara State.
c. To determine the relationship, if any, between the sub-sector type and the financing of SMEs in Kwara State.
d. To know if the source of the start-up (seed) capital has any significant effect on the financing of the SMEs in Kwara State.
e. To determine the effect of the source(s) of business financial information on the financing of SMEs in Kwara State.
f. To find out the extent to which the membership of business/trade organizations affects the financing of SMEs and hence their contributions to the industrialization process in Kwara State.
g. With these objectives in mind, a questionnaire (divided into three sections) was used to obtain primary data from 300 pre-selected SMEs in Kwara State. Out of this number, 170 questionnaires were found useful for analysis using simple statistical tools including the Chi-square analysis. A number of findings were arrived at after the analysis of the data and with respect to the seven hypotheses formulated for the study. A summary of these findings is presented below:

1. That the type of ownership of the Small and Medium Enterprises significantly affects the financing of the enterprises in Kwara State. The variations in ownership include sole proprietorships, partnership organizations and limited liabilities companies. It is pertinent to note that the ownership type/structure certainly affects the management of the organization.
2. The capacity (educational) development of the owners of the SMEs surveyed in Kwara State significantly affects the financing of the SMEs. In addition to the low level of education of the promoters, the study also showed the employees to be of low educational levels too. This implies that the "residual-staff" thesis applies to the SMEs in Kwara State. The thesis opines that what private indigenous Nigerian enterprises get both for labour and management staff is the left over of the government and expatriate firms.
3. The sub-sector to which the small and medium enterprise belongs has significant effect on the financing of the SMEs in Kwara State. A ten sub-sector re-grouping of the SMEs surveyed was used to arrive at this finding.
4. The source of the start-up (seed) capital significantly affects the financing of the SMEs and hence the industrialization process in Kwara State.
5. The source(s) of business/financial information significantly affects the financing of the SMEs in Kwara State. The study showed that the "…word of

mouth" communication method was largely used by the SMEs in the state.

6. In the financing of SMEs in Kwara State, the membership of business/trade organization was also found to be significant.

XIX. Conclusion

It is no exaggeration to say that despite the lofty objectives of the government in respect of the Small and Medium Enterprises sub-sector, the results are often disappointing and the potentials of small scale industries are not often realized in the industrialization process.

The study highlighted the type of ownership of the SME, the entrepreneur's educational development level; the sub-sector type and the size of the annual revenue of the SME are significant indices and thus affect the financing of the enterprises in Kwara State. Further, the entrepreneur's source of seed capital, source(s) of business/financial information and the membership of trade/business organization also significantly affect the financing of SMEs, cum industrialization of Kwara State.

XX. Recommendations

There is no gain-saying that the Small and Medium Enterprises are a vital force in the industrialization process of developing and emerging economies. Certainly, governments all over the world will continue to accord the sector the high priority it deserves.

In order to bring about sustainable development in an environment that is characterized by stiff competition, especially against the backdrop of trade globalization, concerted, coordinated and sustained efforts are required from all operators in the economy, i.e. the government and its agencies/parastatals, Non-Governmental Organizations, relevant financial institutions and international bodies.

Accordingly, and with regard to the findings of this study, the following recommendations ensued:

1. In order to focus the country in her economic emancipation and commitment to the building of a virile, competitive and resilient industrial sector, there is need for the government to be better coordinated in the financing of the SME sub-sector more importantly by way of equity. The creation of an SME window in the Nigerian Stock Exchange is very important. In this way, the orderly growth, development and continuity of the nation's SMEs (particularly SMEs in Kwara State) can be put on a solid foundation. The commencement of the Small and Medium Industries Equity Investment Scheme (SMIEIS) by the federal government is highly commendable. However, the scheme needs to be well coordinated in order to address the under capitalization problems of SMEs in addition to the fact that the:

beneficiaries need to be clearly identified

entrepreneurial training needs to be provided for the beneficiaries at little or no cost and financial advice to be given to beneficiaries at little or no cost.

It is pertinent to note however, that SMEs need equity but prefer to take loans and banks have equity funds to give but prefer loans. Thus there is the need to strike a balance.

1. There is the need for all relevant agencies (government, non-governmental, community based and international agencies) to co-ordinate and streamline their activities in the capacity building process of the nation. This is not only in terms of knowledge acquisition but also in terms of cultural reorientation in order to imbibe transparency, accountability and good governance, and to deter corruption, fraud and inefficient or wasteful practices.
2. There is the need for all relevant (government and non-governmental) to structure their assistance efforts in ways that build up indigenous systems and capacities that support entrepreneurs in sourcing for seed capital and hence facilitate resource flows throughout the economy.
3. The need arises for government to formulate and implement policies that will address the problem of low/dwindling revenues accruing to the small and medium scale enterprises. Such measures include the provision of infrastructural facilities, establishment of purchase/trade agreements by government agencies with the SMEs and the provision of training to address production needs production needs, marketing activities and technology acquisition/management issues.
4. In addition to the promotion of the use of modern communication facilities like the telephone, fax, internet, it is recommended that the government should provide and enabling environment for private participation with the collection and dissemination of information. There is also the need for the relevant agencies to work continually on areas where little or no information is available. This will enable the SMEs to be well positioned to participate in today's global economy in which businesses are largely driven by information technology.
5. There is also the need for the government to take deliberate and positive steps to address all structural defects in the industrial sector by adopting industry concrete measures in the financing of the Small and Medium Enterprises. This ensures that the goals of industrialization are consistent with the motivations internal to each sub-sector.
6. There is the need for the government to promote and foster the formation of SME associations/organizations in addition to encouraging the active participation of the SMEs. The government/donor agencies should subsidize these associations and their programs (i.e. advisory services) so that they can charge lower fees on the SMEs.

7. Certainly, there is the need to investigate further and carry out detailed sub-sector analysis of the financing of the Small and Medium Enterprises with a view top finding out the problems/bottlenecks that do not enable these enterprises to contribute meaningfully towards the industrialization process.

XXI. Contributions Of The Study To Knowledge

The Small and Medium Enterprises (SMEs) sub-sector play a significant role in the industrialization process of many countries. The small-scale enterprises have the capacity to provide employment to a large number of people (they are labour intensive) and form the nucleus for the generation of indigenous entrepreneurs. They aid the development and growth of local technology founded on local capabilities and comparative advantage. Also, in the transition from a resource based economy, society and culture to the one that is knowledge-based, technology driven and responsive to the environment, the SMEs are highly important.

This study critically analyzed the impact of certain variables on the SMEs in the industrialization process of Kwara State. Results emanating from the study showed that the form of ownership, low educational level of the owners, low annual income, the source of initial capital (owner's savings), sub-sector type, source of information and the membership of associations militate against the meaningful contribution of the SMEs in the industrialization process of Kwara State.

The study through these indices has made important contributions to knowledge and practice as follows:

The study remains an immense benefit to the industrial development policy makers whether government or private and the international agencies. It highlighted and made recommendations that will contribute to the success of these bodies and hence enable the SMEs contribute meaningfully in the transformation process of a primitive/resource-driven economy to an industrialized economy that is driven by technology and knowledge-based especially the skills and expertise of its people. The study shed more light on the importance of capacity (educational) level with respect to SME development and growth. In this regard, it recommended the streamlining of the activities of the relevant bodies in the capacity building process. In addition to this, the study showed the method of obtaining information with respect to policy formulation on the provision of funds for the SMEs should be "bottom-up" and not "up-bottom" as it is being practiced. This is in realization of the fact that institutional framework, policies, programs and the overall economic environment are important indices that determine the success of the industrialization process through the small and medium scale enterprises.

With respect to the owners of the enterprises, the studies have widened the entrepreneurs' scope and thus enable them to be more successful. The inability of the owners to form or join trade associations was clearly shown to be a factor that militates against the adequate financing of the SMEs. The low capacity development of the owners was also stated among the causes that significantly affected the financing of the SMEs. The recommendations that ensued were such as to enable the SMEs contribute positively in the industrialization process of the nation. Thus, in the emerging new global world of trade, investment, competition and industrialization, the SMEs as the nation's instruments for global engagement and the quality of its human capital (i.e. the skills and expertise of her citizens) will be a major resource to propel the country's economic growth and be at par with the industrialized economies.

XXII. References

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APPENDIX III

LIST OF FUNCTIONAL INDUSTRIES IN KWARA STATE AS AT OCTOBER, 2008

NAME/ADDRESSES	BUSINESS INTEREST/PRODUCTS
1. 7UP Bottling Company, Plc Coca-Cola Road, Ilorin	Soft Drinks
2. Nigerian Bottling Company, Plc Coca-Cola Road, Ilorin	Soft Drinks
3. Irewolede Bakery, Gaa-Akanbi, Ilorin	Bread
4. Noble Breweries, Ajasse-Ipo Road, P.M.B. 437 Ijagbo-Offa	Larger Beer (Noble Beer)
5. Okin Biscuit Ltd, Ajasse-Ipo Road, P.O. Box 289, Ijagbo-Offa.	Biscuits/Foam
6. Mos-Nak Industries, Muritala Muhammed Road, Ilorin	Snacks and Juice
7. International Tobacco Company, Off Ajasse-Ipo	Cigarettes

Road, Ilorin
8. AF Trac & Sons. Kuntu Road, Ilorin Oil and soap
9. City-Sun Pure Water, Offa Pure Water
10. Limca (Sagaya Bottling Company) Soft Drinks
Asa Dam Road, Ilorin
11. Sam Pharmaceutical Coy. Ltd. Pharmaceutical products Adewole Road Ilorin
12. Raj-Rab Pharmaceutical Coy. Ltd. Pharmaceutical products
Coca-Cola Road, Ilorin
13. Tuyil Pharmaceutical, Asa-Dam Pharmaceutical products
Road, Ilorin
14. Lubcon, Nig. Ltd. Trade Fair Road, Ilorin Lubricating Oil
15. Global Soap & Detergent Detergents & Scouring Powder Industries
Ltd. Asa-Dam Road, Ilorin
16. Bio-Medical Services Ltd Intravenous infusion of all types
Industrial Area, No. 1 Ohunege
Road, Ilorin
17. Adisco Nig. Ltd, Ajasse-Ipo Road, Ilorin Generator Assembling
18. Abulenla Furniture, Tanke, Ilorin Furniture
19. Tundyson Investment (Nig.) Ltd. Electric Pole
20. Metal Specification 22/24 Steel & Metal Construction
Amilengbe Road, Ilorin
21. FAATECCO Nig. Ltd. Near CBN Qtrs., Agric equipment
Ilorin
22. Mesba Engineering Co. Ltd. No. 12 Agric equipment
Western Reservoir Road.
23. Moi Engineering Nig. Enterprises No. 7 Agric equipment
Alikinla Surulere, Ilorin
24. Segalum Nig. Enterprises. Opposite Olarewaju Aluminium Frames
Estate Ajasse-Ipo Rd., P.O. Box 4227, Ilorin
25. Kay Plastics. Opp. International Plastic Rubber & Artificial
Tobbacco Company, Gaa-Immam, Ilorin Leather
26. Samad Paper Converter Paper products
Behind Agip Station, Offa, Garage
27. Pilot Newspaper. No. 5, Patigi Off Lajorin Newspaper
Street, Sabo-Oke, Ilorin.
28. Herald Newspaper Company. New Yidi Newspaper
Road, Ilorin.
29. Advocate Newspaper Company. Newspaper & paper publishing
Opp. Coca-Cola Mini Depot,
Basin Road, Ilorin.
30. Great Ajibaiye Industries Ltd. Paper Paper
House, Ajasse-Ipo Rd, Ilorin.
31. Decency Printers & Stationery Ltd. Paper
7 Minijidadi Street, Ilorin
32. Unilorin Press, P.M.B 1515, Paper
University of Ilorin
33. Nathadex Printers, Sabo-Line, Ilorin Printing
34. United Foam Products Ltd. Asa-Dam, Foam Products
New Yidi Rd., Ilorin
35. Pacific Plastics Ltd., Odota, Ilorin Plastics
36. J-Imnis Investment. 183, Ibrahim Taiwo Rd, Ilorin Marble Mining
37. O'supa Mining Company. Near Christian Marble Quarrying & Chips
Nur. & Pry. Sch. Ajasse-Ipo Rd., Ilorin
38. Earth Values & Ventures Nig. Ltd. Solid Minerals
Jebba-Road, Ilorin
39. Omega Rocks Nig. Ltd., Ilorin Solid Minerals
40. Nals Dee Indsutry (Nig.) Ltd., Ilorin Juice, Yoghurt & Water (table)
41. Rabel (Nig.) Ltd. Table water
42. Replastico Nig. Ltd. Plastic Packaging Materials
43. Lub Box Limited Fabrication
44. Carrubox Nig. Ltd. Card Board Packaging materials
45. Kola & Sons Agro-chemicals Cattle salt lick blocks
46. Remto Industries Ltd Bottled/packaged water
47. Kwara Commercial Metal & Chemical
Ind. Nig. Rod & slate bars Ltd. Ilorin
48. Kam Industries Nig. Ltd. Nails, binding wire & RBC
49. Padson Industry Ltd Poly ethane
50. BPA Services (Nig.) Ltd. Blast Freer

51. Mercy of God Business Venture
Bakery
52. Rinde Multipurpose Venture
Industrial Glue
53. Bakare Aladejama Leather Work
Shoe & Bags
54. Adessham Poultry Equipment
Cage, Feeders & Drinkers
55. MO Water
Sachet Water
56. Efemab Blessing Nigeria Enterprises
Pounded Yam
57. Fadamo Nigeria Ltd.
Cassava
58. Ladley Nigeria Ltd.
Yoghurt
59. J.K.B. Enterprises
Cassava chips
60. Vedret Nigeria Enterprises
Industrial Starch
61. Bilewumi Farms
Eggs, poultry and meat

Ailing Industries In Kwara State

1. Nigerian Yeast & Alcohol Manufacturing
Portable & Industrial
Company Ltd. Jebba Road, Bacita, Kwara State

2. Nigerian Sugar Company Ltd, Bacita
Granulated
sugar & molasses
3. United Match Company (Nig.)
Safety Matches
4. Demosco Ltd., Erinle, Kwara State
Toilet paper
5. Prime Tissue, Off Trade fair Rd., Ilorin
Toilet paper
6. Olalomi Industries, Osogbo Road, Ilorin
Rug (carpet)
7. Onya Farms, Tanke, Ilorin
Feed Mill
8. Samduke (Nig.) Ltd. No. 6 Ajasse-Ipo Rd.
Candles & school chalk
P.O. Box 398, Ilorin
9. Kwar Metal Works Ltd., 3, Oko Erin, Rd.
Steel doors & Windows
10. Kwara Furniture and Manufacturing
Trunk & Louvres
Company Rods, Abdulmalik Ind.
Estate, P.O. Box 232, Ilorin
11. Union Steel Limited, Ajasse-Ipo,
Iron rods, steel doors and Windows
Kwara State
12. Prospect Textile Mills (Nig.) Ltd.,
Industrial and handloom
P.O. Box 193, Ilorin
13. Nomar-Teccu International Ltd.,
Hospital equipment & Furniture
Airport Road, Ilorin
14. Mawab Kaolin Mining & Processing
Kaolin Processing
Company, G.R.A., Ilorin
15. Omoniyi Industries
Detergent

16. Ayo Ayodele Pharmaceutical
Surgical cotton
Chemists Nig. Ltd.
17. Singer manufacturing company,
Sewing machine
Asa-Dam, New Yidi Road, Ilorin
18. Adeyemi Furniture Work Ltd.,
Furniture
Ajasse-Ipo Road
19. Resino Plastics (Nig.) Ltd. Yidi Road,
PVC Granules
Asa dam
20. S.A.S. Ventures, Opp. S.S Deen
Beverage
Block Industry Adewole, Ilorin
21. Nigeria Paper Mill, Jebba
Paper
22. Kwara Paper Converters Ltd.,
Paper
Elerin Way, Erinle
23. Patigi Rice Mill
Rice

APPENDIX III

QUESTIONS IN RELATION TO MEMBERSHIP OF TRADE/BUSINESS ORGANISATIONS

	Yes	No
Is the government efficient in the implementation of SME facilities program?	51	119
Are the major inputs into government financed SME support schemes obtained from the SME promoters through the associations?	45	125
Does the membership of trade/business association guarantee adequate information?	111	59
Are the trade/business associations highly organized And Efficient to handle the various SME Financing scheme?	58	112

Evaluation Of Potential Sewage Sludge Usage Associated To The Strain Inoculation From *Bradyrhizobium* Spp. In Cowpea

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Q56 K32 Q57 Q51 Q52 Q53 150106
150499 050205 D31 Q56

***Abstract*-The work's aim was to evaluate the sewage sludge (SS) potential associated with inoculation of *Bradyrhizobium* spp. strains in cowpea. The experiment was conducted in a greenhouse, with five strains of *Bradyrhizobium* spp. (EI-6, NFB700, BR2001, BR4406 and BR3267) and four SS levels (0, 25, 50 and 75 Mg · ha^{-1}). Plants were harvested at 45 days, to measure shoot and root dry weight (SDW and RDW), nodule fresh weight (NodFW), total nitrogen (RTN and STN) and leghemoglobin content (LHb). The equivalent level of SS 75 Mg ha^{-1} supplied higher values in SDW, RDW and increased CEC, Ca, Mg, and Na in the soil. The strain EI-6 and the equivalent level of SS 25 Mg · ha^{-1} had supplied higher quantity of NodFW. The SS application and the use of the strains NFB 700 and BR 4406 showed that these treatments can be used for seeds production in cowpea.**

Keywords: Bradyrhizobium spp.; biological N2 fixation; symbiosis; solid residue

I. Introduction

Inconsequent human actions, such as: expansion of culture areas, extensive cattle breeding, wrong irrigation projects, energy production for different purposes, mining and forest fire, they require new concepts and alternative for sustainability (16). The need for an increase on the world agricultural production has been impaired by the drain and diminution of cultivated soil fertility. As a result, the use of expensive chemical fertilizers has increased (44). To overcome this situation, an efficient alternative is recycling nutrients from the sewage sludge (SS) in both agricultural areas (42) and the recovery of degraded areas (2). From an environmental point of view, the agricultural recycling of Sewage sludge is the alternative with less impact for its final disposition. Besides, it saves energy and natural reserve as Long as the need for mineral fertilization decreases (18, 40, 45). Almost 60% of the amount of inorganic nutrients found in food area poured in sewers, after taking part in human metabolism (23). In Brazil, the agricultural use of sewage sludge, is not yet widely spread out, however, it takes part in national program of environmental impact control. The Brazilian Agenda 21 has a theme area known as "sustainable agriculture", where a series of aspects seen in the current Brazilian agriculture are studied (38). The production of sewage sludge in Brazil, in the beginning of the 21st century, was estimated as something between 150 and 220 thousand Mg of dry weight per year. Its application in Brazil should increase substantially in the next years, following a world-wide trend, as well as the demand generated for one accented growth by volume of treated sewer (38, 47).

We should highlight the improvement in the aggregating state of soil particles due to an increase in the aeration and retention of water, among the effects of sewage sludge on the physical properties of soil, conditioned, mainly, by the presence of organic matter (3, 4, 30). The sewage sludge also induces changes in the chemical properties of the soil, being able to increase in phosphorus (45), organic carbon (11), the humic fraction of organic matter (32), pH, electrical conductivity and cation exchange capacity (37).

Another activity that aims the sustainable development allied to the reduction of costs is the use of leguminous associated to nitrogen fixing microorganisms. Within this harmonic relation, the leguminous has a superior capacity to survive than non inoculated plants, since it has an additional nutritional alternative. Applying sewage sludge to inoculated leguminous culture, there is an increase of nutrients necessary for its development; however, the heavy metals existing in dregs can contribute for the reduction of nitrogen biological fixing, due to its toxicity (10, 26, 42, 51). The objective of the present investigation was to evaluate the potential use of sewage sludge in different levels of concentration associated to the inoculation of different strains of *Bradyrhizobium* spp. in cowpea, as well as to determine its symbiotic efficiency.

II. Materials and Methods

The experiment was conducted in a greenhouse, at the Pernambuco Enterprise of Agricultural and Livestock

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Research (Empresa Pernambucana de Pesquisa Agropecuária – IPA) at a range 28º - 36º with 50 – 70 % relative humidity.

The soil from the Itapirema Experimental Station (0 – 20 cm), located in a atlantic forest region of Pernambuco State at 7º24'50" S, 35º06'30" W and 190 m of altitude.

The soil was air dried; sieved (5.0mm) and the pots were filled with 6 kilograms.

Chemical analysis of the soil was conducted at the IPA in accordance with the Embrapa (15).

The residue used was sewage sludge, from the Sewer Treatment Station of Mangueira, Recife/PE, by using doses equivalent to 0, 25, 50 and 75 Mg · ha-1, chosen according to the results obtained in previous experiments (34, 35), which after the collecting, was dried in the open air, bolted and chemically analyzed (9).

The seeds were inoculated with strains of Bradyrhizobium spp.: BR 2001, BR 4406 and BR 3267 supplied by the National Agrobiology Research Center (Embrapa CNPAB – Rio de Janeiro – Brazil); NFB 700 from Federal Rural University of Pernambuco (Universidade Federal Rural de Pernambuco); EI 6 – Pernambuco Enterprise of Agricultural and Livestock Research (Empresa Pernambucana de Pesquisa Agropecuária - IPA).

The strains of Bradyrhizobium spp. were purified (52) and replated in duplicated into 125 mL erlenmeyers flasks containing 25 mL of liquid mannitol yeast extract medium. All strains were incubated in rotary agitation at 28 ºC per 72h.

The seeds of cowpea cv IPA 206 were desinfested with alcohol at 70 %, for one minute, and solution of sodium hypoclorite at 2,5 %, for five minutes, and washed with deionized sterile water. Six seeds were used in each pot and then inoculated with six mL pot-1 of Bradyrhizobium spp. liquid culture with 109 CFU · mL-1 inoculum rize (Fig. 1).

After emergence was complete, two plants were left per pot. Hoagland solution (19) without nitrogen was applied weekly at a rate of 2 mL · kg-1 of soil.

The plants were harvested 45 days after sowing (DAS) (Fig. 2), then, shoot and root dry weight (SDW and RDW) (65 ºC for 72 h) and nodule fresh weight (NodFW) were evaluated. Total nitrogen was determined using Tecator 1030 auto-analysis by the Kjeldahl´s method (43). Leghemoglobin (LHb) concentration in nodules was assayed spectrophotometrically (540 nm). Nodule LHb was extracted with Drabkin reagent and its concentrations determined according (53) using human hemoglobin as standard.

The experiment design adopted was a randomized block (4 blocks), each block contained five strains of Bradyrhizobium spp., and sewage sludge at four levels, including control (without inoculation and without sludge).

All data were subjected to analysis of variance ($p<0.05$) in accordance with the experimental layout adopted. Differences among treatment means were determined by Tukey's test ($p<0.05$) (41).

III. Results and Discussion

The results obtained from the soil and sewage sludge fertility analysis, before assembling the experiment. Everything is shown in Table 1. Taking into account the Resolution n. 375, 29th August, 2006, regulated by CONAMA – Conselho Nacional do Meio Ambiente – Environmental Council (Table 2), for the content of some heavy metals present in the SS, levels over the maximum limited permitted were not found considering the ones evaluated in this work. The regulations most used for the levels of heavy metals in SS, shown in table 2, are the P 4230 rule from CETESB (Companhia de Tecnologia de Saneamento Ambiental do Estado de São Paulo), which is based on the legislation of United States of America, USEPA (United States Environmental Protect Agency) 40 CFR Part 503, the rule IAP (Instituto Ambiental do Paraná), which used the parameters of Spanish law as a reference, so, it is similar to the existing regulation in the European Community (86/278/EEC) (8, 12, 21, 29, 48).

All the variables showed results independent of the interaction influence between SS, in growing dose, and the inoculation of strains of *Bradyrhizobium* spp. As a result, the SS and the microorganisms used supplied isolated results in the nodulation and development of cowpea.

The pH results, independent variable, showed a quadratic diminution within the increase of sewage sludge doses application. After 14 days of incubation of sewage sludge doses within the soil, before planting, a change in the soil pH was noticed between treatments, diverging between 6,3, for the treatment of absolute control (TA) and 6,0 for the treatment with higher dose of SS, 75 Mg · ha^{-1}. At the end of the experiment, a more accentuated diminution of pH in relation to a bigger application of sewage sludge in the soil (Fig. 1; Table 3).

Other authors found similar results to the acidification of soil when growing doses of SS were applied (5, 36, 37, 42).

The pH is a determining factor of metal availability in the soil, which indicates that the more acid the more solubility and consequent availability of the those elements will be available (6, 7, 22).

According to some researches, it was observed that heavy metals can bring about diverse effects on the soil microbiological processes, as in the microbial biomass, ATP concentration of the soil and nitrogen fixation by heterotrophic bacteria (27, 28). However, the fact that heavy metal is present in the soil does not mean that it is in a form ready to be absorbed by plants. As a result, it can remain for long periods of time without being absorbed in toxic amounts. Researches have showed that there is no correlation between total content of heavy metals in the soil and its phytotoxity (14). Therefore, to know the contamination, in relation to the effects on plants and the food chain, it is necessary to determine the phytoavailable concentration of those metals (24).

Other variables also showed a meaningful difference between growing application of SS to the soil, responding in a quadratic way to the Ca and the linear form for CEC (cationic exchange capacity), the Mg and Na. Only P did not

showed any meaningful change due to the increase of SS doses (Table 3). The increase of CEC and the elements (Ca, Na and Mg), according to the SS doses used helped (36) to get the results.

According to the results, the CEC showed good results with the increase of LE doses applied to the soil, as it plays a fundamental role in the residual effect of this residue in the soil, then, together with a big specific surface of organic matter present in SS, though a bigger number of electrostatic connections between soil particles, diminution of density and increase in airing and water retention (3, 4, 30, 31, 37).

The increase of P and Mg content are fundamental for enriching the soil fertility; the increase of Ca brings about a radicular growth and precipitate Al present in the soil (13).

Although there was an increase of soil fertility, some elements can be harmful when leached for water sources, it can bring about problems similar to eutrofization. The P in high content become the main responsible for this process, however, its usage from urban sewage is extremely necessary due to the decrease of phosphorus natural sources. This need to get some benefit out of P is due to the "break" in its natural cycle by human activities (49).

The increase of the Na level can also be harmful when it indicates an increase of salinity of the soil (33).

The increase of SS doses applied to the soil also brought about an increase in the production of dry weight of cowpea. The shoot dry weight (SDW) increased considerably, and it was represented by a quadratic function. The root dry weight (RDW), even represented by a linear function, it showed a little growth (Table 4; Fig. 2).

It is known that the increase of residue, rich in organic matter, in agricultural soils, brings about an accentuated increase of dry weight in plants, in comparison with treatments without residue. Results of biomass increase with application of growing doses of SS were also found in other researches (36, 46).

A bigger production of fresh weight of nodules (NodFW) when the equivalent dose to 25 Mg · ha-1 was applied. Due to the increase of applied doses, the MFNod decreased in a cubic proportion (Fig. 2).

The answer to NodFW in relation to the increase of SS dose applied can be justified by the presence of metals in residue, since; when they are present in specific concentrations they can omit the development of microorganisms present there. Each microorganism has a specific tolerance or a capacity of resilience on it own for each kind and quantity of existing element.

The SS doses applied to soil did not show any meaningful difference in the leghemoglobine content (LHb) (Tables 4 and 5), besides, it did not show any meaningful difference in relation to the inoculated treatments with different strains (introduced and native), even though they presented, inside nodules of cowpea, rose color in different tones (data not presented).

Due to the sensibility of LHb, the presence of other nodules of native rhizobia of soil may have influence its response. The LHb is a symbiotic product, in which the part of globine is synthesized by the plant in response to the rhizobia infection (50) and the LHb occur before N2 fixation (17). The LHb content in the nodules change according to the leguminous specie, rhizobia strain used, beside it depends on the process of oxygen diffusion via the infected cells in the nodules (25).

In relation to the total accumulated Nitrogen in the root (RTN) and the shoot part (STN), there was no meaningful difference between the treatments, as a result, the LE doses applied to the soil and the inoculated strains did not influence meaningfully in the total accumulated Nitrogen by cowpea (Tables 4 and 5). However, the application of growing doses of SS, even without demonstrating expressive difference, there was an increase in the contents of RTN and STN.

Only the variable NodFW showed statistic difference among inoculated strains via Tukey´s test ($p < 0,05$), though it showed better results with strains EI-6 (Table 5).

Even with high NodFW, the results of strain EI-6 did not differ meaningfully, among other inoculated strains and different doses of LE, in variables such as: RTN, STN and LHb. Then, suggesting that it does not have a bigger potential in fixation of atmospheric Nitrogen.

(39) checked negative effect of heavy metals in the survival of B. japonicum in soil treated with sewage sludge, which reduces the nodulation potention in soy, according to the results of (1). (27) observed that the application of sewage sludge in soils cultivated with white clover, it reduced meaningfully the growth and fixation of N.

The strains used in the experiment did not show meaningful differences in RDW and SDW of root of cowpea; however, absolute control (TA) showed higher results in SDW and similar ones in RDW, probably due to the presence of native rhizobia in the soil (Table 5).

During the observations performed, daily, for 45 days of experiment, in the greenhouse, a growth of string beans was noticed on the 36th day after plantation. The treatment with sewage sludge application at three levels (25, 50, 75 Mg · ha-1) without inoculation, however, the inoculated treatments with NFB 700 and BR 4406 strains at 3 levels of adubation with SS, they showed a precocious growth of beans. It is fundamental to study it further on the possibilities of those treating potential on the production of beans, as a result it is also important and necessary to evaluate the content of heavy metals transferred to the beans, in order to avoid any harm brought about those elements (20). Once, the precocious of beans development happened within the sludge, its applications in smaller doses, would be important economically speaking, besides, it easier to conduct environmentally.

At first it is possible to indicate BR 2001, BR 3267 and IPA 206 strains and the LE 75 Mg · ha-1 doses can be indicated in the shoot cowpea production to animal fodder or even as green compost, checking the contents of heavy metals absorbed to avoid any phytotoxic harm, however, researches in locum should be done.

According to the results, the production of shoot dry weight and cowpea root showed better results with the application of sewage sludge in a dose equivalent to 75 Mg · ha-1, it was not suffer any influence of inoculated strains. This same dose showed the possibility of CEC, Ca, Mg, and Na

increase in the soil, without producing risks at a short term. The fresh weight of nodules was in a bigger quantity in the dose equivalent to 25 Mg · ha-1. The plants of cowpea inoculated with the EI-6 strain had bigger nodule fresh weight. The leghemoglobin present in the nodules and the total nitrogen accumulated by cowpea did not show any meaningful difference between doses of SS applied or inoculated strains. The application of sewage sludge and inoculation of strains NFB 700 and BR 4406, in cowpea, they have potential for producing beans. High doses of sewage sludge increase the quantity available of potentially toxic elements for the plants, via the amount of sludge inserted and the acidification of pH, increasing the solubility of those elements in the soil, therefore, constant evaluations of the levels of those elements are necessary, since they offer risks at the long term.

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V. Resumo

Avaliação do lodo de esgoto inoculado com Bradyrhizobium spp.
na cultura do caupi O objetivo do trabalho foi avaliar a potencialidade do lodo de esgoto (LE) associado à inoculação de Bradyrhizobium spp. em caupi. O experimento foi realizado em casa de vegetação, com cinco estirpes de Bradyrhizobium spp. (EI-6, NFB700, BR2001, BR4406 e BR3267) misturadas ou não com LE em quatro níveis (0, 25, 50 e 75 Mg · ha^{-1}). As plantas foram colhidas aos 45 dias após desbaste, para medir produção de matéria seca de raiz e parte aérea, peso fresco de nódulos, nitrogênio total e conteúdo de leghemoglobina. O nível equivalente a 75 Mg · ha^{-1} de lodo de esgoto forneceu valores mais elevados de produção de matéria seca da parte aérea e da raiz e aumentou CTC, Ca, Mg e Na no solo. A estirpe EI-6 no nível equivalente a 25 Mg · ha^{-1} de LE apresentou maior quantidade de peso fresco de nódulos. A aplicação de LE e a utilização das estirpes NFB 700 e BR 4406 mostrou que esses tratamentos podem ser utilizados para a produção de caupi.
Palavras-chave: *Bradyrhizobium spp.*; fixação biológica de N_2; simbiose; resíduo sólido

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Table 1. Chemical analyses of the soil and of the sewage sludge (SS)

Elements	Soil	SS
pH (H_2O)	6,3	5,1
P ($mg \cdot kg^{-1}$)	20	45,0
Cu ($mg \cdot kg^{-1}$)	1,5	155,0
Fe ($mg \cdot kg^{-1}$)	1,6	16,9
Zn ($mg \cdot kg^{-1}$)	1,8	548,0
Mn ($mg \cdot kg^{-1}$)	5,0	207,0
Pb ($mg \cdot kg^{-1}$)	---	120,0
Na ($cmol_c.dm^{-3}$)	0,08	0,3
K ($cmol_c.dm^{-3}$)	0,15	2,1
Ca ($cmol_c.dm^{-3}$)	3,40	9,4
Mg ($cmol_c.dm^{-3}$)	0,55	1,2
H ($cmol_c.dm^{-3}$)	2,21	---
S ($cmol_c.dm^{-3}$)	3,21	---
CTC ($cmol_c.dm^{-3}$)	5,70	---
N-total ($kg.kg^{-1}$)	---	22,5
C ($kg.kg^{-1}$)	1,39	28,5
MO ($kg.kg^{-1}$)	2,4	49,3
C/N	---	12,7
V (%)	56,32	---

Table 2. Different heavy metals concentrations in sewage sludge for agricultural applications regulated by USA, European Community (EC) and Brazil

Heavy Metals	USEPA	CETESB	IAP	CE	CONAMA
	----------	(mg · kg^{-1})		----------	
As	75	75	nd	nd	41
Ba	nd	nd	nd	nd	1300
Cd	85	85	20	20-40	39
Pb	840	840	750	nd	300
Cu	4300	4300	1000	1000-1750	1500
Cr	nd	nd	nd	1000-15000	1000
Hg	57	57	16	16-25	17
Mo	75	75	nd	nd	50
Ni	420	420	300	300-400	420
Se	100	100	nd	nd	100
Zn	7500	7500	2500	2500-4000	2800

nd = not defined
*CETESB (Companhia de Tecnologia de Saneamento Ambiental do estado de São Paulo); CONAMA (Conselho Nacional do Meio Ambiente); IAP (Instituto Ambiental do Paraná); USEPA (United States Environmental Protect Agency).
Source: Usepa (1982), Cetesb (1999), Iap (2003), Melo et al. (2006), Brasil (2006).

Table 3. Averages and polynomial functions for the sewage sludge levels on variables pH, cationic exchange capacity (CEC), Ca, Mg, Na and P

Levels	pH	CEC	Ca	Mg	Na	P
(Mg · ha^{-1})		----------	(cmol$_c$ · dm^{-3})		----------	(mg · kg^{-1})
CT	5,99*	5,9*	2,833*	0,718*	0,060*	17,208
25	5,48*	6,7*	3,345*	0,875*	0,085*	15,208
50	5,21*	7,5*	3,643*	0,972*	0,091*	19,250
75	5,18*	7,9*	3,704*	1,108*	0,105*	22,083
function	Q	L	Q	L	L	---
msd	0,05	0,53	0,27	0,15	0,01	5,77

Table 4. Averages and polynomial functions for the sewage sludge levels on variables shoot and root dry weight (SDW; RDW), nodule fresh weight (NodFW), root and shoot total nitrogen (RTN; STN) and leghemoglobin content (LHb) in cowpea at the different levels of sewage sludge

Levels	SDW	RDW	NodFW	RTN	STN	LHb
(Mg · ha^{-1})	----------	(g · pot^{-1})	----------	---	(mg · pot^{-1}) ---	(mg · g^{-1} nodule)
CT	8,021*	0,720*	1,458*	0,579	8,025	0,135
25	10,550*	0,890*	1,725*	0,624	13,719	0,167
50	11,920*	1,050*	1,191*	0,789	12,985	0,169
75	12,822*	1,103*	0,800*	1,036	15,573	0,176
function	Q	L	C	---	---	---
msd	0,81	0,14	0,23	0,80	7,667	0,073

CT = control treatment
* = significant to polynomial functions at F test ($p < 0,05$).L = linear; Q = quadratic; C = cubic.
msd = minimum significant difference.

Table 5. Changes in shoot and root dry weight (SDW; RDW), nodule fresh weight (NodFW), root and shoot total nitrogen (RTN; STN) and leghemoglobin content (LHb) in cowpea inoculated with different *Bradyrhizobium spp.* strains

Strains	SDW	RDW	NodFW	RTN	STN	LHb
	----------	($g \cdot pot^{-1}$) ----------		----- ($mg \cdot pot^{-1}$) -----		($mg \cdot g^{-1}$ nodule)
CT	11,074 a	0,942 a	1,075 b	1,005 a	8,411 a	0,120 a
EI-6	10,892 a	0,921 a	1,412 a	0,783 a	13,783 a	0,169 a
NFB 700	10,781 a	0,992 a	1,375 ab	0,918 a	13,418 a	0,180 a
BR 2001	10,647 a	0,905 a	1,262 ab	0,685 a	15,343 a	0,202 a
BR 4406	10,618 a	0,916 a	1,381 ab	0,633 a	9,819 a	0,157 a
BR 3267	10,959 a	0,964 a	1,256 ab	0,520 a	14,681 a	0,141 a
msd	1,11	0,19	0,32	1,104	10,455	0,099

CT = control treatment.
msd = minimum significant difference.
In each column the means followed by the same letter do not differ statistically ($p<0.05$) from each other, according to Tukey´s test

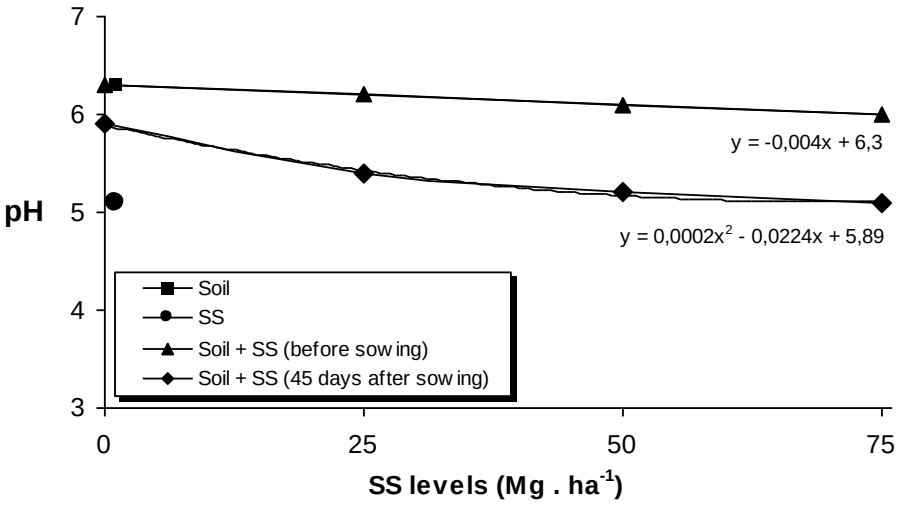

Figure 1. Influence of the sewage sludge (SS) levels on soil pH

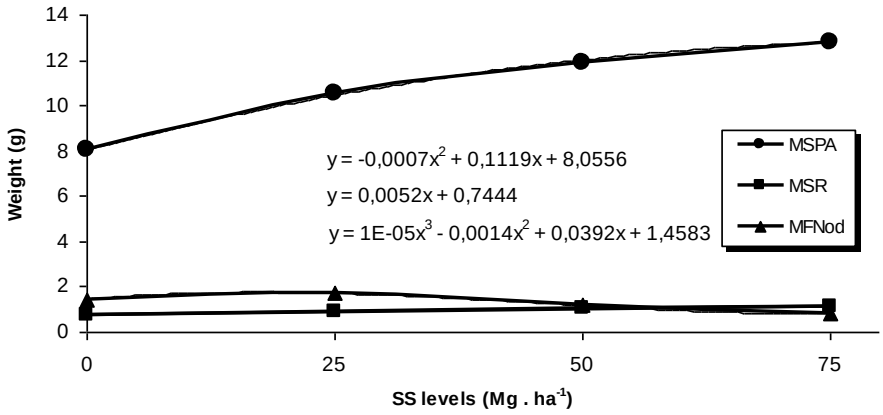

Figure 2. Changes in root dry weight (RDW), shoot dry weight (SDW) and nodule fresh weight (NodFW) in cowpea at the different levels of sewage sludge (SS)

Impact Of Weiner Process On Exchange Rate Forecasting

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GJMBR Classification (FOR)
F31 F37 G15 E37 E32 E44 E42 F13

Abstract- **Hedging techniques whether in portfolio or foreign exchange management require accurate forecasted underlying assets' prices and rates not only to quantify the expected losses but also for computing the optimum premium payable and in deciding the number of contracts needed to neutralise the expected losses. Most of the previous studies in this area prove the efficiency and accuracy of the forecasting models through intensive algebra and a few tested on the real underlying assets' prices and exchange rates. To overcome this problem we tested Black-Scholes and Euler-Maruyama models on Indian Rupee and Malaysian Ringgit rates of eight country currencies. Our results show that the Black-Scholes and Euler-Maruyama models forecast exchange rates close to each other though they work on different principles. These two forecasted rate trajectories converge almost perfectly. But when compared to real Indian Rupee rates the models are inefficient as the real path of exchange rates of these eight countries diverge very much. In case of Malaysian Ringgit rates for almost six months, Black-Scholes and Euler-Maruyama models forecasted exchange rates with lesser error and their paths converge with the real rates. This finding will be useful in exchange rate risk management.**

I. Introduction

Foreign exchange rates assume importance in the present global financial crisis. US dollar continuously depreciated during the last three years against Euro and other major world currencies including Indian Rupee. To protect the values of imports, exports and foreign assets multinational corporations (MNCs) use derivative instruments like forward and futures contracts. These contracts work alike in protectecting value of financial assets. The futures contracts are standardised contracts traded on the exchange while forward contracts are mostly customised to the MNC's needs and the participating banks. The futures contracts work on the marking to market principles to reduce default risk. Both futures and forwards are highly inflexible and they are not resilient when the financial assets move favourably. On the other hand the options contracts offer flexibility in the form of exercise right to the buyer of the contract to execute or not in the future. This valuable right given by the option contracts is the reason for the popularity of these contracts in all spheres of finance especially hedging. Traditionally the MNCs use forward contracts to protect the foreign financial assets. Modern derivative instruments include option contracts and swap contracts. These contracts are very attractive as they are standardised, cheap in terms of price, flexibility and liquidity as they are traded on derivative exchanges. Strict regulation allays fears of default, fraud and breach of agreements. Reasonable commission, transparency in dealings and on line trading are the other additional attractions for the option contracts.

Despite the above positive points these options contracts are elusive not only in pricing but also in quantifying their risk, even experienced brokers find it difficult to price. They use market standard models like Black and Scholes (BS) to price them. Model like BS will work only when the underlying asset's price movements are accurately forecasted, if not errors creep in and lead to either over or under pricing consequently the cost of hedging increases. The real challenge is in forecasting the movement of the underlying assets price and the co-movement of these contracts' prices. The prices of these contracts are to be efficient to avoid arbitrage opportunities in spot and forward markets.

The Black Scholes method is the pioneering effort in pricing the European type options, which could be exercised only on maturity. The later models like Longstaff-Schwartz and other methods modify the BS method to accommodate the pricing of American options and the exotic options like Bermuda, Asian, Barrier options. The challenge lies not in pricing techniques but in forecasting the future movements of financial assets' prices like share and foreign exchange. Almost all models use Brownian motion (Weiner process) to quantify random movements in financial asset prices. Even the BS model uses the Weiner process and the logarithmic returns to forecast the movement of underlying values (David, 2009, De Los Rios, 2009). A new branch of calculus is applied to estimate random movements in prices. The stochastic calculus which incorporates the Weiner process for estimating the random movements in prices of financial assets is the main theme of the financial engineering. Ito's lemma is mainly applied in stochastic calculus which is a subset of Taylor series is the main branch advocated by several researchers to capture the evolution of prices of financial assets, with Brownian motion.

In this paper we attempt to compare empirically the forecasting accuracy of the BS model which is based on natural log returns and works on Geometric Brownian Motion (GBM) with the Euler Maruyama method (EMM) which works on Arithmetic Brownian Motion (ABM). The stochastic behaviour and movement of almost all financial time series are based on two parameters namely mean (drift) and variation (diffusion) (McMillan, 2009). While ABM computes future movement by adding the returns the GBM computes the future movement by exponentiation. We test these motions on six different exchange rates of Indian Rupees (INR) and Malaysian Ringgit (MYR). Most of the

research papers published in this area takes Monte Carlo Simulated data to prove the property, pattern and behaviour of time series data (Giles et al, 2009, Higham, 2001). Another group of researchers explain the above properties through pure algebra. Pure algebra and Monte Carlo simulated data both produce the expected behaviour perfectly and researchers conclude that the stochastic calculus is ideal for forecasting the underlying prices and thus good for option valuation (Chenggui, 2006, Golightly, 2009, Jacob, 2009, So Mike, 2007). Our paper is different from others as it tests the Weiner process stochastic behaviour of exchange rates with real exchange rates. In our paper we attempt to compare the real exchange rate with Monte Carlo Simulated diffusion based BS and EMM to find out their convergence and divergence.

Reminder of this paper is organised as follows. Section two discuses the Weiner process and its importance in stochastic calculus. The methodology is given in section three. The sources of data and its scope are given in section four. Section five gives results of data analysis and interpretation. Section six concludes the paper.

II. Brownian motion - Weiner process

Botanic Scientist Brown (1827) found pollens floating in water were moving in different directions haphazardly due to the random bombardment of water molecules. Weiner (1926) refined it with time dimension and established trajectories of drift to the random movements. This analogy is applied in finance and in forecasting the movements of various financial asset prices (Kiani, 2009, Wu, 2009). In financial engineering the water molecules are equated with the transactions in the capital market (demand and supply of financial assets) and prices move at random due to the buying and selling activities which are equivalent to molecular bombardment. The trading transactions in the capital market and foreign exchange market are innumerable small independent events which collectively determine the price of financial assets. Prices of shares, bonds, units, rates like interbank offered rate and exchange rate are all fall in this domain, (Adkins et al, 1999).

III. Methodology

Assume that N transactions independently occur at a time interval Δt, with mean λ, we can define the process as Poisson process. In a time interval (t,t+Δt) the number of transactions that would happen is equal to ΔNt =Nt+Δt-Nt i.e. the expected number of transactions is E(ΔNt)=λΔt and the variance is Var(ΔNt)=λt as per the Poisson process. If the number of transactions are sufficiently larger (>20) then the Poisson Process will become normal Gaussian process with mean μ and variance σ2. These facts lead us to write, the number of transactions that takes place in a time interval is equal to

$$\Delta Nt \cong \lambda\Delta t + \sqrt{\lambda \Delta t} Z \quad (1)$$

In other words the number of transactions in the next time interval is approximately equal to mean transactions plus square root of variance (volatility) multiplied by a random number drawn from the standard normal distribution (Gaussian Distribution) or noise.

Gaussian Process (otherwise known as Weiner process or Brownian motion) plays an important role in modelling returns (Hall Peter et al, 2008). The transactions, like water molecules, hit the underlying asset prices. The fundamental reason for their importance is that the volatility in prices of financial assets is the direct consequence of stochastic nature of orders received in capital market (Hooper et al, 2009; Adkins et al, 1999). If ask orders are more than the bid orders the price decreases and vice versa (Beine et al, 2009). The volatility in prices generated by orders is collectively characterised by Gaussian probability density function which is:

$$p(x) = \frac{1}{\sqrt{(2\pi)^n |\Sigma|}} \exp(-0.5(X-\bar{X})' \Sigma^{-1} (X-\bar{X}) \quad (2)$$

Σ is the covariance matrix of X=(x1,x2,...,xn)t n orders at times of t1, ... tn

The normal cumulative probability distribution function F(x) gives the cumulative probability or area of the normal curve for a given size of standard deviation. The volatility is stochastic as discussed earlier and may be any random number which can be simulated through Monte Carlo method. The normal cumulative distribution function is to find probability is:

$$F(x) = \int_{-\infty}^{\infty} p(x)\, dx = 1 \quad (3)$$

Natural variables such as population of all species, financial assets like shares bonds etc grow continuously. But nature always controls the growth of these variables with random events like pandemic, natural calamities as tsunami, earth quake etc. Technically speaking to the deterministic models a noise is added to control the continuous positive growth. This growth is equivalent to drift (mean) and the diffusion is equivalent to (variance) which could be modelled by stochastic differential Equation (Chenggui, 2006, Golightly, 2009, Jacob, 2009, So Mike, 2007). Financial time series data are to be differenced to get stationary data. The stationary data (returns) has the property of constant mean and variance which could be easily modelled through Weiner process. Thus

$$dX_t = \bar{r} X_t dt + \sigma X_t dW_t \quad (4)$$

dxt = change in underlying price
r= mean rate of growth
Xt = underlying price
dt= small time interval may be a day expressed in decimal years
σ= annual volatility in underlying returns
dWt = change in the random Weiner number drawn as per Monte Carlo simulation

Increment in any asset's price in a given time is the growth in mean price plus another increment based on volatility. When $\sigma = 0$ the diffusion component in the above equation will become zero and the process will become deterministic, which has a solution $x(t) = x_0 e^{rt}$. When random diffusion

enters the stochastic Calculus (Itô Calculus) is applied as the normal calculus is not suitable for differentiation and integration. The underlying financial asset's price will change from x0 to xt. In integral form equation four becomes

$$X(t) = X_0 + \int_0^t f(X(s))ds + \int_0^t g(X(s))dW(s), \qquad 0 \le t \le T \quad (5)$$

f = represents mean
g = represents volatility
s = small time in terms of years

The above equation five is based on arithmetic progression. But the celebrated Black Scholes (BS) proves that the growth is based on Geometric Brownian motion (Berkowitz, 2010, Madan, 2009) which argues that the growth is a compounded rate and hence the log returns are to be the basis for any modelling. Itô calculus emerging from Taylor series models the geometric growth as:

$$dF = \frac{dF}{dS}dS + \frac{1}{2}\sigma^2 S^2 \frac{d^2F}{dS^2}dt \quad (6)$$

By manipulation we get

$$\ln\left(\frac{S_t}{S_0}\right) = \frac{1}{S}(\mu S dt + \sigma S dX) - \frac{1}{2}\sigma^2 dt \quad (7)$$

$$\ln\left(\frac{S_t}{S_0}\right) = \left(\mu - \frac{1}{2}\sigma^2\right)dt + \sigma dX \quad (8)$$

$$S(t) = S(0)e^{\left(\mu - \frac{1}{2}\sigma^2\right)t + \sigma(X(t) - X(0))} \quad (9)$$

$$X_t = X_0 \exp\left((r - 0.5\sigma^2)\,t + \sigma dW_t\right) \quad (10)$$

The above equation is the celebrated Black Scholes equation which works on geometric compounded growth principles.
Another model which works on arithmetic progression is the EMM. Two main differences can be attributed to this EMM compared to Black Scholes model. Firstly it is based on integration by parts with the initial spot price. Secondly it works on longer time interval say a week (Chenggui, 2008, Garrison, 2005). The proposed model is given below.

$$x_j = x_{j-1} + \delta t(f(x_{j-1}) + g(x_{j-1})(W(t_j - W(t_{j-1})) \quad (11)$$

The time limit δt in the above equation $\lim_{\delta t \to 0}$ the frequency of transactions will increase to infinity. This infinitive solution is desirable but the time, effort and computations not worth it. Even in longer time intervals with fewer transactions the same answer to the SDE is arrived. The above equation in differential form is as follows.

$$X(t) = X_0 + \int_0^t f(X(s))ds + \int_0^t g(X(s))dW(s), \qquad 0 \le t \le T \quad (12)$$

X_0 is the price of the underlying at time t_0, s is the s is the smallest time in years f and g are the mean and standard deviations of returns. The first integral is the deterministic growth (drift) and the second integral is the Brownian motion in a longer time interval Δt times standard deviation. The solution *x(t)* will give the trajectory of any financial underlying asset.

The above equation will be given in differential form is as follows

$$dX(t) = f(X(t))dt + g(X(t))dW(t), \qquad X(0) = X_{0,} \qquad 0 \le t \le T \quad (13)$$

The same equation for numerical computation is

$$X_j = X_{j-1} + f(X_{j-1})\,\Delta t + g(X_{j-1})\,(W(\tau_j) - W\tau j{-}1, \quad j{=}1, 2, \ldots, L \quad (14)$$

The trajectories of BS and EMM models are simulated and therefore theoretical in nature. Their convergence or divergence to real price trajectory could be quantified through the sums of squares of deviations known as residuals or errors. To get the deviation of sums of squares the theoretical prices are subtracted from real underlying prices squared and added as follows to get the average.

$$aerr = \frac{1}{n}\sum_{t=1}^{T}(X_r - X_{BS/EM})^2 \quad (15)$$

aerr= average error
X_r = Real price of underlying asset
X_{BS} = BS rate or EMM rate

Another way of measuring the error is to take the end point data of both real and theoretical rates to find the absolute error at T. This will give only the error at the end of the trajectory.

$$err = ep\,|X\_r - X\_(BS/EM)\,| \quad (16)$$

ep = prices of underlying at the end of trajectory

With the above methodology we write MATLAB m file (given in appendix) to empirically generate rates and visualise the paths generated by the Black-Scholes and Euler-Maruyama Method SDEs.

IV. Data

To empirically test the above SDEs under BS and EMM we took Indian Rupee (INR) and Malaysian Ringgit (MYR) as the base currencies and downloaded data of exchange rates of eight currencies for 2008 and 2009. Excluding African continent we have two currencies each for every continent. American continent is represented by USD, CAD, Europe is represented by EUR, GBP, Australia is represented by AUD, NZD and Asia is by JPY, KRW. Presently the trade is not limited to any closed boundary due to globalisation and the present global financial crisis also emphasises the importance of exchange rates in quantifying currency risks

(Rahman, 2009). As the exchange rates growing in prominence in every sphere of business hedging decision is also grow in proportion. We proceed to test the BS and EMM SDEs with real exchange rates. Using 2008 data for BS we computed log returns and for EMM we used normal returns and computed descriptive parameters like mean and standard deviations. Exchange rate data of 2009 is used as a holdout sample to validate the Black-Scholes and Euler-Maruyama theoretical rates.

V. Analysis and Interpretation

Applying the above methodology we simulated random volatility using Monte Carlo technique for every day exchange rate and applying the parameters computed on 2008 data, we forecasted exchange rates for 2009. If the SDEs are efficient in deriving the trajectory they should provide a trajectory closer to real exchange rate path. If the theoretical rates do not converge to real rates, errors emerge. We have quantified the errors in sums of squares and in absolute deviation for both BS and EMM. The results of our analysis are presented below.

The table below gives the parameters estimated with 2008 data. January 2, 2009 rates for each exchange rate is treated as starting rate (Xzero) over which the trajectory starts and moves in Brownian motion and ends at T, which is the end of the year. Different currencies start the trajectory at different starting point as per the strength of the currency in relation to INR and MYR. The second column gives the mean rates for 2008 with returns and their deviations for both INR and MYR. Very small average returns could be observed due to daily returns. It is less than five basis points.

Table 1 Mean and Standard Deviations of returns based on 2008 exchange rates

	Indian Rupee			Malaysian Ringgit		
	Mean Rate	Mean return	SD	Mean Rate	Mean Return	SD
USD	48.615	0.001	0.007	3.310	0.000	0.003
CAD	39.698	0.000	0.011	3.334	0.000	0.006
EUR	67.668	0.001	0.010	4.878	0.000	0.004
JPY	0.536	0.002	0.013	0.030	0.000	0.007
GBP	71.043	-0.001	0.010	6.562	0.000	0.004
AUD	33.942	0.000	0.016	2.917	0.000	0.007
NZD	28.261	0.000	0.013	2.559	0.000	0.008
KRW	0.039	0.000	0.017	0.004	0.000	0.003

SD = Standard Deviation

The mean rates for hard currencies are greater than Rupees 30 while for soft currencies it is less than one Rupee. Japanese yen though it is less than one Rupee it is still a hard currency. The British Pound shows a small negative return while other currencies show an average closer to zero. Once the rates are converted to returns they become stationary. In terms of volatility Korean Wong and Australian Dollar show a wider variation of 0.017 and 0.016. USD shows very less volatility. It implies that USD is more stable in 2008 than other exchange rates. In case of MYR the average returns are zero for all currencies which indicates that 50% of the time the exchange returns (ExR) are positive and vice versa. This shows that when the rates are converted to returns they become stationary and useful for further analysis. NZD, AUD and JPY show somewhat higher variation. Other currencies returns are less volatile and stable. INR is soft when compared to MYR and hence the means and volatility are higher for INR. This is consistent with the prevailing economic situation and shows the traders confidence in a country's currency.

The parameters mean and standard deviation computed with 2008 ExR are applied in forecasting the BS and EMM exchange rates. Monte Carlo simulated random noise was included while estimating the exchange rates under BS and EMM. Table two below gives the real ExR mean, BS mean and EMM mean with their respective volatilities in terms of standard deviations.

Table 2 Rupee and various exchange rates' mean and standard deviation for 2009

	Real Mean	Real SD	BS Mean	BS SD	EMM Mean	EMM SD
USD	48.352	1.429	47.554	2.190	47.435	2.249
CAD	42.451	1.907	36.167	2.018	35.944	2.075
EUR	67.276	2.193	69.304	3.044	68.843	3.196
JPY	0.517	0.015	0.523	0.029	0.517	0.030
GBP	75.546	3.251	67.124	3.771	66.325	4.057
AUD	38.150	3.696	40.081	7.045	39.407	6.616
NZD	30.602	3.080	36.931	5.564	36.526	5.351
KRW	0.038	0.002	0.042	0.003	0.041	0.003

SD = Standard Deviation

The first two columns give real INR average and standard deviations, column four and five give the mean and standard deviation of BS method and the final two columns give the same parameters for EMM for the selected eight currencies. USD, CAD and GBP show lesser mean rate than the real mean and higher standard deviations both in BS and EMM rates. But Euro, Yen, AUD, NZD and KRW show the opposite. Their BS and EMM mean rates are higher than real mean rates and show lesser volatility. These results do not convey any fixed pattern and it seems the currencies move at random and not based on any co-movement or regional links.

The mean rate movement against MYR is given in the following table for the same eight currencies. Except Japanese Yen all other currencies both in BS and EMM show higher mean rates than the real mean rates. In terms of volatility the forecasted volatilities are less than the real volatilities of these eight currencies. For Yen the opposite behaviour could be observed.

Table 3 Ringgit and various exchange rates 2009, means and standard deviations

	Real Mean	Real SD	BS Mean	BS SD	EMM Mean	EMM SD
USD	3.332	0.149	3.375	0.033	3.372	0.033
CAD	3.136	0.134	3.632	0.160	3.623	0.154
EUR	4.888	0.173	4.927	0.150	4.919	0.153
JPY	0.032	0.003	0.028	0.001	0.028	0.001
GBP	6.154	0.375	6.461	0.110	6.454	0.115
AUD	2.828	0.270	3.050	0.158	3.040	0.152
NZD	2.370	0.201	2.579	0.127	2.571	0.124
KRW	0.003	0.000	0.004	0.000	0.004	0.000

SD = Standard Deviation

This shows the importance of base currency on which ExRs are computed. INR is softer by thirteen times and hence the multinational corporations and traders dependent more on harder currencies while pricing their products and services. Stronger currencies not only brigng good margin of profits but also they are chosen frequantly for pricing goods and services it seems.

The errors are deviations of BS and EMM rates from the real rates. They show the convergence or divergence of the rates forecasted. The errors are as follows.

Table 4 Black-schools and Euler-Maruyama average error and Absolute error

	Indian Rupees				Malaysian Ringgit			
	BS error		EMM error		BS error		EMM error	
	Mean	Absolute	Mean	Absolute	Mean	Absolute	Mean	Absolute
USD	3.08	363	96.2	1,638	0.02	34.34	8.1	8.6
CAD	47.96	1,584	408.4	1,353	0.31	125.29	7.1	29.7
EUR	24.64	786	203.2	3,333	0.02	25.43	17.2	6.6
JPY	0.00	7	1.8	0.2	0.00	0.99	0.0	0.2
GBP	106.57	2,179	593.6	4,276	0.21	78.48	26.8	16.8
AUD	19.16	835	177.9	1,172	0.18	73.84	5.7	16.6
NZD	49.93	1,595	376.7	771	0.14	71.57	3.9	16.7
RW	0.00	1	0.2	0.0	0.00	0.12	0.0	0.0

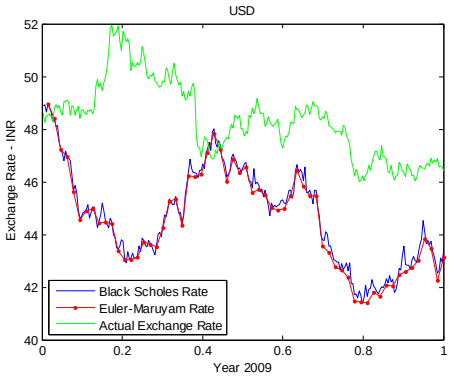
The errors shown by INR exchange rates are higher when compared to MYR. Two reasons could be attributed for this larger error in INR. The INR is a soft currency and hence the exchange rates are higher in number. Therefore by volume the error is larger. Secondly the error also could be attributed to the deviation of the forecasted rates from actual rates. Due to non convergence also the error could arise. For INR the mean and absolute errors are lesser in BS computations than the EMM computations. The EMM errors are several times higher because the BS model computes 252 rates for each day and it is an average while the EMM computes 63 rates each for one week in a year, to be precise rates for every four days. Hence the magnitude of the errors is more in case of EMM. Similar explanation could be given for MYR error levels.

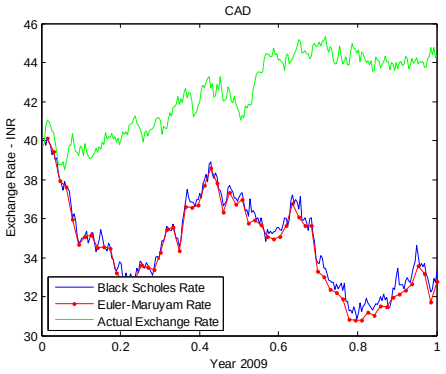
The predicted or forecasted exchange rates and the error level will not reveal the true convergence of the rates. A graph in the form of line chart will visually show the convergence. The following figure shows the convergence of these rates

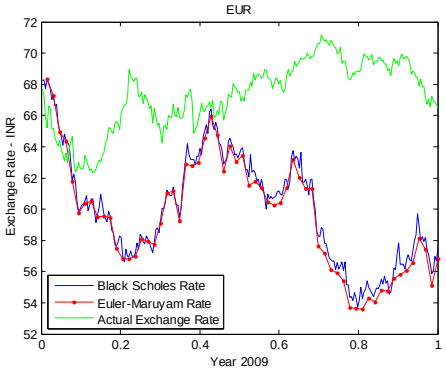
The above figure gives the real rate trajectories of eight currencies with the BS and EMM rates' trajectories. The trajectories of BS and EMM converge closely in all eight figures. This proves the BS method which works on geometrical Brownian motion and EMM which works on arithmetical Brownian motion do not vary in forecasting the exchange rates. Despite this the actual exchange rates do not converge with the theoretical trajectories produced by BS and EMM. In all figures the actual exchange rates go above the BS and EMM rates. They all show substantial divergence. The USD, Euro, JPY and KRW come closer to the forecasted trajectories in the middle of 2009. All other

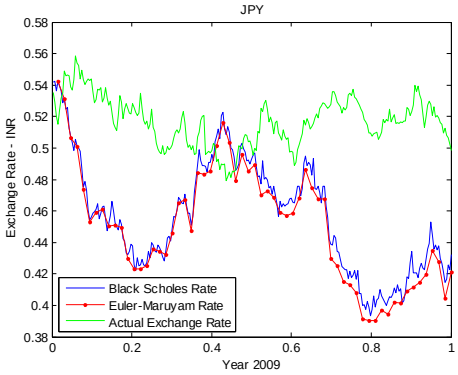
rates walk above the expected rates. In all currencies the tail end rates show a very large divergence than beginning rates. All trajectories start at spot rates prevailed at the beginning of 2009 but in two months time they go in different paths. The BS and EMM paths fall sharply and increase in the middle of the year and again fall at the end of 2009.

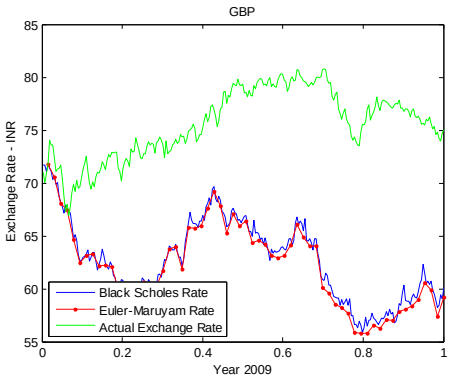
The MYR rates are not as divergent as seen in INR. The USD for almost six months in 2009 goes closer to the forecasted paths. The CAD goes hand in hand throughout 2009. The Euro and Japanese Yen capture the trend but the real rate goes above the theoretical rates. GBP, AUD and NZD all move with the forecasted trajectories for almost nine months and then they show some divergence. The real exchange rate at the tail end falls sharply and steeply than the BS and EMM rates. The Korean Wong only for two months moves with the actual rates and later it goes below the forecasted path. It further declines steeply showing a wider divergence at the tail end.

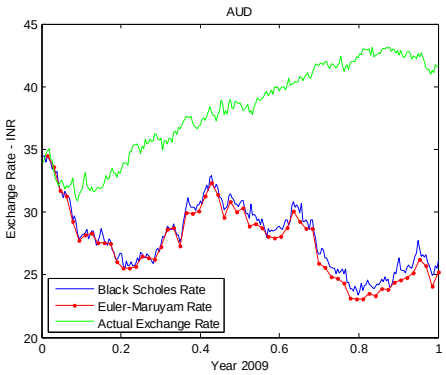

USD
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

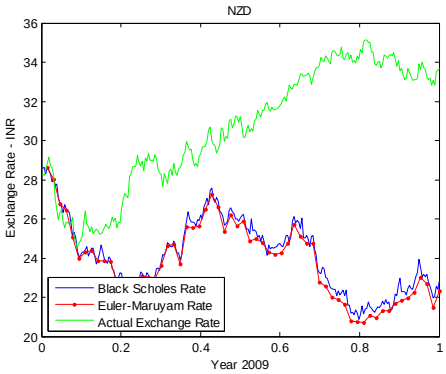

CAD
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

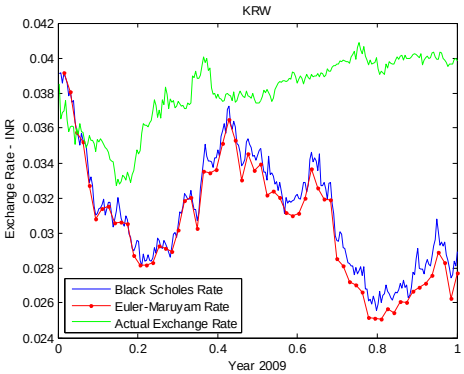

EUR
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

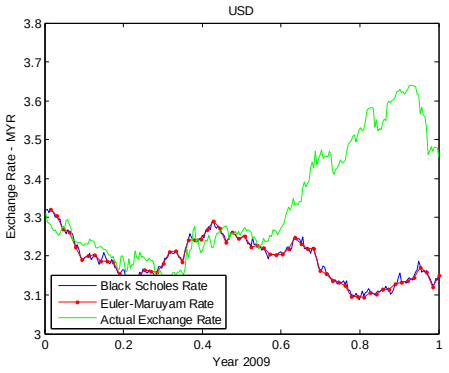

JPY
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

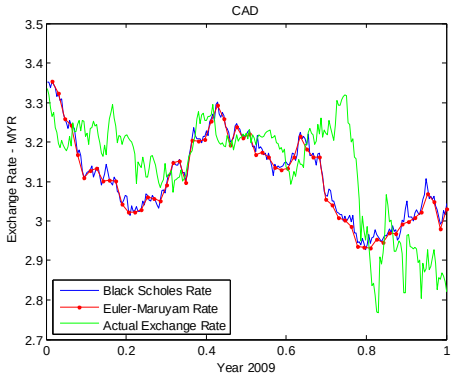

GBP
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

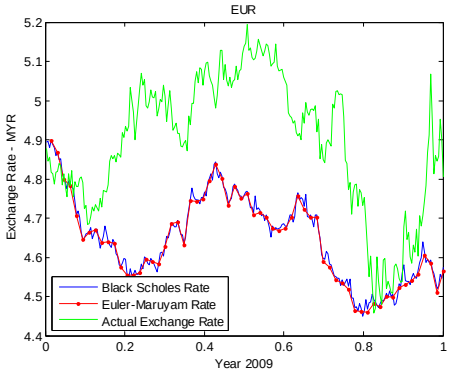

AUD
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

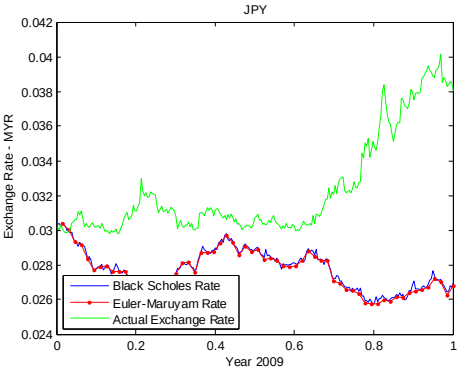

NZD
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

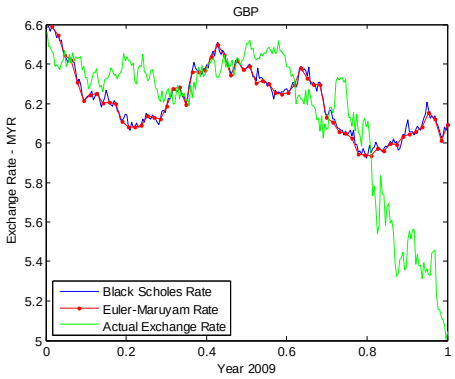

KRW
Exchange Rate - INR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

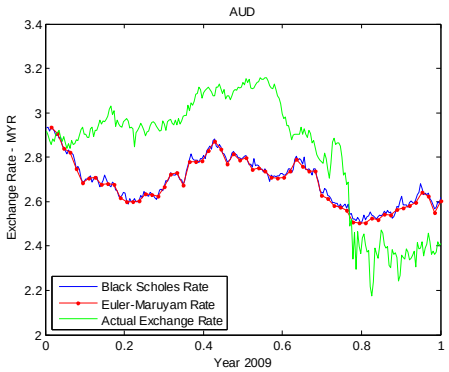

USD
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

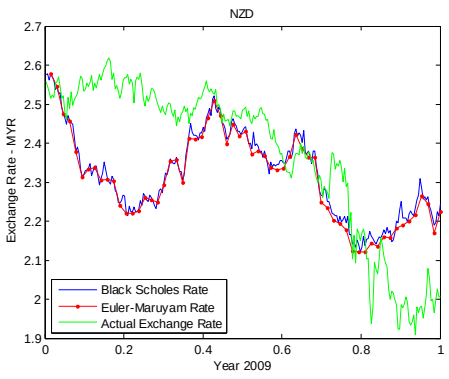

CAD
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

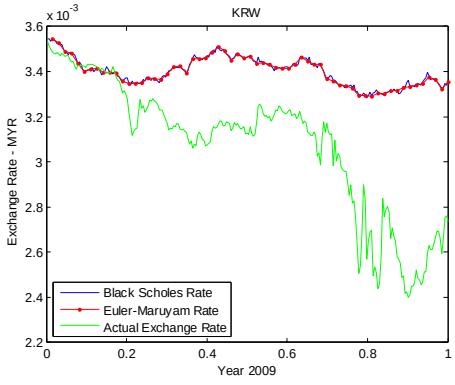

EUR
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate


JPY
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate


GBP
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate


AUD
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate


NZD
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate


KRW
x 10-3
Exchange Rate - MYR
Year 2009
Black Scholes Rate
Euler-Maruyam Rate
Actual Exchange Rate

VI. Conclusion

In foreign exchange management hedging decisions play a significant role in controlling the transaction and translation risks. Hedging instruments pricing is dependent on the underlying asset's pricing as they are cointegrated. For pricing and as well as for finding matching instrument in terms of price and the number of contracts needed to hedge are all dependent on the forecasted rates. Any mispricing will lead to inefficient hedgingwhich not only increases the cost but also could not avoid the expected losses fully. Several attempts have been made in the past to forecast the expected price path of the underlying assets. We also attempted to forecast the exchange rates through the two prominent models BS and EMM. Financial engineering mostly relies on stochastic differential equations in deriving the financial assets' prices.

We took eight exchange rates in INR and MYR to test the forecast accuracy through SDEs. Our results are mixed. In the case of INR these stochastic models produce lower rates than the actual exchange rates. The actual rates' path is well above the forecasted trajectories. The same technique when applied on MYR the results are good. In almost all exchange rates the BS and EMM converge for almost 6 months and later it diverges. Even this divergence is not so significant. We conclude that for strong currencies these models work well and for weak currencies' exchange rates some adjustments are needed to make them converge. This finding is useful in foreign exchange risk management especially in transaction risk management.

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MATLAB M file for simulating Black- Scholes and Euler – Maruyama trajectories

```
close all
clear all
clc

format short
load INRMY

data1=price2ret(data); % Take all returns

fore=[];bserr=zeros(16,1);d8=zeros(16,1);
emerr=zeros(16,1); d6=zeros(16,1);d7=zeros(16,1);
d9=zeros(16,1);d16=zeros(16,1);
d10=zeros(16,1);d12=zeros(16,1);

for i= 1:16          % for loop for elevn currencies

 d1=data1(1:250,i)';  % Take log returns of 2008
 d2=data1(251:502,i)';% Take log returns of 2009
 d3=data(1:251,i);    % Take Exchange rates of 2008
 d4=data(252:503,i);  % Take Exchange rates of 2009
 xmean=mean(d1);      % Find mean
 xstd=std(d1);        % Find Standard Deviation
 xzero=data(252:252,i); % Take 1-Jan-2009 data

 T=1; N=252; dt=T/N; t=dt:dt:T; %Set the time variables
 randn('state',1)       % Set the same random numbers for all
 xwei=randn(1,N);       % Simulate Brownion motion 252 times
 xcwei=cumsum(xwei);    % Integrate Brownion motion

 xbs=xzero*exp((xmean-.5*xstd^2)*t+xstd*xcwei);     % Black Scholes Rates
 xbsxr(:,i)=xbs;        % Store Black Scholes Rates

 R=4; Dt=R*dt; L=N/R; tt=Dt:Dt:T; %Set the time variables for E-M Method
 xem=zeros(1,L);        % Create memory storage
 temp=xzero;            % Keep the 1-Jan-2008 in temporary

for j = 1:L % for loop for finding E-M rates with a wider time interval
 winc=sum(xwei(R*(j-1)+1:R*j));% Integrate Brownion motion in wider time
 d5=d4(R*(j-1)+1);
 temp=temp + temp*Dt*xmean + temp*xstd*winc; % Find rate in every time interval
 xem(j)=temp; % Store each Euler-Maruyama Rates
end
 fore=[fore; xem]; % Store all Euler-Maruyama Rates
 figure
 plot(t,xbs);hold on; plot(tt,xem,'.-r'); % Plot various exchange rates
 hold on; plot(t,d4,'-g')
 title(textdata(i))
 xlabel('Year 2009')
 ylabel('Exchange Rate - MYR')
 legend('Black Scholes Rate', 'Euler-Maruyam Rate',...
 'Actual Exchange Rate',3)

bserr(i)=sum((d4-xbs').^2); % Find the sums of squares-Black Scoles
emerr(i)=sum((d5-xem').^2);% Find the sums of squares - Euler Maruyama
d6(i)=xzero;
d7(i)=xmean;
d8(i)=xstd;
d9(i)=mean(xbsxr(:,i));
d10(i)=mean(fore(:,i));
d16(i)=std(xbsxr(:,i));
d12(i)=std(fore(:,i));
end
xerr=[bserr./2.56 emerr./.64]; % Find error pecentage
xdesr=[d6 d7 d8];
xdesbs=[d9 d10 d16 d12];
```

Failure and Success Factors of an Information System Development in a Charitable Organization

Abdulrahman A. Mirza

GJMBR Classification (FOR)
L31 L39 150312 150399 D21 150305 C44

***Abstract*-This paper presents a case study of an ambitious charitable organization that decided to start developing its information systems at a very early stage in the life of the foundation. Even after the completion of the information system, almost two years after the initiation of the project, operational functions of the foundation were still transforming. Once operational functions of the foundation had finally stabilized it was realized that the developed system, to a great extent, had failed to meet the actual user needs. Even though, some specific modules of the system managed to succeed in gaining great acceptance by its users. We present here causes of failure and success in information systems development at this charitable organization.**

Keywords- Requirements definition, non-profit organization, critical failure factors, critical success factors, Saudi Arabia.

I. Introduction

The King Abdullah Foundation for Developmental Housing is a Saudi Arabian private charitable organization established in 2002. One of the main objectives of the foundation is to develop housing communities for the most-needy citizens in the different regions of the country. Another important objective is to provide the residents of those communities with developmental programs that would help them become self-sufficient and eventually effective contributing members of the society.

In this paper we present what we perceive to be the main factors behind the mostly inadequate utilization of the foundation's developed IS. Out of the eight developed modules of this integrated information system, only two were adequately utilized. Hence, we shall also present the critical success factors behind the utilization of those two subsystems.

We shall start with a look at related research regarding the role of IT in non-profit organizations, and the issue of software systems requirements definition and its critical role in producing successful systems. The following two sections present the foundation's organizational structure and the drivers behind its decision to adopt information technology as a strategic solution for an organization within an emerging economy. We then briefly introduce the different modules of the foundation's developed information system.

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In the following section, we describe causes leading to the failure in the adoption of certain components of the IS, followed by success factors of utilized subsystems. A brief conclusion section will end the case study with a discussion of lessons learned and some closing remarks.

II. Related Research

A. Requirements Definition

Software projects are typically characterized as being late, over budget, unpredictable (Reel 1999), do not accomplish what the users want, and produce systems that are often ineffectively utilized by those who paid for them (Sommerville & Sawyer 1977). Based on many studies, the rates of software project failure range between 50% and 80% (Saqib 2007). The same can be said about offshore software development with a 50% failure rate and a 33% customer satisfaction rate (Rottman 2006).

One of the most commonly blamed factors for the failure of software projects are inadequately explored or described requirements (El-Ansary 2002; Verner & Cerpa 2005). Defining business requirements is considered to be the most important task of software development. However, it is also the poorest performed (Goldsmith 2004), and the most difficult (Hoffman & Lehner 2001). Out of the ten identified signs of IS project failure by Reel (1999), seven occur before a system design is developed or a single line of code is written.

Requirements are described as those conditions that must be met in order for the developed software system to be acceptable by the users, customers, and other stakeholders. Requirements may be capabilities, functions, constraints, or other properties that must be satisfied by the system (Sodhi & Sodhi 2001). A requirements definition document is typically produced after a contract is won and includes a description of the client's problem statement and the tasks to be accomplished in order to derive the desired software solution (Lecky-Thompson 2005).

Among the more common problems with requirements definition are those described by Sommerville & Sawyer (1977):

1. Requirements do not represent the actual needs of the customer
2. Requirements are incomplete or conflicting
3. Requirements are difficult and expensive to update after they have been agreed upon.
4. Customers, requirements analysts, and software engineers who develop the system have difficulties understanding each other.

The most common method of requirements gathering is through interviews with clients and through the collection of any available customer forms or described processes. The appropriate communication and understanding between developers and clients is a must for proper requirements definition (Holtzblatt & Beyer 1995). Representatives from the client side must include the potential users of the system, as they are the ones who possess the true and detailed knowledge of how things work. The three main factors of software projects success involve executive management support, a clear statement of requirements, and user involvement in the requirements definition process (Herlea 1999).

B. IT in Non-Profit Organizations

Non-profit organizations typically have limited budgets and resources, and commonly rely on volunteer work. Even so, computer and information technologies still play an important role for these types of organizations (Ouellette 1996). IT departments of charitable organizations just like in their for-profit counterparts, and in spite of their limited resources, are faced with pressures to produce great results and value (Slofstra 1996). The wide-spread IT acceptance within nonprofits has brought with it a great potential for change. IT has the ability to reconfigure a non-profit's internal and external structures and working relationships, as well as improving its organizational learning and knowledge management systems (Burt & Taylor 2000; Castells 1996).

A non-profit organization typically has a strategic objective which mostly involves some social mission: the creation of public value (Moore 2000; Bryce 1992; Bryson 1995). Leaders of nonprofits are encouraged to "obtain a better overall appreciation of IT's full potential, along with a willingness and capacity to more directly link the acquisition and utilization of IT to the organizational mission" (Hackler & Saxton 2007). According to a research study of 1,572 non-profit organizations in the U.S., 98% of such organizations utilize personal computers in their offices, 97% have Internet connections with 56% of them through high-speed broadband connections. Leaders of nonprofits in the study perceive that the most valuable aspect of IT is in increasing the number of clients served (27%) and in improving communications between staff members (26%). To a lower extent, 11% believe the value is in providing staff with more time to work on other projects, and for reducing operational costs (6%) (Hackler & Saxton 2007).

As far as technology pitfalls that need to be avoided by non-profit organizations, Gleason (2007), identifies five areas of caution: heavy dependence on used equipment; failure to designate proper budgets for IT infrastructure; failure to clarify operational needs; ignoring decisions incorporated in the organization's systems; and, relying on home grown software. In-house developed software can become almost impossible to maintain, especially if the system developer had departed the organization. It is more advisable to establish a relationship with a software contractor who can provide necessary services when they are needed (Gleason 2007).

C. Foundation's Decision To Adopt Information Technology

The foundation came to life during an era of great technological advancements within the country, where a growing societal acceptance of the Internet and modern modes of telecommunications was taking place. The government had just around the same period put forth a national strategic plan for the dissemination of information and communications technologies (ICT). Soon after that, the ministry of communications and information technology (http://www.mcit.gov.sa/english) and the communications and information technology commission (http://www.citc.gov.sa) were both established. The spread of the use of mobile devices, personal computers, and the Internet within the country has been far exceeding the world cumulative annual growth rate (CICT 2005). As a result of such developments, information technology was immediately recognized by the board of trustees as a critical and strategic means for supporting and managing the day-to-day activities of the foundation.

A consulting firm was hired to develop an IT plan for the foundation. This plan included the suggested infrastructure of the local area network, an organizational chart of the IT department, a foundation website, and a comprehensive information system. This information system covered both financial and human resources systems, as well as specialized information systems that were based around the foundation's organizational structure. Each module of the system basically representing a single department or division of the foundation. Brief bullet point descriptions of each subsystem were created. These descriptions, however, were mainly derived from the foundation bylaws document.

The suggested information system initially included twelve different modules. These were later expanded to fourteen modules based on recommendations of the foundation's social and engineering consultants. Soon after the selection of a software contractor to develop the information system, but before making any formal agreements, the foundation's initial IT manager decided to seek employment elsewhere. This meant that the IS development project came to a halt. Seven months later, the author of this paper was hired as a part-time consultant, and within a couple of months hired on a full-time basis as the foundation's CIO. Among the main tasks that he set-out to immediately accomplish was the continuation of the IS development project, as it was perceived to be a priority for the foundation.

D. Modules of the Developed Information System

The initially determined fourteen modules were narrowed down to only eight. These included the modules for housing projects management, beneficiaries management, housing and residents management, developmental programs management, investments management, managerial communications (correspondence system), archiving, and the system management module.

Even though each module mostly serves a single department, the foundation's CIO stressed to the system

analyst the importance of systems integration since in the end all departments of the foundation aim to provide a valuable service to their end customers, the needy families.

E. Factors Behind the General Failure of the Foundation's Information System

Among the ten signs of IS failure as described by Reel (1999) are the ill definition of project scope, resistance of system users, loss of sponsorship, and the change in business needs. All four signs described here in addition to other failure factors were clearly visible in the case of the foundation's IS implementation, and hence leading to the failure of the system for the most part. We take a look at these factors in this section.

F. Change in Management and System Expectations

In the case of the engineering department requirements, it seems that the department head did not consider all the possible variations that may occur in the various construction projects. As an example, he indicated that there were 16 different activities that make up the total components of a construction project. When asked by the CIO about the possibility that there may be more, less, or different activities, he said no! This might have been true for housing units being developed at a particular period using a particular method. Hence, the system was developed with a limited ability to track a static and predefined number and set of activities.

A new department head later expressed that the housing construction activities were not set and that they could vary based on the actual type of building being constructed and type of contract signed with the construction contractor. Additionally, other important aspects of tracking payments to contractors were missing. Payments made to external consultants who also play an important role in the supervision of housing construction projects were not considered in the system at all. The new department manager also demanded a much improved and detailed document archiving system. Without these important components of the system, he claimed that the system is useless to his department. Hence, the problem of requirements not representing the actual needs of the customer as well as being incomplete (Somerville & Sawyer 1977).

G. Not Involving all Stakeholders in the Requirements Definition Process

A good number of the departments of the foundation were, and in some cases still are, a one-man show. The only departments that had supporting staff were the engineering, beneficiaries, and general management departments. The engineering department had two engineers working at the time when system requirements were being gathered. One of the main problems with the engineering management subsystem is that none of the department engineers were asked to participate in the requirements definition process. This resulted in missing important system functionality that the first department manager had failed to include as requirements. According to the engineers who were asked to utilize the system after it was deployed, it was not flexible enough to handle their day-to-day operational requirements, and hence refrained from using it. The department manager who defined the initial system requirements had actually defined them for activities that needed to be carried out by his engineers, and hence the requirement did not represent the actual needs of the end-users (Somerville & Sawyer, 1977). Both the CIO and system analyst relied strictly on the manager's defined requirements and unfortunately did not communicate with the main would-be users of the system. One of the main success factors for software project success described by Herlea (1999) is user involvement in the requirements definition process, this was surely missing in this case.

III. Defined Scope and Changes in Business Needs

The housing and residents management subsystem is a very innovative module. Its requirements were mostly envisioned by one of the foundation's architectural full-time consultants. It is used for creating housing models, including the definitions of each model in the number and types of rooms as well as the different components within each room (e.g., A/C, sink, oven, door knob, etc.). Beneficiaries that have been selected are assigned a unit number that is also defined through this subsystem. Additionally, the subsystem provides the ability to track maintenance requests by tenants. This includes specific detailed information about the maintenance request including the actual component of the housing unit needing maintenance, the action taken, the cost of repair, and the name of the maintenance engineer, etc. Naturally, this system should enable the foundation to track all maintenance requests, costs, problem components, and even problem tenants. Unfortunately with the conclusion of the first housing community project, a managerial decision was made such that the foundation will not be responsible for maintaining the inside of housing units. Tenants themselves will need to bare the cost, in an effort to instill upon them the value of responsibility, and to make them aware that maintenance repairs can be costly, and hence be more apt to take good care of the assigned housing unit. Tenants would need to find their own maintenance engineers as the housing communities did not hire any. This meant however, that the main functionalities of the subsystem will hardly be utilized. The main benefits of the subsystem will be limited to mainly realizing which unit the beneficiary lives in and what are the different model designs. This case definitely reflects the problem of ill-defined scope and change in business needs (Reel 1999).

A. Passive Requirements Analyst Role

The software company's system analyst unfortunately did not do much to help department heads in utilizing the full potential that information systems can offer. The company did on the most part deliver what was agreed upon in the requirements analysis document. However, the analyst could have done a lot more to help the foundation's personnel in recognizing additional functionality that could have resulted in a much more useful system. A very probable and good reason for this is that the company had found itself in an

already set price contract and hence wanted to get away with getting as little as possible done. The software contractor's system analyst was more concerned about clarifying certain points rather than trying to help the customer discover new ones, and hence the problem of inadequately explored requirements (El-Ansary 2002; Verner & Cerpa 2005). The limited contract value for the development of the total project did not leave much space for the developer to work on more innovative solutions.

B. Passive CEO and Department Manager Roles

Both CEO and departmental heads for the most part did not take the implemented system seriously. Once the system was deployed, a memo was written from the CIO to all department heads requesting that they start using the system. It was explicitly explained that they had to perform acceptance testing to verify that developed systems meet their previously defined requirements. Training had been conducted by the developing company to all would be users of the system. Departments were asked to give their feedback within three weeks after the end of training. The three week period expired and only the beneficiaries department and managerial communications division had performed their requested tasks. All other departments did not use the system at all.

The CIO kept informing the CEO that most departments were reluctant to use the system, however, rather than directing each department's manager to take the matter seriously, the CEO continued placing the burden on the CIO. Naturally the CIO does not have the executive capacity to enforce other managers to answer his requests. This problem however, clearly points to the lack of the critical success factor of executive management support (Herlea 1999), as well as the problem of management loss of sponsorship (Reel 1999). Even though upper management initially pushed for the development of organizational information systems and realized its importance, it did not realize that continuous follow-up and support for the system was needed all the way through.

C. User Resistance to the Developed System

The would-be system users had become comfortable performing their tasks in a certain way, and were not too excited about doing things any other way. Others were not involved in the requirements definition process. With the lack of strong efforts by the CEO and most department heads in pushing the use of the newly developed system, it was natural that the foundation personnel would not make a great effort on their own will. This is a good example of the problem of user-resistance to new systems (Reel 1999).

D. User Acceptance Testing Carried-out by CIO not Actual System Users

As most departments and divisions were unwilling or incapable of using their developed software modules, the CIO had to take on the responsibility of testing the system himself. The software contractor had provided a three months period during which the foundation can report any missing functionality or system bugs. Armed with the systems requirements document, the CIO made sure that customer requirements were implemented in the system and that the system operated correctly. A good number of bugs were discovered in the system as a result of performed acceptance testing. This process however, being carried-out by a non-expert in the subject matter of tested subsystems, did not capture missing functionality not expressed through system requirements. This is a good example again of the problem of resistance by system users (Reel 1999) who were not willing to use the system and hence not testing it for completeness. The CEO and department managers failed to play a more visible role in making sure that end-users actually performed their required tasks.

IV. Most Successful System Module and Factors of Success

In addition to the system management module, mainly for the use by the system administrator, the beneficiaries management subsystem is considered to be the main successful implementation. The beneficiaries department relied heavily on this subsystem in determining its qualifying families. System data is continuously modified with up to date information and data of new prospective beneficiaries. Reports are used for official purposes and are used for presenting information to the CEO and other official committees. Critical success factors for this system include the following:

- Even though no actual family selection process had been carried-out, the main activities to be conducted by the beneficiaries department were for the greater part well defined before the start of the requirements definition process.
- Determined rules and regulations for the selection of beneficiaries were arrived at as a result of a collective effort. These regulations which were translated into system requirements were arrived at by the managers of the three social departments: the beneficiaries, the research and studies, and developmental programs departments, and had the feedback and approval of the foundation's CEO.
- Beneficiary data was readily available in SPSS files and migrated to the IS database through a specially developed data migration tool. This meant that necessary data for the quick utilization of the system did not require great collection and population efforts in order to start taking immediate advantage of the system.
- The head of the beneficiaries department was greatly anticipating the completion of the proposed information system, and was a great advocate for it.
- Even though the department's social worker, who would be using the application, did not participate in the requirements definition process, the strong direction by the department manager to use the module lead to his quick acceptance of the developed subsystem.
- Deriving the names of qualified beneficiaries and creating reports regarding selected and rejected families would require a much greater effort if any other method for arriving at those results was to be used. Hence there

was an urgent need for using automated processes to carrying-out the required tasks of the department. For other departments, the urgent need for system utilization did not exist.

- Active participation by the system's end-user in the acceptance testing process and immediate recognition of missing functionality and needed modifications.
- Active support by the CIO in immediately relaying discovered buggy and missing functionality, and requested modifications to the software developer.

V. Conclusion

Among the very important lessons derived from this case study is that software projects should not be jumped into without careful consideration. It is very easy for organizations these days to recognize the value and importance of information technology in general and information systems in particular. However, organizations must first determine their exact needs and get all users involved in the requirements definition process before setting out in pursuit of a silver bullet solution that would solve all their system needs.

Very important in the requirements definition process is not to over estimate actual system needs. This does not mean that a system should not anticipate modifications in organizational processes, but, decisions to anticipate such modifications and additions must be based on solid evidence that such activities could occur with high probability.

The King Abdullah Foundation for Developmental Housing is currently awaiting the deployment of a new release of it information system. It is anticipated this time around that the implemented system will be much more useful to all users. This is based on the great efforts made by all stakeholders in the development of much improved requirement definitions. This was only possible after the stabilization of operational activities within each department and the foundation in general. Additionally, for areas where specialized knowledge was needed and not possessed by the foundation, experts where hired to supervise the requirements definition process. Last but not least as drivers for expected IS adoption success, the second time around, are the much more proactive roles played by department managers, CIO, and CEO.

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