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IMPACTS OF MACROECONOMIC VARIABLES ON ECONOMIC GROWTH: A PANEL DATA ANALYSIS OF SELECTED ASIAN COUNTRIES

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Abstract

Emphasis of the study is to empirically analyze the impacts of macroeconomic variables on economic growth in case of some selected Asian countries. For this purpose annual data is taken from 1990 to 2010. It is a panel data analysis and by estimating the model it is found that in case of the sample countries economic growth is positively affected by foreign direct investment and saving rate while exports in the sample period have negative impacts on economic growth and labor force and tax rate have no impacts on economic growth.

Key Words: Economic Growth, Macroeconomic Variables, Fixed Effects, Random Effects

Introduction:

Whenever there is increase in real GDP of a country it will boosts up the overall output and we called it economic growth. The economic growth is helpful to increase the incomes of the society, help the nation to bring the unemployment at low level and also helpful in the deliveries of public services. Over the last few decades the macroeconomic variables and the economic growth relationship became the hot issue amongst the researchers. Amongst these variables current study emphasis is on the foreign direct investment (FDI), exports of a country, savings, labor force and tax revenue. In this study we proxy the Real GDP for economic growth.

The GDP growth in India was recorded 9.5% in 2010 which was at the lowest level (3.8%) since the last six to seven years and this was mainly because of excessive expenditure by the government but again in 2009 showed increasing trend and reach 8.2% at the end of fiscal year. Similarly the GDP growth rate in Indonesia and Malaysia was 6.19% and 7.19% respectively. The GDP growth rate of Indonesia showed increasing trend since the last 10 years while that of Malaysia was in negative in 2009.Pakistan and Sri-Lanka also showed increasing trend in their respective GDP growth rates which showed that the countries were growing economically. In Pakistan it was found half pass than 14% and in Sri-Lanka it was recorded 8% in 2010.

The other macroeconomic variables in the sample countries also showed increasing trend during 2010. As far as exports are concerned, taking as a % of GDP it were almost 23% in Indian economy, 24% was recorded for Indonesia, and for Malaysia, Pakistan and Sri-Lanka its growth as a %age of GDP were, 97%, 13%, and 22% respectively. FDI in the period from 2008 to 2010 in case of India declined considerably as it was 3.5% as a percentage of GDP in 2008 while decline to 2.6% as %age of GDP in 2009 and further goes down and touch the level of 1.43% (as a %age of GDP).In case of Indonesia it showed increasing trend since the last two years because it reach to 1.94%(as a %age of GDP) in 2010 which was 1.82 % in (as a %age of GDP) in 2008 and 0.90% in 2009.

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The Malaysian economy was also attracted market for the foreign direct investment as it reached to 3.8% in 2010 while it was only 0.71% in 2009. In case of Pakistan the FDI during 2010 declined to 1.14% and this was mainly because of the uncertainty found in Pakistan and the investors were afraid of investing in such uncertain environment while the FDI were more or less remain same in Sri-Lanka.
Because of this uncertain performance of the macroeconomic variables in the sample countries the authoris motivated to empirically check that how these fluctuations in macroeconomic variables affect the economic growth in these countries. Therefore the current study is conducted to fill the gap in the literature on the relationship between economic growth and key macroeconomic variables and it is believed that it will be helpful for the policy makers to formulate a suitable policy in light of this paper.

Rest of the paper is organized as following; section two review some previous studies, in third section there is methodology and description of the variables, section four consist of estimation and results interpretation and at the last there is conclusion and policy recommendation.

ii-Literature Review:
There are strong arguments that support the hypothesis that macroeconomic factors do have some effects on economic growth. Fischer named the following variables that have some impacts on economic growth, these are, budget deficit, inflation, balance of payments.Friedman (1977) is of the view that fluctuation in the price level leads to poor coordination of the economic activity.High inflation is an indicator that shows that the economy is not control properly and this leads to low growth of the economy.Barro (1976) is of the view that inflation causes the investment negatively and he said that because of inflation the rate of return on investment became difficult. Here are some empirical studies that have been conducted on the economic growth and macroeconomic variables nexus.

ZafarIqbal and Ghulam Mustafa Khan (1998), "Macroeconomic Determinants of Economic growth" took primary education, physical capital, trade openness, budget deficit and external debt to analyze their impacts on economic growth. They found that trade openness, stock of physical capital, and primary education have significant impacts on economic growth while external debt and budget defcicit have negative impacts on economic growth and they are of the view that to finance economic growth domestic resources has to be fully utilized.

Dr. Hazoor Muhammad Sabir and SafdarHussainTahir "the impacts of different macroeconomic variables on poverty in Pakistan" used annual data to empirically investigate macroeconomic variablesimpacts on economic growth in case of Pakistan and found that inflation have negative impacts on economic growth while openness and investment have positive impacts o economic growth.

Nick Cunningham (2008), "the effects of macroeconomic factors on economic growth within the former soviet union" concludes that foreign direct investment is helpful to enhance economic growth. This study also found that economic growth in the member countries of WTOare at higher level than the non-member countries as the member countries are engaged in internal trade which help to improve the economic condition of the country.

Serhanand Nermin (2008) "The relationship between economic growth and selected macroeconomic indicators in a group of Central and East European countries" conduct their study on the basis of panel data and found that domestic investment, trade openness, ratio of

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budget balance all have positive impacts on economic growth while inflation negatively affect growth of the economy.

M. Imam Hossain "The role of selective macroeconomic factors on sustainable economic growth in Bangladesh" found that inflation rate in Bangladesh have negative impacts on economic growth while the budget deficit have positive impacts on the growth of the Bangladesh economy.

Khalid Zaman (2012) "Macroeconomic factors determining Foreign Direct Investment impacts on Pakistan Growth" suggest that foreign direct investment has positive and significant impacts on economic growth. Trade liberalization has negative impacts in the long run while in short run trade liberalization has positive impacts on economic growth in Pakistan.

iii-Data and Methodology:

a- Data:

To collect the data on the selected variables various sources have been consulted. like the federal bureaus of statistics (Pakistan), various publication of central Banks of the four selected countries, the World Bank. The period of the study extended from 1990 to 2010. The data has the annual frequency.

b- Variables Description:

For the current study six variables has been selected to analyze the impacts of macroeconomic variables on growth in a selected Asian countries. These variables are then divided into dependent and independent variables. The dependent variable of the study is the real GDP while the other variables are taken as independent variables. A brief description (economic justification) with respect to dependent variable is given as;

Dependent variable

Economic growth

Our dependent variable is economic growth and this study used GDP growth rate as a proxy for economic growth which is consistent with the literature(Gagan Deep Sharma et al, Ming Yu Ching, Vladimir Ristanovićalso used the same variable for economic growth).

Independent variable

In this study some key macroeconomic variables have been taken so that to empirically analyze their impacts on economic growth in the sample countries. These are;

FDI: The role of FDI to bring economic growth can be justified as it is helpful in bringing new technologies and funds. The new technologies mean a ways of innovation which further help in the production process. The flow of foreign direct investment is because of many factors like government policies, the investor's interest in a country etc.

Exports: Exports of a country are also important factor that might affect economic growth. More exports mean more allocation of resources and more utilization of resources means more production.

This is possible through technological development, new capital formation and employment creation which are pre requisites for accelerated economic growth.

Saving: Economic growth and savings have a close association with one another. Marginal propensity to save say that as the income increase the saving rate also increase so on the basis of this theory we can say that economic growth and savings a close relationship. Governments most of the time launch different savings schemes so that to encourage the

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savings in a country and as these schemes are tax exempted (mostly), so this leads to save tax and the government investment leads to earn capital and in this way economy grow.

Labor Force: Human capital plays important role in the economic development of a country as well. If the labor force is skillful then this will help to bring prosperity in the country. The quality of labor force is also important in the country. Mortensen (2004) emphasized the role of labor saying that the reforms improve labor performance and help to reduce unemployment on one hand and it encourages investment in research and development required for long-term growth, on the other.

Tax Revenue: Taxes and economic growth association can be described in many ways, e.g. if the tax rate is high it will leads to low investment which means the capital stock growth is low so economy will not grow.Increase in tax rate leads to discourage the labor supply and distort working hours. Also if the tax rate is high it badly affect the productivity by discouraging the research and development in the risky projects of capital intensive industries. Fourth, tax policy can also influence the marginal productivity of capital by distorting investment from heavily taxedsectors into more lightly taxed sectors with lower overall productivity. And fifth, heavy taxation on labor supply can distort the efficient use of human capital by discouraging workers from employment in sectors with high social productivity but a heavy tax burden.

Methodology:

In order to show the impact of exports, foreign direct investment, labor force, savings and tax revenue on economic growth the following model have been used.

$$GDP_{it} = \beta 0_{it} + \beta 1 FDI_{it} + \beta 2 X_{it} + \beta 3 S_{it} + \beta 4 LF_{it} + \beta 5 TR_{it} \text{.....1}$$

Here

FDI= is foreign direct investment. it shows foreign direct investment net inflow as % of GDP

X= is export of goods and services as % of GDP

S= is gross domestic saving as % of GDP

Lf= is logarithm of total labor force

TR= it shows tax revenue as % of GDP

t = the subscript "t" is used for time series

While the estimated model is;

$$lGDP_{it} = \beta 0_{it} + \beta 1 lFDI_{it} + \beta 2 lX_{it} + \beta 3 lS_{it} + \beta 4 lLF_{it} + \beta 5 lTR_{it} \text{.....2}$$

In equation 2 the "l" is used for "log" while the remaining notations are as discussed in equation 1.

Panel data have been used in order to show the impact of exports, foreign direct investment, labor force, savings and tax revenue on economic growth.

We go for panel data analyses whenever cross sectional and time series data exist simultaneously .there are three model in panel data analyses.

Common effect model assume that intercept is constant across sectional and time series data.

Fixed effect model assume that intercept is not constant but it is group specific.

Random effect model assume that intercept is not constant but it is group specific.

F- Test is used when we take decision between common and fixed effect model selection.

Here if probability of Chi square is insignificant mean it is greater than 5%. Then common effect model will be used and if probability of Chi square is less than 5% then fixed effect model will be used.

The above statement can also be checked by using the following formula.

F= [(R2FE – R2CC)/N-1]/ [(1- R2FE)/(NT-N-K)]

Here if value of F calculated is less than F critical than common effect model will be used

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and if it is greater than fixed effect model will be used.
Hausman test is used when we take decision between fixed and random effect model selection. If probability of Chi square test is greater than 5% than fixed effect model will be used and vice versa.

Empirical Results

Table 1 presents descriptive statistics of data. This table shows that India has high GDP growth rate. Average growth rate of India is 6.48% annual. Maximum value of growth rate is 9.80%. it was during 2007 while minimum growth rate of GDP is 1.05 which was in 1991. Malaysia has second position in GDP growth rate. Its maximum GDP is 10.01%. this value of GDP was obtained during the period of 1996. On the other hand its minimum GDP during stated period is -7.36.

Table 1

	Mean	Median	Std Deviation	Minimum	Maximum
Pakistan					
GDPGR	4.31	4.27	2.37	1.01	7.70
EXP	15.44	15.67	1.38	12.85	17.37
FDI	1.33	1.14	.99	.42	3.91
LLF	17.58	17.58	.22	17.28	17.91
SAV	14.83	15.41	2.37	10.16	17.62
TAX	11.41	10.79	1.61	9.28	13.82
India					
GDPGR	6.48	6.66	2.36	1.05	9.80
EXP	14.09	12.39	5.23	6.94	23.61
FDI	.99	.76	.91	.03	3.55
LLF	19.83	19.84	.13	19.62	19.98
SAV	25.99	24.19	4.31	20.92	34.02
TAX	9.54	9.34	.93	8.21	11.90
Sri Lanka					
GDPGR	5.27	5.6	1.99	-1.55	8.02
EXP	32.28	33.82	4.90	21.33	39.02
FDI	1.25	1.13	.54	.42	2.85
LLF	15.86	15.89	.09	15.71	15.98
SAV	16.34	15.91	1.77	12.76	19.51

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TAX	15.34	14.58	1.96	12.72	19.03
Malaysia					
GDPGR	6.09	6.78	4.29	-7.36	10.01
EXP	100.68	103.19	15.31	74.54	121.31
FDI	4.35	4.05	2.10	.60	8.77
LLF	16.07	16.11	.17	15.78	16.30
SAV	41.35	42.15	3.88	34.13	48.68
TAX	17.01	16.73	2.24	13.66	19.75
Indonesia					
GDPGR	5.03	5.70	4.58	-13.12	9.01
EXP	30.92	29.44	6.86	24.15	52.96
FDI	.85	1.20	1.47	-2.75	2.92
LLF	18.40	18.42	.15	18.16	18.58
SAV	30.50	30.82	3.30	19.46	34.06
TAX	13.69	14.02	1.72	10.89	16.00

This value of GDP was achieved during 1997 when financial crisis came in Thailand and badly affected the currency of various Asian countries like Malaysia, Indonesia and many other countries.Sri Lanka, Indonesia and Pakistan has third fourth and fifth position regarding GDP growth rate.

Malaysia exports more goods and services then other selected countries in the sample. Its export is 100.68 million as % of GDP. Sri has second position in export of goods and services. Pakistan,Indonesia, India has third, fourth and fifth position respectively.

Table 2 shows common effect model. This model indicates that FDI and SAV shows positive and significant relation with GDPGR. If there is increase in any of these two variables then GDP will also increase. LLF and EXP shows negative and significant relationship with GDPGR. While TAX shows no effect with GDPGR. EXP, FDI, LLF, SAV and TAX explain 35% variation in GDPGR. The rest of variation in economic growth may be due to some other reasons. The value of F-statistics is greater than 5 which mean that this model is significant.

Table 2 Common Effect Model

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Variables	Coefficient	Std. Error	T-statistics	Prob
C	28.199	10.169	2.273	0.007
EXP_?	-0.137	0.028	-4.975	0.000
FDI_?	0.852	0.185	4.609	0.000
LLF_?	-1.439	0.532	-2.707	0.008
SAV_?	0.336	0.080	4.212	0.000
TAX_?	-0.179	0.162	-1.106	0.272
R-square				0.351
Adjusted R-square	0.318			
F-statistics	10.677			
F-significance	0.000			

Table 3 Fixed Effect Model

Variables	Coefficient	Std. Error	T-Statistics	Prob
C	6.915	47.423	0.146	0.885
EXP_?	-0.189	0.045	-4.291	0.000
FDI_?	0.601	0.237	2.542	0.014
LLF_?	-0.248	2.618	-0.095	0.925
SAV_?	0.395	0.095	4.163	0.000
TAX_?	-0.077	0.217	-0.355	0.724
IND-C	-2.981			
INDO-C	-2.953			
MALA-C	4.647			
PAK-C	-1.103			
SRI-C	2.389			
R-Square	0.407			
Adjusted R-Square	0.349			

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F-statistic	7.221
F-significance	0.000

Above table 3 shows fixed effect model. Results of the above table indicate that there is positive and significant relationship between FDI, SAV and GDP annual growth rate during 1990-2010. EXP has negative and significant effect on GDP during this period of study. LLF and TAX have no impact on GDP. These five variable explain 40% part of GDP and the remaining in GDP may due to some other variables that are not included in the sample.

Table 4 F-test

	Chi-Sq. Statistic	**Chi-sq.d.f.**	**Prob.**
Cross-section Chi-square	9.440891	4	0.051

F-Test is conducted in selection between common effect and fixed effect model. Here as we see that probability of F-Test is insignificant therefore common effect model is best model.

Conclusion and policy recommendation:

In this study four Asian countries were selected to analyze the impacts of macroeconomic variableson economic growth. The nature of the data was annual and time period of the study ranged from 1990 to 2010. On the basis of the analysis made in this paper it is concluded that in case of the sample countries GDP growth is enhanced by attracting foreign direct investment, and saving rates while others selected variables have no or negative impacts on the economy of the selected countries. Therefore for policy makers it is suggested in the light of this study to improve the economic growth in these countries the investment friendly policies has to be formulated and also the government should encourage the saving habits of the inhabitants.

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Perception of service-providers on Use of technology on CRM

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Abstract

CRM is a topic of prime importance in the present days and its requirement is required irrespective of sectors. This study is an attempt in the hospitals of Chennai city. The study highlights the perception of the service providers on use of technology on CRM in hospitals. The most important factors of technology were also identified and the priority of their influence on CRM also has been discussed in the study.

Key Words : CRM, customer relationship management, relationship management, hospitals, service providers.

I. Introduction

Customer Relationship Management is the combination of people, process and technology that seeks to understand the company's customers. It is an integrated approach to manage relationship by focusing on customer retention and relationship development. CRM has evolved from advances in information technology and organizational changes in customer centric processes. Company that successfully implements CRM will reap the rewards of customer loyalty and long run profitability. Managing a successful implementation requires an integrated and balanced company wide, cross functional, customer- focused approach to technology process and people.

II. Review of Literature

Technology advancement is not an exception in any industry. The influence of technology in customer relationship management is the latest and the most important need of the study. Several studies serve as a base to insist the importance of technology in CRM.

Andersen and Surensen (1999), opine that CRM technology applications link front office (e.g. sales, marketing and customer service) and back office (e.g. finance, operations, logistics and human resources) functions with

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the company's customer touch points. Touch points may include internet, e-mail, sales, direct mails, telemarketing operations, call-centers, advertising etc often these touch points are controlled by separate information systems. CRM integrates touch points around a common view of a customer.

Lancioni et al. (2000) say that the communication options offered by e-mail and Internet applications, made available by the new information technology, have made it possible to route communication in business operation areas such as ordering, shipment, payment and delivery. All these procedures are part of the day-to- day communication between buyers and sellers in industrial markets. Web sites supporting customer interactivity have been shown to serve as an integral aspect of long-term relationship marketing. Moreover, integrating relationships via the Internet is believed to support closer integration of buyers and sellers.

Rao and Perry (2002) opine that the increasingly large impact Of the service sector is noted as one reason for the reemergence of a relational perspective in marketing. Services are prone to relational exchanges by their very nature in that their production often requires direct contact of the producer and consumer, and production and consumption normally occur simultaneously requiring the cooperation and contribution of the consumer. Another explanation for the shift back to relational marketing activities is technological advancement. Technology has allowed mass communication and information sharing on an individualized basis and has created an opportunity for direct contact between buyers and sellers despite geographical boundaries. Lastly, increased global and local competition has impacted the comeback of RM practices as sellers are looking progressively more for avenues to lower customer churn rates and increase customer loyalty.

Wilson and Mummalanei (2004) suggested that relationship marketing could be practiced on multiple levels, depending on the type of bonds used to foster customer loyalty. They proposed three types of bonds: 1) Financial, 2) Social, and 3) Structural. Companies can strengthen the financial bonds by maintaining a competitive price; social bonds can be strengthened by operating a dedicated customer care team and assigning a dedicated sales manager to every customer; structural bonds can be achieved through the process of educating the public, providing

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specialized technical support and in providing ancillary support. The nature of these bonds will vary according to types of customers; structural bonds for a B2B context will be different from B2C.

In a previous study of CRM performance to explore the aspects that are related to CRM technology across customer lifecycle phases, Greve and Albers (2006) argue that the usage of CRM technology consistently has a strong impact on CRM performance. They propose that more the comprehensive is CRM technology and higher the CRM technology usage, better the CRM performance across the phases of the customer lifecycle. This shows that CRM technology has an important impact on the performance of the customer relationship.

Extensive literature review shows that technology has a significant impact on the performance of customer relationship management across sectors. This study is an attempt to study the perception of service providers on use of technology on CRM.

III. Methodology

Non-probability Convenience Sampling Method was adopted to collect the primary data. The respondents for the purpose of the study were selected at the convenience of the researcher and the samples. The following criterion was adopted to collect responses from the service-seekers and the service-providers. At the first instance, the total number of corporate hospitals in the city of Chennai has been taken into consideration to decide about the number of hospitals used for the purpose of study. Out of 36 multispecialty and super-specialty hospitals, 5 hospitals were chosen for the purpose of study. From these 5 hospitals 70 samples inclusive of doctors, paramedical staff and technicians.

The study is based on both primary data and secondary data. The primary data has been collected through structured questionnaires from the service providers. 70 samples from 5 service providers were surveyed on the use of technology in enhancement of customer relationship management. The city of Chennai has been chosen for the purpose of study because the city has become the healthcare hub of the

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entire country and Chennai has more number of successful corporate hospitals.

Measure

A well-framed questionnaire was used for data collection from the samples. The Cronbach's Alpha Criterion was applied to test the reliability. The value was determined as 0.872 for the questionnaires collected from the hospital employees. This also explains that the statements in the questionnaires are understood by the service-providers at 87.2 % level.

Technology and CRM

Technology plays a critical role in the context of leveraging CRM activities and thus contributes to improved organizational performance. Use of appropriate technology is considered as the key enabler to integrate the processes of CRM. Nowadays new technologies have empowered CRM to dominate marketing paradigms. The function of technology is to promote relationship orientation, customer retention and customer value initiated through process management. Customer information management and use of modern medical technology are two vital strategies for CRM implementation in hospitals. Parametric t-test is applied for 12 variables of use of technology and the following results are obtained.

IV.Analysis and Discussion

Table 1 Perception of service-providers on Use of technology on CRM

Variables	Mean	Std. Deviation	Std. Error Mean	t Value	Sig. (2-tailed)
Medical Technology	4.0049	0.75265	0.0527	19.07	0.000
Modern Equipment	3.8971	0.79045	0.05534	16.209	0.000
Precision	3.7108	0.78764	0.05515	12.889	0.000
Technicians	3.8039	0.7433	0.05204	15.448	0.000
Video Conferencing	3.6961	0.91823	0.06429	10.827	0.000
Tele Medicine	3.7794	0.88522	0.06198	12.576	0.000
Billing	3.8235	0.78045	0.05464	15.071	0.000

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E-appointments	3.8235	0.75478	0.05285	15.584	0.000
E mail reports	3.8627	0.70939	0.04967	17.37	0.000
Feedback	3.6912	0.78012	0.05462	12.654	0.000
Patient Database	3.5931	0.71998	0.05041	11.767	0.000

From the above table 1 it is clear that the variables involved are highly significant in explaining the use of technology in CRM. From the above table it is found that the mean values range from 3.5931 to 4.0049 and the respective standard deviations also show the consistency of the opinion. The t-values are positive and statistically significant at 5% level.

It can also been seen that the mean value of the variable medical technology (4.0049) is the highest indicating that corporate hospitals use the latest technology in practicing CRM and frequently update information according to the needs of the service-seekers.

The service-seekers tend to choose the place of service based on the modern technology applications and advancements in one particular hospital in comparison to the other hospitals. The hospitals have to therefore have to update their medical technology to the latest possible in order to win the loyalty of the service seekers as it is rightly said by Greve and Albers (2006) that technology advancement is required to maintain the customer life cycle effectively.

The requirements of modern equipments (3.8971) also were shown equal importance by the service seekers. The service seekers compared the place or location to get their service. Technical expertise (3.8039) of any service organization is very important for the evergreen functioning of the organization. E mail reports (3.8627) were also given priority because quick service and prompt information handling is demanded by various customers. Billing procedure (3.8235) became an important or even a mandatory requirement these days. There is almost no mandatory billing in many places. It enables work completion quickly, precisely and in a neat manner. E-Appointments (3.8235) with same mean value shows that it is equally preferred by customers than appointments by phone or walk in. It enables minimal time requirement to complete a job and less waiting time inclusive of formalities in making an appointment.

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V. Conclusion

The above discussion clearly indicates the importance of technology in CRM in terms of the various factors. It is a valuable addition to the literature of CRM and it has discussed several important aspects that are practically experienced by the service seekers of the hospitals in Chennai city. This will give an idea to the hospitals about the care that they need to take in terms of technological advancements in the hospitals.

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Cross-Cultural Management: An Empirical Study on Cultural Identity and Knowledge Management of Indian Software Engineers

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Abstract

With ever increasing scope of globalisation, managers need to live with more than one culture. Under these dynamic business environments, whether Indian software engineers are losing their cultural identity in a globalised working environment is an important research question. The review on cross-cultural management is based on two fold; one is to assess the cultural influence with regard to organizational behavioural pattern in a multinational company's working environment and the other is to find out the linkage between knowledge management and cultural values. This is an empirical study tries to explore bicultural/multicultural behavior of Indian software engineers in MNCs context. Implications of the findings are discussed.

Key Words: cross-cultural management, cultural identity, cultural values, bicultural, multicultural, traditional culture, and knowledge management.

1. Introduction

Cross-cultural management is a phenomena having greater impact in global business practice. With ever increasing scope of globalisation, managers need to live with more than one culture. The new economic policy of Government of India 1991 paved way for liberalisation, privatisation and globalisation of Indian businesses. The substantial increase in the quantum of Foreign Direct Investment (FDI) in many of the business field is further incentive to boost global business in a more cross-cultural environment in the country. Due to its concentration on outsourced and offshore software and Information Technology (IT) enabled services, the Indian IT industry developed to a large level; its' operation extends across different cultures, i.e. regional, national, trans-national and global. So, strengthening the human force with more domestic and global business skills and knowledge in a cross-cultural environment is one among the emerging needs of the fast developing economy.

The broad field of the study is strategic human resource management and the specific area is cross-cultural management in a multinational companies working environment. Cross-cultural management is a process of transferring modern management knowledge to a cross-cultural environment. Though much cultural research has already been taken, until recently, most of these studies have been based on western management philosophies and theories (Hofstede, 1980). Most of the cultural studies associated with western management were concerned with cultural differences encountered in non-western markets. India is one among the non-western markets for

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which the researcher wants to conduct a cross cultural study for the MNCs operating in India. While working in a cross-cultural environment, the important barriers identified by many researchers are cultural differences, assumptions, language, mistrust, different styles etc. This study emphasises on national cultural values and adaption of different cultural values without losing traditional/national culture in a cross-cultural environment. There is very limited empirical research in the area of cross-cultural management in India. Hence, the strategic human resource management will gain importance in a cross-cultural organizational environment. With a view to assess the cultural influence in organizational behavior pattern of software engineers in MNCs environment, the important research questions raised are,

1) Whether Indian software engineers are losing or retaining their cultural identity in a MNCs' working environment?

2) Do the Indian software engineers having cultural influence in their behavioural pattern?

3) Are the Indian software engineers interested to adapt bicultural/multi-cultural behaviour on their expatriate assignment?

4) Whether the Indian software engineers are able to gain their "knowledge management" without losing or compromising their cultural values?

5) Is there any implication in the study on strategic human resource management?

2. Different Concepts of Culture

Culture is the sum total of ideas, beliefs, values, material cultural equipments and non-material aspects which man makes as a member of society (E.B.Taylor, 1980). No one knows how the 'culture' got rooted through, but, people some time, started damaging the same within no time. They, often, misunderstand traditional culture with cross-cultural management practice. Work-life is a part of life but not life as a whole. One involves in work-life by virtue of one's own education, knowledge and experience. But life is severely tied with our own cultures and customary laws, taught by our predecessors and expected be followed by our future generations. As certain practices are antique by nature, which encompass validity of our traditional culture in which most of our community men, say, national or regional started sailing along with the culture. Though the meaning of culture is improperly understood by many, they used to feel comfort and convenience being with the fellow community men. People working in the organizations is very few per cent, the remainders are major portion in which follower of the traditional culture is at a larger level.

Culture has been defined in many ways. The culture is also named as 'national culture', 'regional culture', 'family culture' and 'traditional culture'. 'Organizational culture' is a modern concept in which the influence of individual's culture is reflected in the organizational work behaviour. The meaning of culture as used in literature about information systems and organisations is often contested (Myers and Tan, 2002). The concepts of 'negotiated culture' (Gregory et.al. 2009) and 'working culture' (Krishna et.al. 2004) are developed to compromise norms, values and systems which provide cross-cultural working environments in IT dominated organizations. The concept of 'ethnicity' is often referred to expatriate citizens. The term "ethnic" is commonly used to refer to a group that differs from others in terms of *culture* (either immigrant and/or non-immigrant), *nationality*, *race* or even *religion*.

2.1. Cultural Values and Beliefs

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According to Hofstede (1980), values of employees vary across culture; employees from different countries want different things from work. The differences shall be of individual based performance matrices, desire to autonomy, merit-based hiring, and nepotistic hiring etc. There are also debates and arguments in deciding the cultural values on conceptual framework. Kitayama (2002) rejected the search for culture in values on conceptual grounds, arguing that culture is to us like water is to fish- an aspect of the environment that enables and structures our behavior without us being aware of it. Cohen (2007) also witnessed that fact by declared that cross-cultural analysis should be grounded in peoples' actual social behaviour, rather than in the abstract values that people used to talk about themselves.

There has always been a coexistence of beliefs in India. Virtually all religious and cultural traditions incorporate some notion of high powers which motivates good deeds such as pro-social behavior (Johnson and Kruger, 2004). When commented on belief systems in the organisations, Tripathi (1990) categorized some myriad factors, which are, level of professional education, family's exposure to organizational work, peer leadership, organization expectation of universalism, participation in decision making, support from boss, team work and control. There are strong evidences by the researchers that cultural values and religious and other belief systems are tied with one another.

2.2. Cultural Influence across Borders

The present Indian culture is not only the unified system of our ancient and modern Indian culture, but also the synthesis of western and eastern culture. During 1960s, management researchers have shown interest in the concept of culture because it was believed that culture has an influence on managerial behavior and performance (Sekaran 1983). From that onwards, many problems have been arising among the researchers in predicting and prepositioning the concept of culture and its influence in management of organizations. The term "cross-culture" must be understood with right sprit. It is quit common for the modern organizations to assimilate culturally-different people to work together for common objectives. Many social scientists tried their understanding through theories and empirical studies to explain the relationship between culture and management. As it is the era of globalization and exchange of human skills and knowledge are getting advanced across the countries, the complexity of the understanding the cultural influence is again bewildering one. During 1970s, culture was criticized that much of the claim about culture being the most significant variable in management comparisons rest more on '*speculation*' than on '*facts*' (Ajiferuke and Boddewyn, 1970). The national identity of many rigid (culturally) nationals and *neo-national* concepts such as 'American Indian', 'American Chinese', 'Chinese American', 'Japanese American', 'American Japanese', 'European Indian', 'Indian European' etc. gave birth. The problems are necessitated to find cultural solutions to modern organizational problems. To gain competitive advantage for their parent organization, managers need to involve in executing the science and technological solutions across borders where they have to deal with a different culture.

The problems faced are accompanied by an increasing necessity to find cultural solutions to organizational problems in a world that has begun to resemble a 'global village' (Doktor et al. 1991). The heightened pace of global integration, brought about by technological and economical forces, suggests that managers will increasingly have to deal with counterparts from cultures quite unlike their own. It is believed that substantial competitive advantages will be derived by those managers who are able to tackle these cultural issues appropriately.

2.3. The Concept of Bi-culture and Multi-culture

Biculturals are individuals who identify strongly with two cultures. The globalization process witnessed a

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steadily growing concept of individuals with bicultural or multicultural behaviour. From the multinational and trans-national organizational point of view, the companies may encourage those employees with rewards and awards for adjusting cultural norms. But, there are aggressive oppositions from the anthropologists' and sociologists' point of view that compromising or losing one's cultural identity is a serious damage to the society. Bicultural individuals organize their cultural identities in different ways. Some represent their cultural identities as integrated or interconnected, whereas others represent the two as divided or separated (Benet-Martinez, Leu, Lee, & Morris, 2002). It was reviewed by Miramontez et.al (2008) that the degree to which individual integrates two cultural identities has implications for cognition and behavior. For example, integrated heritage and host culture identities foster self-perceived similarity to members of those cultures in personality. It was also advocated that more integrated bicultural identities are associated with more culturally diverse friendship networks (Mok, Morris, Benet-Martinez, & Karakitapoglu-Aygun, 2007).

3. The Impact of Culture and Knowledge Management

Management of knowledge itself it is a crucial task in the present society. Once, the scientific temper was detained due to stringent culture and good old custodial practice, where the growth of knowledge was restrained to a regional level with retrospective effects. But the present society is being witnessed with 'neo-culture' by continuous inventions, innovations and creativity in all spheres of human life. Hence the present society is in great demand of managing the knowledge, which must be suitable to the betterment and existence of the society. Culture brings knowledge to the society which means culture is a process of creating new ideas by reviewing the past experiences of our good old customs. This process is also molding the society with perfect understanding to an invisible bondage, which in turn, paves way for better understanding and adaptability of social, political and other economic obligations. Cohen (1998) explained that the clear context for knowledge is not one clear theory, but a "fabric of ideas' each enriched and textured by its contrast and connection with others, that bring different pattern of understanding and approaches to light. Following the Cohen's notion, Zhichang Zhu (2004) developed a cross-cultural and cross-institutional statement of different dimensions of knowledge management as follow:

Table: 1**. US and Japanese Contrast on Knowledge Management**

Western	Eastern
Focus on Explicit Knowledge	Focus on Tacit Knowledge
Re-Use	Creation
Knowledge Projects	Knowledge Cultures
Knowledge Markets	Knowledge communities
Management and Measurement	Nurturing and Love
Near-Term Gains	Long-Term Advantage

Source: Zhichang Zhu (2004)

National and traditional cultures have contributed extensively to the modern society with unique styles and values at different stages at different regions, which must be properly assessed and understood for a very fair and optimistic role of human behavior in the organizations. There may be lapses in different styles, but, it should be perceived with good intension to learn new things in a different business environment.

The different perceptions of ideal-type of knowledge management has been classified by Zhichang Zhu

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(2004) are; *knowledge as resource* by Americans, *knowledge as relationship* by Japanese, *knowledge as power* by Europeans and *knowledge as virtue* by Chinese. As the modern knowledge is perceived differently by different regions, the reason for these diversities is culture and culture alone. Knowledge is an integral part of any culture i.e. national and traditional through which learning process of human being continues. For all this knowledge management process, a silver lined strategic vision is rooted through their organizational life. For example, the westernized culture aims for leverage business life whereas Japanese business strategy is continuous innovation and creativity since their fundamental objective is "*love the job*". While most of this knowledge about innovations and creativity is politicized in European countries and the Chinese have a strong business strategy in assimilating and integrating the knowledge. When the business focus of Western and European companies is on premium products and niche markets, the business strategy of Chinese firms is to thrive and sustain in mass markets and gross root levels.

4. Methodology

There about 27 Indian software engineers who were working for at least five years in the US and European countries were surveyed. All the professionals were born in India and for the purpose of employment they were sponsored to foreign countries. Convenient samples, picked from the MNCs of Chennai and Bangalore and some of the samples collected from European and Western countries were administered for the study. Age of the participants ranged from 28 years to 35 years (M = 33.07 and SD = 1.82). Both women (37%) and men (63%) software engineers were considered for the study. The qualifications of the respondents were graduates and post graduates in engineering/technology stream. All the respondents were Hindus and their native place is the State Tamil Nadu.

4.1. Research Tool and Measurements

Semi-Structured questionnaire is the tool for the study. The open-ended questions were conveyed to the respondents through e-mails and telephones. The respondents were from both currently working and returned from the foreign countries after having completed at least five years of assignment. Initially, the questions were asked to get the background information like education, experience, nativity, sponsored company etc. The important questions raised for the purpose of the study were on cultural identity at expatriate country, continuance of cultural influence, cross-cultural management in MNCs working environment, opinion of bicultural and multicultural behavior, knowledge management practice and cultural influence. The open ended questionnaire was classified into the *domain* of four categories namely cultural identity, cultural influence, bicultural / multi-cultural behaviour and knowledge management. The questionnaire also consists of many numbers of *criterions* which are perceived as suitable for this cross-cultural study. Five points-scale (SS=Strongly Supported; MS=Moderately Supported; NL=Neutral; PS=Poorly Supported; and NS=Not Supported) was used to measure the cross-cultural behavior of the Indian software engineers. Only engineers with Hindu religion were allowed to answer for the study.

5. Results

The open-ended questions were circulated to 39 software engineers and 34 were responded. Out of 34 responses, 27 questions were considered for the study based on the quality of responses. The whole study gave valid information regarding cross-cultural management. As it is opinion survey of software engineers, almost all the respondents were actively engaged in the process. The investigation is made from several points of judgements. Most of the respondents recognized that *knowledge management* is need of the hour for the present "knowledge society", but refuse to accept "cultural compromise". Most of the respondents gave their opinion that traditional/national culture can't be over-ruled for the sake of foreign assignment. The results were classified

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into four categories. Only 2 engineers have shown interest for bicultural behavior. Both of them wanted to follow the Western culture as well as Indian culture. They also anticipated settling at the repatriate countries if work permits were extended permanently. The remaining participants were strong in predicting and following cultural identity. The gender profile of the respondents is as follow:

Table: 2. **Age Composition of the Respondents**

Age	Men	Women	Total
28	1		1
29	-	1	1
30	-	-	-
31	2	-	2
32	2	2	4
33	4	3	7
34	4	1	5
35	4	3	7
Total	17	10	27

* M = 33.07 and SD = 1.82

The mean and standard deviation of the positive responses are M=18.81818, and SD=3.59413 respectively. The positive and negative responses are as shown in Table 3:

Table: 3. **Cross Tabulation of different responses**

Domain	**Criteria**	**Positive**	**Neutral/ Negative**	**Total**
Cultural Identity	Inner conscious as Indian	23	8	27
	Cultural practice at home	21	6	27
	Cultural practice at office	16	11	27
	Adoption of traditional/national values	17	10	27
	Demonstration of traditional/national values	14	13	27
	Family tie as Indian nuclear family	19	8	27
	Religious values	17	10	27
	Spirituality as in the home country	18	9	27
	Rejection of perceived Western / European values	13	14	27
Cultural Influence	Organisational behavior pattern	18	9	27
	Leadership styles and qualities	15	12	27
	Continuous learning and adoptability	18	9	27
	Management of change	16	11	27
	Perseverance & tolerance	23	6	27
Bicultural or	Disagree to adapt as bicultural / multicultural	25	2	27

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Multi-cultural Behaviour	Disagree to conversion of family members as bi-cultural/multi-cultural	23	4	27
	Willingness to cultural compromise	25	2	27
Knowledge Management	Maintaining traditional, cultural and religious knowledge	18	9	27
	Tacit knowledge	19	8	27
	Adoption of new knowledge with right sprit of Scientific and technological advancement	23	4	27
	Rejection of *westernized* knowledge	14	13	27
	Adoption of knowledge communities	19	8	27

Source: Developed for the study

Among the 27 respondents, the results of the majority of the respondents' view and the correlation coefficient of the cross-cultural management are tabulated in the Table 4.

Table: 4.**Test Report**

S.N.	Domain	Criteria	Result	Correl. Coeffi.
1.	Cultural Identity	Inner conscious as Indian	SS	.956
		Cultural practice at home	SS	-
		Cultural practice at office	MS	.960
		Adoption of traditional/national values	MS	.961
		Demonstration of traditional/national values	NL	.952
		Family tie as Indian nuclear family	MS	.931
		Religious values	MS	.930
		Spirituality as in the home country	MS	.928
		Rejection of perceived Western / European values	NL	.949
2.	Cultural Influence	Organisational behavior pattern	MS	.888
		Leadership styles and qualities	MS	-
		Continuous learning and adoptability	MS	-
		Management of change	MS	-
		Perseverance & tolerance	SS	.906
3.	Bicultural or Multi-cultural Behaviour	Disagree to adapt as bicultural / multicultural	MS(except 2)	-1
		Disagree to conversion of family members as bi-cultural/multi-cultural	SS (except 2)	-1
		Unwillingness to cultural compromise	MS (except2)	-1
4.	Knowledge Management	Maintaining traditional, cultural and religious knowledge		
		Tacit knowledge	MS	.987
		Adoption of new knowledge with right sprit of Scientific and technological advancement	MS	-

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		Rejection of *westernized* knowledge	SS	.982
		Adoption of knowledge communities	NL	.993
			MS	.991

Note: SS = Strongly supported; MS = Moderately supported; NL = Neutral;

* The value of correlation coefficients is less than 1

Source: Developed for the study

The findings of the study allowed the provision of answers to some of the fundamental questions the study has posed. Though work related attitudes and values are universal, the work is being influenced by the individual's cultural norms. At the same time, losing of one's individuality with reference to cultural identity was inadmissible for most of the engineers. Many theorists of international studies strongly advocated that adaption of bicultural or multicultural behaviour of employees will give positive results to the multinational organizations. But most of the Indian software engineers are interested to avoid cultural compromise. A meager percentage (7.4%) of respondents though not interested to show their cultural identity, they also denied for cultural compromise. As explained in the review, cross-cultural study is still being explored by many researchers. The field of management of MNCs poses several challenges and the cross-cultural management of human resources is one among the challenges. This study is a valid attempt and significant contribution with regard to cross-cultural management to the professionals and stake holders who are involved in the MNCs working environment. Though the study is focused on cultural identity of Indian software engineers, as per the findings, the MNCs of European and Western countries are not so ethnocentric. The findings of the study are also an indication that the MNCs' organizational climate is more conducive to the Indian software engineers. With a view to further assess the software engineers' *cultural identity*, it is decided to validate through weighted average method, which is explained as follow:

Weighted Average Method:

Table: 5. **Software Engineers' Positive Attitude of Cultural Identity**

Attribute	X	Rank	W	XW
Strongly supported	44	1	5	220
Moderately supported	87	2	4	348
Neutral	27	3	3	81
Poorly Supported	-	4	2	-
Not supported	-	5	1	-
Total	158			649

Source: Developed for the study

Weighted Average = €xw/n

= 649/158

Weighted Average = 4.107

Inference: This study proves that the respondents are having positive attitude in adopting cultural identity.

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From the above findings, it is observed that there is no significant difference among the four domain variables (cultural identity, cultural influence, disagree to adapt bicultural/multicultural behaviour and knowledge management) except 2 biculturals identified. The detailed cross tabulation of cross cultural management variables is given below:

Table: 6. **Cross Tabulation of Cross-Cultural Management Variables**

S.N.	Variables	Chi Square	df	P value
1.	Cultural Identity	316	16	0.000
2.	Cultural Influence	90	4	0.000
3.	Disagree to adaption of bicultural/multicultural	73	2	0.000
4.	Knowledge Management	186	8	0.000

Source: Survey data compiled

6. Strategies to Manage Human Resources in MNCs Working Environment

Many numbers of strategic issues involved in management of MNCs. Cross-cultural management is one among the issues. The mid of 20th century witnessed the peak of interest among professionals in India to get expatriate to Western and European countries. Though there is tremendous scope for the software engineers in these countries, the present decade witnesses that people often hesitate for assignments for which the reasons are many. The impulsive situation arises due to equal job opportunity in domestic companies, the recent economic recession and frequent terrorist attack on the civilians. Under these circumstances, MNCs have to learn lesson to create a very conducive organizational climate by providing adequate value addition to cross-cultural management.

7. Limitations

Semi-structured interview schedule is most suitable for this kind of socio-psychological research. Due to time and resource constraints, questionnaire is used in the survey. As it is mailed survey and some of the software engineers are still working in the foreign countries, personal observation and face-to-face interview was not possible.

8. Conclusion

The ancient Indian society has been rooted through stringent rules and cultural norms. But, modern India is molded with the fast track of economic development based on the western model of development which consists of high dose of science and technology. Indian companies has already started practicing westernized management style with cut through competitions, merit and quality considerations and a no-non-sense approach to work ethics. Hence, this study is conducted on Western and European MNCs working environment. This study focused on cultural identity and knowledge management to identify the cultural influence of organisational behavior pattern of Indian software engineers. More research is needed to validate the various issues of cross-cultural management of Indian expatriates to European and Western countries. Obtaining larger number of samples from different industries will ensure more reliability and validity for the study.

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Steps To The Green Technology

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Abstract

Green technology focuses on how to achieve sustainability through science and technology. In this paper principles of the Green Technology, that should be followed while designing and developing any product,have been discussed.The Principles of Green Technology provide a framework for scientists and engineers to engage in when designing new materials, products, processes, and systems that are benign to human health and the environment. From these discussions, specific goals have emerged, such as minimizing waste, increasing recycling, or approaching sustainability. When dealing with design architecture and building some products ,these technology principles play a vital role. A design based on the principles moves beyond baseline technology quality and safety specifications to consider environmental, economic, and social factors.The Principles of Green Technology provide a structure to create and assess the elements of design relevant to maximizing sustainability. Engineers can use these principles as guidelines to ensure that designs for products, processes, or systems have the fundamental components, conditions, and circumstances necessary to be more sustainable. A balancing of principles will be required to optimize the overall system solution.

Keywords:- Hazardous, Life-cycle, Inherency, Principles, Energy,Input,Output, Re-cycle,Materials.

Introduction

In recent years, numerous papers, books, and conferences have centered on the subject of lessening the negative human impacts on the planet and on its ability to sustain life (*1–10*).The breadth of the principles' applicability is important. When dealing with design architecture- whether it is the molecular architecture required to construct chemical compounds, product architecture to create an automobile, or urban architecture to build a city-the same green technology principles must be applicable, effective, and appropriate.. In this paper, we illustrate how these principles can be applied across a range of scales. It is also useful to view the principles as parameters in a complex and integrated system. Just as every parameter in a system cannot be optimized at any one time, especially when they are

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interdependent, the same is true of these principles. There are cases of synergy in which the successful application of one principle advances one or more of the others.There are, however, two fundamental concepts that designers should strive to integrate at every opportunity: life cycle and inherency.

The Principles of Green Technology

Principle 1: Designers need to strive to ensure that all material and energy inputs and outputs are as inherently non-hazardous as possible.

Principle 2: It is better to prevent waste than to treat or clean up waste after it is formed.

Principle 3: Separation and purification operations should be designed to minimize energy consumption and materials use.

Principle 4: Products, processes, and systems should be designed maximize mass, energy, space, and time efficiency.

Principle 5: Products, processes, and systems should be "output pulled" rather than "input pushed" through the use of energy and materials.

Principle 6: Embedded entropy and complexity must be viewed as an investment when making design choices on recycle, reuse, or beneficial disposition.

Principle 7: Targeted durability, not immortality, should be a design goal.

Principle 8: Design for unnecessary capacity or capability solutions should be considered a design flaw.

Principle 9: Material diversity in multi component products should be minimized to promote disassembly.

Principle 10: Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.

Concept of Life cycle and inherency

The materials and energy that enter each life cycle stage of every product and process have their own life cycle. Designers should consider the entire life cycle, including those of the materials and energy inputs. The life cycles of materials and energy begin with acquisition and move throughout manufacturing, distribution, use, and end of life. It is the consideration of all of the impacts that is needed when applying the green technology principles. This strategy complements the selection of inherently benign inputs that will reduce the environmental impact across life-cycle stages. Making products, processes, and systems more environmentally benign generally follows one of the two basic approaches: changing the inherent nature of the system or changing the circumstances of the system. Although inherency may,

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for example, reduce the intrinsic toxicity of a chemical; a conditional change can include controlling the release of, and exposure to, a toxic chemical. Inherency is preferable for various reasons, most importantly to preclude "failure". By relying on technological control of system conditions, such as air scrubbers treatment, there is a potential for failure that can lead to a significant risk to human health and natural systems. However, with an inherently more benign design, regardless of changes in conditions or circumstances, the intrinsic nature of the system cannot fail. In those cases in which the inherent nature of the system is predefined, it is often necessary to improve that system through changes in circumstances and conditions.

The principles

Principle 1: Inherent rather than circumstantial. Although the negative consequences of inherently hazardous substances may be minimized, this is accomplished only through a significant investment of time, capital, material, and energy resources. Generally, this is not an economically or environmentally sustainable approach. Designers should evaluate the inherent nature of the selected material and energy inputs to ensure that they are as benign as possible as a first step toward a sustainable product, process, or system. Similarly, molecular designers are developing methods and technologies to create inherently benign material and energy sources (*11–14*).

Principle 2: Prevention instead of treatment. There is nothing inherent about energy or a substance that makes it a waste. Rather it results from a lack of use that has yet to be imagined or implemented. As such, waste is assigned to material or energy that current processes or systems are unable to effectively exploit for beneficial use. Regardless of its nature, the generation and handling of waste consumes time, effort, and money. Although it may seem obvious that waste generation should be prevented or avoided wherever possible, there are plentiful examples where it is not inadvertently generated; rather, waste generation is thoughtlessly designed into the process. Technologies targeted toward waste-free design at any scale are based on the same fundamental concept: inputs are designed to be a part of the desired output. This concept has been described at the molecular scale as "atom economy" (*14*) and can be extended across design scales as the "material economy". This principle can be illustrated by the design of current power generation systems based on fossil fuels, which inherently produce waste at each life cycle stage. Although waste is also generated during mining and processing, most is produced during use. Burning fossil fuels releases greenhouse gases and particulate matter, which contribute to global climate change and its subsequent impacts (*15*). However, power generation systems do not have to produce waste, as exemplified by fusion energy. Although still unrealized,

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fusion energy could move energy systems toward sustainability (*16*).

Principle 3: Design for separation. Product separation and purification consume the most energy and material in many manufacturing processes. Many traditional methods for separations require large amounts of hazardous solvents, whereas others consume large quantities of energy as heat or pressure. Appropriate up-front designs permit the self-separation of products using intrinsic physical/chemical properties, such as solubility and volatility rather than induced conditions, decrease waste and reduce processing times. A similar design strategy can be applied across scales such that the final product, process, or system is shaped from components with desired properties. This approach minimizes the energy and materials necessary to isolate the desired output from a complicated matrix of undesirable and valueless extraneous matter. Furthermore, the components of the unwanted matrix are often classified as waste, which requires time, money, and resources for handling, transportation, disposal, and possible monitoring. Additionally, design decisions at the earliest stage can impact the ease of product separation and purification for later reuse and recycling of components. Economic and technical limitations in separating materials and components are among the greatest obstacles to recovery, recycle, and reuse (17**)**.These obstacles can be overcome by avoiding permanent bonds between two different materials wherever possible. Up-front consideration for separation and purification avoids the need to expend materials and energy to harvest the desired output across all design scales and throughout the life cycle. At the molecular scale, for example, separation and purification processes such as column chromatography and distillation are often inefficient. Column chromatography can require large quantities of hazardous solvents (18), whereas distillation consumes significant amounts of energy, both in terms of cooling and heating requirements. However, if chemical reaction products can be designed to self-separate from the reaction medium, it would eliminate the need for these additional resources. Polymers, for example, can be used to control the solubility of substrates, ligands, and catalysts for separation and reuse. Up-front consideration for separation and purification avoids the need to expend materials and energy to harvest the desired output across all design scales and throughout the life cycle (19).

Principle 4:Maximize mass,energy,space,and time efficiency. Because processes and systems often use more time, space, energy, and material than required, the results could be categorized as "inefficiencies", but the consequences are often broadly distributed throughout the product and process life cycles. If a system is designed, used, or applied at less than maximum efficiency, resources are being wasted throughout the life cycle. Historically, only a part of the available volume of large batch reactors in chemical manufacturing has been commonly used during the reaction period, often at dilution levels far

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more than required. Through process intensification techniques, such as micro reactors that operate continuously at very low volume with efficient mixing, high productivity can be obtained from small amounts of material (*20*). Similar strategies designed for maximum efficiency and intensity can be applied across the molecular, product and process. Examples of how this applies across the hierarchy of systems scales include spinning-disk reactors replacing batch reactors (20),powder coatings instead of paints.

Principle 5: Output-pulled versus input-pushed when a stress is applied to a system at equilibrium, the system readjusts to relieve or offset the applied stress. A stress is any imposed factor, such as temperature, pressure, which upsets the balance between the forward and reverse transformation rates. Often a reaction or transformation is "driven" to completion based on this principle by adding more energy or materials to shift the equilibrium and generate the desired output. However, this same effect can be achieved by designing transformations in which outputs are continually minimized or removed from the system, and the transformation is instead "pulled" to completion without the need for excess energy or material. Design through this principle, minimizes the amount of resources consumed to transform inputs into the desired outputs. This is well known at the molecular level in chemical transformations such as condensation reactions in which water is eliminated from the product stream to "pull" the reaction to completion. This same technique, though not necessarily in the traditional context, can be applied across design scales. Just-in-time manufacturing requires that equipment, resources, and labor are only available in the amount required and at the time required to do the job. Only the necessary units are produced in the necessary quantities at the necessary time by bringing production rates exactly in line with demand (*21*).

Principle 6: Conserve complexity. The amount of complexity that is built into a product, whether at the macro, micro, or molecular scale, is usually a function of expenditures of materials, energy, and time. For highly complex, high-entropy substances, it could be counterproductive and sacrifice value to recycle the material. High complexity should correspond to reuse, whereas substances of minimal complexity are favored for value-conserving recycling, where possible, or beneficial disposition, when necessary. Natural systems should also be recognized as having complexity benefits that should not be needlessly sacrificed in manufacturing transformation or processing. The complexity of a brown paper bag also may not, however, warrant the time and energy for collection, sorting, processing, remanufacturing, and redistribution as an intact shopping bag. End-of-life design decisions for recycle, reuse, or beneficial disposal should be based on the invested material and energy and subsequent complexity across all design scales.

Principle 7: Durability rather than immortality. Products that will last well beyond their useful

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commercial life often result in environmental problems, ranging from solid waste disposal to persistence and bioaccumulation. It is therefore necessary to design substances with a targeted lifetime to avoid immortality of undesirable materials in the environment. However, this strategy must be balanced with the design of products that are durable enough to withstand anticipated operating conditions for the expected lifetime to avoid premature failure and subsequent disposal. Effective and efficient maintenance and repair must also be considered, so that the intended lifetime can be achieved with minimal introduction of additional material and energy throughout the life cycle. By targeting durability and not immortality as a design goal, the risk to human and environmental health at end of life is significantly reduced. For example, single-use disposable diapers consisting of several materials, including non-biodegradable polymers, have represented the single largest non-recyclable fraction of municipal solid waste (*22*).

Principle 8: Meet need, minimize excess. Anticipating the necessary process agility and product flexibility at the design stage is important. However, the material and energy costs for over design and unusable capacity or capability can be high. There is also a tendency to design for worst-case scenarios or optimize performance for extreme or unrealistic conditions, which allow the same product or process to be used regardless of local spatial, time, or physical conditions. This requires incorporating and subsequently disposing and treating components whose function will not be realized under most operating conditions. The tendency to design an eternal, global solution (e.g., chlorofluorocarbons, PCBs) should be minimized to reduce unnecessary resource expenditures. Drinking water disinfection using chlorine is a good example. Water distributed from a centralized location is treated to ensure that the water remains disinfected to the furthest receiving point. However, water at a shorter distance from the drinking water treatment plant in the system will have higher-than necessary levels of disinfection byproducts because some dissipate with time. An alternative and potentially more sustainable strategy would be to installactuator and control systems throughout the distribution system that regulate the dose of chlorination (23).

Principle 9:Minimize material diversity. Products as diverse as cars, food packaging, computers, and paint all have multiple components. In an automobile, components are made from various plastics, glasses, and metals. Within individual plastics there are various chemical additives, including thermal stabilizers, plasticizers, dyes, and flame-retardants. This diversity becomes an issue when considering end of useful life decisions, which determines the ease of disassembly for reuse and recycle. Options for final disposition are increased through up-front designs that minimize material diversity yet accomplish the needed functions. At the process level, this is being done by integrating desired functionality into polymer backbones and thereby avoiding additives at a later stage in the

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manufacturing process (24).

Principle 10: Integrate local material and energy flows. Products, processes, and systems should be designed to use the existing framework of energy and material flows within a unit operation, production line, manufacturing facility, industrial park, or locality. By taking advantage of existing energy and material flows, the need to generate energy and/or acquire and process raw materials is minimized. At the process scale, this strategy can be used to take the heat generated by exothermic reactions to drive other reactions with high activation energies. This principle is also illustrated by regenerative braking systems in hybrid electric vehicles. In these systems, heat generated by braking that is typically wasted is captured, reversing the electric motor. This turns the motor into an electric generator, creating electricity that is fed back into a battery and stored as energy to propel the vehicle. Integrating the drive train with the regenerative braking system reduces the vehicle's fuel demands and significantly improves fuel efficiency (25).

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Conclusion

Innovation in design technology has resulted in feats ranging from the microchip to space travel. Now, that same innovative tradition must be used to design sustainability into products, processes, and systems in a way that is scalable. By using the Principles of Green Technology as a framework, the conversation that must take place between designers of molecules, materials, components, products, and complex systems can occur using a common language and a universal method of approach. The principles are not simply a listing of goals, but rather a set of methodologies to accomplish the goals of green design and sustainability. Because of practical, logistical, economic, inertial, and institutional reasons, it will be necessary in the near term to optimize unsustainable products, processes, and systems that are currently in place.

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Comparing artificial neural networks and regression methods for predicting crude oil exports

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Abstract
To develop and improve the time-series forecasting models, many efforts have been done in past years. Due to the important role of crude oil in the global economy, crude oil export is a key factor affecting economic plans. Therefore, proactive knowledge of its future movement can lead to better decisions in various governmental and managerial levels. However, since the mechanisms governing the export of crude oil are complex, thus forecasting of crude oil will not be easy. In this paper we use a regression equation and an Artificial Neural Network (ANN) model for forecasting crude oil export from 2006 to 2012. We evaluate the performance of the models using performance indexes such as RMSE and MAE and R^2. Results show that Neural Network model has better performance than linear regression method for crude oil export forecasting. Data used in this study are several time series which represent crude oil export, agricultural energy consumption, domestic and commercial energy consumption, refinery energy consumption, plants energy consumption, transport energy consumption and industrial energy consumption from 1976 to 2005 that published in Statistical Center of Iran.
Keywords: Artificial Neural Network, crude oil export, forecasting, multiple linear regression

1. Introduction
Crude oil is one of the critical commodities in the world's economy. The global supply and demand of crude oil is 80 million barrels per day. Crude oil export forecasting approaches basically involve single and multi-factor models. Crude oil has been playing an increasingly important role in the world economy since nearly two-third of the world's energy demands is met from crude oil (Alvarez-Ramirez et al., 2003). It is said that crude oil is also the world's largest and most actively traded commodity, accounting for over 10% of total world trade (Verleger, 1993). Oil exports are directly affected by the factors such as

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agricultural energy consumption, domestic and commercial energy consumption, refinery energy consumption, plants energy consumption ,transport energy consumption and industrial energy consumption. These factors, bring about a highly nonlinear time series for crude oil export, which makes it rather difficult to capture the underlying mechanism for future forecasts.

Forecasting future events based on current and future data is very exciting to people and experts. Forecasting is one of the main statistical tools used by the makers of economic strategy. Since processes in economic strategy are composed of complex operations, such as inflation, stock market returns or stock indices, then they are usually difficult to predict in a timely manner. One source of difficulty is the complex interactions between factors affecting the market and the unknown random processes such as unexpected news or unpredicted changes in influencing factors (Clement et al., 2002).

Recent studies have shown that many economic relations are usually non-linear in either parameters or even non-stationary. It seems that the nonlinear least squares methods are widely used methods to obtain the parameters in the non-linear models. However it is very difficult to draw a standard formula for the parameters in these models.

The researcher found that there are several techniques that can be applied in such cases and may overcome the problems of non-linearity and non-stationary. One of these techniques includes Artificial Neural Networks (ANN) methods. This technique has been used in forecasting in many fields and especially in economics. The use of ANN in this domain increased because of their ability to form a complex non-linear system based on sample data. Because of their enormous storage capacity and capabilities to learning and prediction, the applications of ANN received a great attention in recent years in many fields. The result of the use of ANN in forecasting helps investors to hedge against the risk of potential markets and creates new opportunities for profit. This method also makes timely decisions and prevents a lot of losses.

Unfortunately the fundamental mechanism governing the complex dynamics is not well understood by human beings. In the past decades, statistical and econometric techniques, such as linear regression, have been widely applied to crude oil export forecasting. Numerous experiments have demonstrated that the prediction performance might be very poor if once continued use of these traditional statistical and econometric models (Weigend et al., 1994). The main reason leading to this phenomenon is that the traditional statistical and econometric models are built on linear assumptions and they cannot capture the hidden nonlinear patterns in the crude oil export series.

Time series forecasting is an important area of forecasting in which past observations of the same variable are collected and analyzed to develop a model describing the underlying relationship. The model is then used to extrapolate the time series into the future. To develop and improve the time-series forecasting models, many efforts have been done in past years. Over the past decades, there has been a considerable amount of research directed at predicting future values and thereby helping policy makers in arriving to better decisions. Today artificial neural network is one of the most widely used methodologies that we will discuss to it in this paper.

It is well known that, most economic and financial data are either non-linear or non-stationary that is one of problems when using the traditional statistical methods, such as regression analysis. It was necessary to

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look for other methods which are more appropriate and produce more accurate forecasts when the data is non-linear or non-stationary. In this study we will apply the ANN as modern method of forecasting technique to see how it could be used as an alternative method. In the present study we are going to perform some comparisons among ANN and linear regression methods.

The aim of this study is to evaluate the performance of linear regression method and Artificial Neural Network forecasting techniques in forecasting of crude oil export based on agricultural energy consumption, domestic and commercial energy consumption, refinery energy consumption, plants energy consumption, transport energy consumption and industrial energy consumption. In this paper first we review literature of research. Then we explain consepts that we use. To achieve this goal we perform the following steps:

1. Finding a regression equation.
2. Finding a most suitable ANN model.
3. Comparing the two methods using RMSE and MAE and R^2.
4. Give the relevant recommendations based on the results of the comparison that we obtained above.

2. Literature Review

In the past two decades, researches have been focused on forecasting using ANN. In this section we discuss briefly some previous studies which conducted comparison between the use of traditional methods and Neural Networks in time series forecasting in several applications. ANNs have been widely used for solving many forecasting and decision modeling problems (Hiew et al., 1992). Investigators have been attracted by ANN's freedom from restrictive assumptions such as linearity that are often needed to make the traditional mathematical models tractable. They have further argued that ANN can easily model both parametric and non-parametric processes and transform the input data automatically. ANNs have been tried out as research tools in several fields. Empirical analysis of the application of the Neural Network in financial time series shows that ANN models have outperformed to traditional time series models. Bosarge (1993) suggested an expert system with a Neural Network at its core. He found significant nonlinearities in different time series and was able to improve the quality of the forecast considerably (Bosarge, W. E., 1993).Moody, Levin and Rehfuss (1993) have focused on the US aggregate industrial production finding that a Neural Network model outperforms a linear model at horizons of six months and longer (Moody et al., 1993).Results achieved by, Kuan and White (1994) indicated the possibility of using ANN in economic variables and discussed the usability of traditional models and emphasized the similarities between the two methods. The use of Neural Networks in macroeconomics is still in its relative infancy. Kuan and White study (1994) is probably the first attempt to introduce ANNs to macroeconomic forecasting (Kuan et al., 1994). Maaoumi, Khontazad and Abaye(1994) applied this method on a group of 14 different time series in macroeconomics and found that the models and projections performed better using the ANN method (Maaoumi et al., 1994).

Moody (1995) has presented empirical result for forecasting the U.S. index of industrial production and argued that superior performance can be obtained using state-of-the-art ANN models instead of using conventional linear time series and regression methods (Moody, 1995). Kohzadi, Boyd, Kaastra,

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Kermanshahi and Scuse (1995) applied Neural Networks to forecast the corn futures and found that the forecast error of the ANN model is 18 to 40 percent lower than the ARIMA model (Kohzadi et al., 1995). Many studies have demonstrated the traditional Neural Network models forecast ability. For instance, Wu (1995) applied multilayer feed-forward Neural Networks to forecast Taiwan Dollar/US Dollar exchange rate and the results were better than ARIMA models. The authors, therefore, concluded that Neural Network approach is a competitive and robust method for the forecasting (Wu, 1995).

Swanson and White (1997) have investigated the performance of Neural Network models in forecasting nine quarterly seasonally adjusted US macroeconomic time series. They used ANN approach in forecasting macroeconomic variables and compared different linear and non-linear models using a large sample size data. They found that the performance of multivariate linear models is marginally better than other Univariate models (Swanson et al., 1997).

Recently, the ANNs have been extensively studied and used in macroeconomic time series forecasting (Zhang et al., 1998), and application of back-propagation to Neural Network learning (Wong, 1990).

Tkacz and Hu (1999) examined whether ANN can be used in modeling the increase in production based on monetary and financial variables. The results indicate that ANN forecasting performances were better than those of the linear models [Tkacz et al., 1999].

However, few studies report opposite results. For example, Qi and Wu (2003) employed a Neural Network to study the nonlinear predictability of exchange rates for four currencies at the 1, 6 and 12-step forecasting horizons. [Qi et al , 2003]Some studies use economical meaningful variables to improve the forecasting performance of the model. For example, Kumar and Joshi (2003) integrated a microeconomic variable and some macroeconomic variables including interest rate and crude oil price into a recurrent neural network forecasting model to predict the movements of Canada/US dollar exchange rate. The results demonstrate that the new model provides better forecasting performance than regression models, and both macroeconomic and microeconomic variables are useful for exchange rate forecasting. [Kumar et al , 2003]

Mohammadi, Eslami and Dardashti(2005) conducted a study by applying different methods for forecasting spring inflow to the Amir Kabir reservoir in the Karaj river watershed. Three different methods, ANN, ARIMA time series and regression analysis between some hydroclimatological data and inflow, were used to forecast the spring inflow. The performances of the models were compared and the ANN model was found to model the flows better. Thus, ANN proved to be an effective tool for reservoir inflow forecasting in the Amirkabir reservoir using snowmelt equivalent data [Mohammadi et al., 2005].

As we have seen through the above literature review, there are many studies conducted comparison between ANN and other traditional methods as regression methods in terms of their performances.

3. Concepts

3.1 Artificial Neural Networks

3.1.1A Brief Exposition

The Artificial Neural Network is an information-processing paradigm inspired by the way biological nervous systems such as the brain process information. It works like the human brain, trying to recognize

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regularities and patterns in the data. It can learn from experience and generalize based on the previous knowledge. Lately, ANNs have used in time series forecasting in various fields [Zhang et al., 1998]. Some statistical time series methods have inherent limitations, requiring human interaction and evaluation. However, the estimation of ANN can be automated [Hoptroff, 1993]. Moreover, many statistical models must be re-estimated periodically when new data arrive whereas many ANN algorithms learn incrementally [Widrow et al., 1985]. Thus, the ANN method for forecasting and decision making is worthy of ANN is one of the non-linear tools that have been recently adopted in econometrics to forecast macroeconomic variables. It has been popular for its back-propagation learning, which enables the estimation of parameters. The innovation of ANN lies, first of all, in the introduction of hidden layers between the input layer and the output layer. The hidden layers capture all indirect relations between explanatory variables and the dependent variable. Second is the application of the activation function, i.e. logistic function, which has the ability to approximate any nonlinear function.

4.1.2 Concept of Artificial Neural Networks

The human brain is formed by over a billion neurons that are connected in a large network that is responsible for thought. An Artificial Neural Network is just an attempt to imitate how the brain's networks of nerves learn. An ANN is a mathematical structure designed to mimic the information processing functions of a network of neurons in the brain [Hinton, 1992]. Each neuron, individually, functions in a quite simple fashion. It receives signals from other cells through connection points (synapses), averages them and if the average over a short of time is greater than a certain value the neuron, produces another signal that is passed on to other cells. As Wasserman (1989) pointed out, it is the high degree of connectivity rather than the functional complexity of the neuron itself that gives the neuron its computational processing ability. Neural Networks are very sophisticated modeling techniques, capable of modeling extremely complex functions. The NN user gathers representative data, and then invokes training algorithms to automatically learn the structure of the data.

The first computational neuron was developed in 1943 M.D by the neurophysiologist Warren McCulloch and the logician Walter Pits based on the biological neuron. It uses the step function to fire when threshold μ is exceeded. If the step activation function is used (i.e. the neuron's output is 0 if the input is less than zero, and 1 if the input is greater than or equal to 0) then the neuron acts just like the biological neuron described earlier. ANNs are comprised of many neurons, interconnected in certain ways to cast them into identifiable topologies as depicted in figure (1).

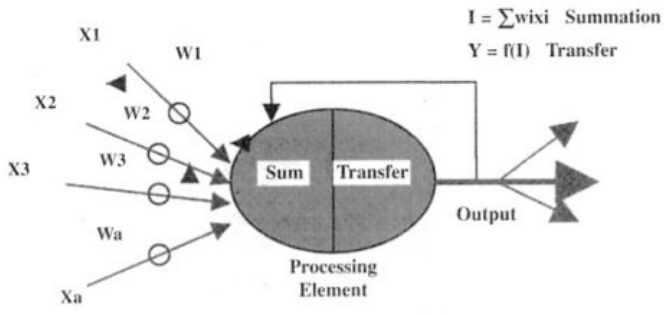

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Figure (1): The basic of artificial neuron

Note that various inputs to the network are represented by the mathematical symbol, x(n). Each of these inputs is multiplied by a connection weights w(n). In the simplest case, these products are simply summed, fed through a transfer function to generate a result, and then output. Even though all ANNs are constructed from this basic building block the fundamentals vary in these building blocks and there are some differences.

4.1.3 Architecture OfThe Neural Network

Neural Networks are computational frameworks consisting of massively connected simple processing units. These units have an analog to the neuron in the human brain. One of the most popular NN paradigms is the feed-forward neural network (FNN) and the associated back-propagation (BP) training algorithm. In a FNN, the neurons (i.e. the processing units) are arranged in layers i.e. the input, the hidden ones and the output. Feed-forward ANNs allow signals to travel one wayonly from input to output. Figure (2) gives a typically fully connected three-layer FNN topology.

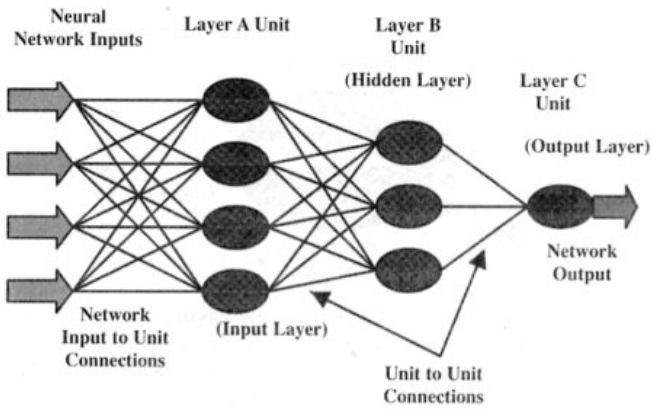

Figure (2): A Three-layer FNN

This network has four units in the first layer (layer A) and three units in the second layer (layer B), which are called hidden layers. This network has one unit in the third layer (layer C), which is called the output layer. Finally, this network has four network inputs and one network output. Each networkinput- to-unit and unit-to-unit is modified by a weight. In addition, each unit has an extra input that is assumed to have a constant value of one. The weight that modifies this extra input is called the bias. All data propagate along the connections in the direction from the network inputs to the network output hence the term feed-forward.[Rummelhart et al., 1986]

4.1.4 Networks Layers

The most common type of ANN consists of three groups, or layers, of units: a layer of input units is connected to a layer of hidden units, which is connected to a layer of output units. The activity of the input

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units represents the raw information that is fed into the network. The activity of each hidden unit is determined by the activities of the input units and the weights on the connections between the input and the hidden units. The behavior of the output units depends on the activity of the hidden units and the weights between the hidden and output units.

4.1.5 Perceptrons

One of the most useful and successful applications of ANN to data analysis is the multilayer perceptron model (MLP). Multilayer perceptron models are non-linear Neural Network models that can be used to approximate almost any function with a high degree of accuracy [White, 1992]. An MLP contains a hidden layer of neurons that uses non-linear activation functions, such as a logistic function. Figure (3) offers a representation of an MLP with one hidden layer and a single input and output.

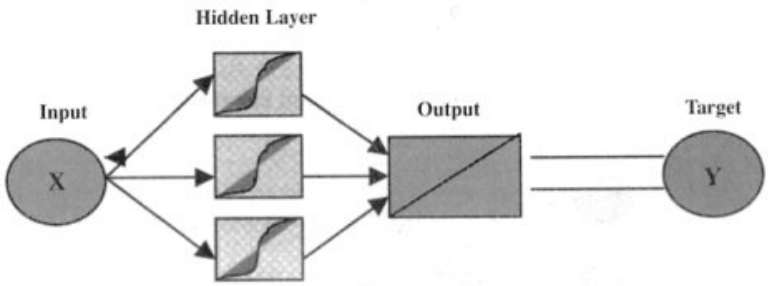

Figure (3): Multi-layer Perceptrons with single hidden layer

It represents a simple non-linear regression. The number of inputs and outputs in the MLP, as well as the number, can be manipulated to analyze different types of data.

4.1.6 Training Neural Networks

AnANN must be trained before it is actually applied. Training involves feeding the network with data so that it would be able to learn the knowledge among inputs through its learning rule. There are two types of training algorithms: supervised learning and unsupervised learning. In supervised learning, the algorithms alter weights and/or thresholds, using sets of training cases that include both input and target output values. In unsupervised learning, using sets of input training cases, the weights and/or thresholds are altered i.e., output values are not required, and if present are ignored.

4.1.7 Back-Propagation Networks

Though several network architectures and training algorithms are available, the back-propagation (BP) algorithm is by far the most popular. The network is considered a feed-forward and the learning is supervised. Multilayer Perceptrons Neural Networks trained by BP consist of several layers of neurons, interconnections, and weights that are assigned to those interconnections. Each neuron contains the

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weighted sum of its inputs filtered by a sigmoid transfer function. The error of the output relative to the desired output is propagated backwards through the network in order to adjust the synapse weights.The learning process of BP is actually an error minimization procedure [Rumelhart et al., 1986]. A typical BPN model uses three vectors: input vector, one or more hidden vectors, and an output vector. After the input and output vectors are fed into the BPN model, the network first selects parameters randomly and processes the inputs to generate a predicted output vector. After calculating the error between its predicted outputs and the observed outcomes, the network adjusts the parameters in ways that will reduce the error, generates a new output vector; calculates the errors, adjust its parameters again, and so on. The iteration or learning process continues until the network reaches a certain specified error.

In a general form, the ANN output vector produced by a model or network consisting of r input units, q hidden units, and one output unit can be written as:

$$F(x,w) = F(\beta_0 + \sum_{j=1}^{q} G(xy_j)\beta_j) \quad \textbf{(1)}$$

where $F(x,w)$ is the network's final output, F is the activation function for the final step, G is the activation function for a hidden or intermediate unit, $X = [1, x_1, x_2..., x_r]$ is the input vectorand $w = (w_1, w_2, ..., w_q, \beta_j)$ is the parameter or weights matrix. Each term w_i stands for a $(r \times 1)$ vector of weights relating the r input variables to one of the q intermediate units. β_j , refers to a $(q \times 1)$ vector of weights relating each intermediate output vector to the final output vector. F and G take the nonlinear sigmoid function.

4.1.8 Neural Networks Model for Time Series Forecasting

Artificial Neural Network models form an important class of nonlinear models that has attracted considerable attention in many fields of application. Researchers are trying to use the ANN as a forecasting tool in several time series data. And this paper will focus on the FNN technique.The ANN forecasting model between the output (x_t) layer and the inputs layer $(x_{t-1}, x_{t-2}, ... , x_{t-p})$ has the following mathematical representation:

$$F(x,w) = F(\beta_0 + \sum_{j=1}^{q} G(xy_j)\beta_j) \textbf{(2)}$$

Where $j = 0,1,2,....q$ and $i = 0,1,2,....p$ are the model parameters often called the connection weights; p is the number of input nodes and q is the number of hidden nodes. The logistic function is often used as the hidden layer transfer function, that is,

$$g(x) = \frac{1}{1+e^{-x}} \textbf{(3)}$$

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Hence, the ANN model of (2) in fact performs a nonlinear functional mapping from the past observations $(x_{t-1}, x_{t-2},..... ,x_{t-p},w)$ to the future value x_t,

$$i.e.,x_t = f(x_{t-1}, x_{t-2},..... ,x_{t-p};w) + \varepsilon_t \quad \textbf{(4)}$$

Where w is a vector of all parameters and f is a function determined by the network structure and connection weights. The simple network is surprisingly powerful in that it is able to approximate arbitrary function as the number of hidden nodes q is sufficiently large [Hornik et al., 1990].

4.2 Multiple Linear Regressions

Regression method is one of the most widely used statistical techniques [Mendenhall et al., 1994].If researcher wants to estimate the dependent variable by one or more independent variables, he will use a linear regression model. In statistics, linear regression is an approach to modeling the relationship between scalars variably and one or more independent variables denoted *X*. The case of one independent variable is called simple regression. More than one independent variables is multiple regression.

In linear regression, data are modeled using linear predictor functions, and unknown model parameters are estimated from the data. Such models are called linear models. Linear regression was the first type of regression analysis to be studied rigorously, and to be used extensively in practical applications. This is because models which depend linearly on their unknown parameters are easier to fit than models which are non-linearly related to their parameters and because the statistical properties of the resulting estimators are easier to determine. Linear regression has many practical uses. Most applications of linear regressions are forecasting.

Multiple regression analysis is a multivariate statistical technique used to examine the relationship between a single dependent variable and a set of independent variables. The objective of the multiple regression analysis is to use independent variables whose values are known to predict the single dependent variable. The effect of independent variables on the response is expressed mathematically be the regression or response function *f*:

$$y = f(x_1, x_2,...x_n, \beta_1, \beta_2,....\beta_n) \quad \textbf{(5)}$$

That *y* is dependent variable, $\beta_1, \beta_2,....\beta_n$ are regression parameters (unknown!).

The regression model for the observed response variable is written

$$z = y + \varepsilon = f(x_1, x_2,...x_n, \beta_1, \beta_2,....\beta_n) + \varepsilon \quad \textbf{(6)}$$

That ε is error in observed value.To find unknown regression parameters $\beta_1, \beta_2,....\beta_n$, the method of least squares [Beenstock et al.,1999] can beapplied:

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$$E(\beta_1, \beta_2, ...\beta_n) = \sum_{j=1}^{n} (z_j - y_j)^2 \quad \textbf{(7)}$$

where $E(\beta_1, \beta_2, ...\beta_n)$ is the error function or sum of squares of the deviations. To estimate $\beta_1, \beta_2, ...\beta_n$ we minimize E by solving the system of equations:

$$\frac{\partial E}{\partial \beta_i} = 0; i = 1, 2, ...m \quad \textbf{(8)}$$

In this paper we have six independent variable so we use multiple linear regression.

Inanalysis regression the dependent variable(y)isa function ofindependentvariables anddegree ofinvolvementorrole ofeachindependent variablein theoutput(dependent variable) is expressedby thecoefficientsof variables.

Linear regression can be a method to estimate a set of time series. Dependent variable will be estimated using regression step method. All independent variables will enter to the regression equation [Balan et al.,1995].

4.3 Performance Index

In time series, it is very important to conform an estimation model to data pattern. We can obtain the conformity of estimation method with data pattern by calculating estimation error during the time period.For example, when a technique of estimation estimates the periodical and seasonal alternations in time series, then estimation error will show the disordered or random component in time series.

The accuracy of a model can be estimated by examining the inputs to the model, or by comparing the outputs from the model. Friedman (1953) claims that testing outputs is the only useful approach to evaluating forecasting methods[Friedman, 1953]. Nagel (1963) criticized Friedman's position as unreasonable[Nagel, 1963]. Machlup (1955) goes to the other extremes by implying that the testing of input is the only worthwhile way to test models [Machlup, 1955]. We think it is more reasonable to test both inputs, for improvement of a model and outputs, for selection of the best model. The objective is to minimize prediction error in test set.In statistics, there are many criteria to quantify the difference between values implied by an estimator and the true values of the quantity being estimated.In this paper we useRMSE, MAE and R^2.

a)Mean Squared Error (MSE) or Root Mean Squared Error (RMSE)

Mean squared error (MSE) is a risk function, corresponding to the expected value of the squared error loss or quadratic loss.MSE measures the average of the squares of the "errors". The error is the amount by which the value implied by the estimator differs from the quantity to be estimated. The difference occurs because of randomness or because the estimator doesn't account for information that could produce a more accurate estimate[Makridakis, 1998].

In an analogy to standard deviation, taking the root of MSE yields the root mean square error (RMSE), which has the same units as the quantity being estimated; for an unbiased estimator [Armstrong et al, 1992], [Lehmann, 1998].

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$$MSE = \frac{\sum (y_t - \hat{y}_t)^2}{n} \quad \textbf{(9)}$$

$$RMSE = \sqrt{\frac{\sum (y_t - \hat{y}_t)^2}{n}} \quad \textbf{(10)}$$

b)Mean Absolute Error (MAE)

In statistics, the mean absolute error (MAE) is a quantity used to measure how close forecasts or predictions are to the eventual outcomes. As the name suggests, the MAE is an average of the absolute errors. The mean absolute error is one of a number of ways of comparing forecasts with their eventual outcomes [Hyndman et al, 2005].

$$MAE = \frac{\sum |y_t - \hat{y}_t|}{n} \quad \textbf{(11)}$$

c)Coefficient of Determination (R^2)

In statistics, the coefficient of determination is used in the context of statistical models whose main purpose is the prediction of future outcomes on the basis of other related information. It is the proportion of variability in a data set that is accounted for by the statistical model. It provides a measure of how well future outcomes are likely to be predicted by the model. This is one statistic that measures the accuracy and validity of training and test datasets. It is obtained usingthe followingformula:

$$R^2 = 1 - \frac{\sum_{i=1}^{N} (y_i - \hat{y})^2}{\sum_{i=1}^{N} (y_i - \bar{y})^2} \quad \textbf{(12)}$$

Where $\bar{y}$ is average of measured values. [Steel et al, 1960], [Wostenet al, 2001]

5. Research Methodology

In this study we are going to apply two different methods to predict future values for the same time series of the crude oil export based on agricultural energy consumption, domestic and commercial energy consumption, refinery energy consumption, plants energy consumption, transport energy consumption and industrial energy consumption. Then we will make the comparison between the results of the two methods in order to determine which is better to use in similar situations. Methods used are:

a) Artificial Neural Network forecasting techniques for time series. The goal is to predict future values from the time series. For this we will use MATLAB[1] software to generate the best ANN model to predict and get the best results.

b) Linear regression method for modeling and analysis of time series. To forecast future values in time series, we will use the SPSS[2] software to find the best equation to fit the time series and get the best

[1]

[2]Statistical Package for the Social Sciences

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possible forecasts.
For the validation and comparison, we have taken a quantitative measure of network performance called "performance index". RMSE and MAE and R^2 are used as the criterion of performance index.

5.1 The Data

Data used in this study is several time series which represent crude oil export, agricultural energy consumption,domestic and commercial energy consumption, refinery energy consumption, plants energy consumption, transport energy consumption and industrial energy consumption. The data representing the period from the 1976 until the 2005 M.D. The data are published in Statistical Center of Iran.

5.2 Data Normalization

In statistics and applications of statistics, normalization can have a range of meanings.Entering the raw data in the Neural Network reduces its speed and accuracy. To avoid such a situation and to same data value, before training the ANN, data become normalized.
There are several methods of data normalization. At the very least, data must be scaled into the range used by the input neurons in the Neural Network. This is typically the range of -1 to 1 or zero to 1. We use a methods of normalization to prepare the data as input to a ANN in the range of zero to 1. One of this methods is:

$$x_{normal} = \frac{(x_i - x_{\min})}{(x_{\max} - x_{\min})} \qquad \textbf{(13)}$$

Where x_i is observed data, $x_{max}$is maximum of data and x_{min} is minimum of data. [Gardner et al., 1998]
In this research first we normalize data and then use regression method and design an ANN model to forecasting.

5.3 Finding ARegression Equation

Inthisresearch, we consider independent variables as agricultural energy consumption (x_1),domestic and commercial energy consumption (x_2),refinery energy consumption (x_3),plants energy consumption (x_4),transport energy consumption (x_5) and industrial energy consumption (x_6) that effect to crude oil export (y). Crude oil export is considered as dependent variable. Since there are six independent variables, therefore we must use multiple linear regressions.
We can calculate the linear regression equation, using SPSS software. Linear regression equation is as follows:

$$y = -6.97x_1 - 10.992x_2 + 75.595x_3 - 19.813x_4 + 15.64x_5 + 19.788x_6 - 549.142 \qquad \textbf{(14)}$$

Using this equation, we can forecast crude oil export for next years.
Also we use it to compare performance of linear regression method to other methods as Neural Network.

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5.4 Fitting the Artificial Neural Network Model to the Time Series

In ANN modeling, through some commands and function with input and output variables have been used. These commands forecasts time series with minimum RMSE which is used as stopping criteria in the network. The RMSE is one kind of generalized standard deviation methods.It is used whenever you look for differences between target and the output. Smaller values of RMSE indicate higher accuracy in forecasting.

In designing ANN architectures, there are several factors such as number of layers, number of neurons in each layer and transfer functions, which have considerable effects on the performance of Neural Networks. Data is divided into three separate sets, the training set, which consists of in-sample data, the validation as well as the test sets, consisting of out-of-sample data. The training set is used to estimate the connection strengths, using the back-propagation method. The validation set is used mainly to find the connection strengths, which enable the error to converge to a global minimum, rather than a local minimum. According to Gonzalez (2000) the validation set contains data that are not used during the training, but which serves as indicator of out-of-sample forecasting accuracy of the network. The test set is used to measure the forecasting accuracy of the network. Data used in this set are out-of- sample data that are not used in the validation set. The difference between two NN models or between NN and econometric models is evaluated in the test set. Although we have a small data set, the total data set of 30 is divided accordingly training-24, verification-2 and test-4. This is especially true in light of the fact that the ANN model can be used even we have a relatively small sample.

The scheme used in this research consisted of a MLP, trained with the back-propagation learning algorithm. In this analysis, the network consists of single input, hidden and output layer. Following the recommendation of Kuan and White (1994), we use a single hidden layer, since this seems to be appropriate for most economic applications.We use three neurons in the hidden layer.

Training is performed until the error obtained with the testing is reached a minimum. The weighting factors are obtained using the BP algorithm. In the BP methodology a set of initial weights is first chosen at random, after which the network starts the learning process, modifying the weights to reduce the error. The network output is obtained through information sent from the input layer through the hidden layer, facilitated by the activation function. The difference between the predicted value of output and the actual value, called network error, is computed and propagated backwards through the network, layer by layer. The connection strengths are modified in proportion to the error.

We can perform a linear regression between the network outputs and the corresponding targets.

The figure (4) shows the results.The output tracks the targets very well for training, testing, and validation, and the R-value is over 0.98061 for the total response.

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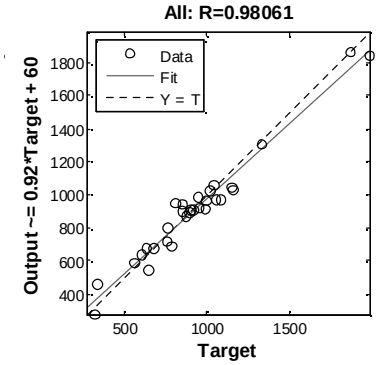

Figure (4): A Comparison between the Network Outputs and the Targets

5.5 Comparison BetweenRegressionAnd ANN Results

We compare real data and data obtained from applying both regression and ANN methods from 1976 until the 2005 M.D.

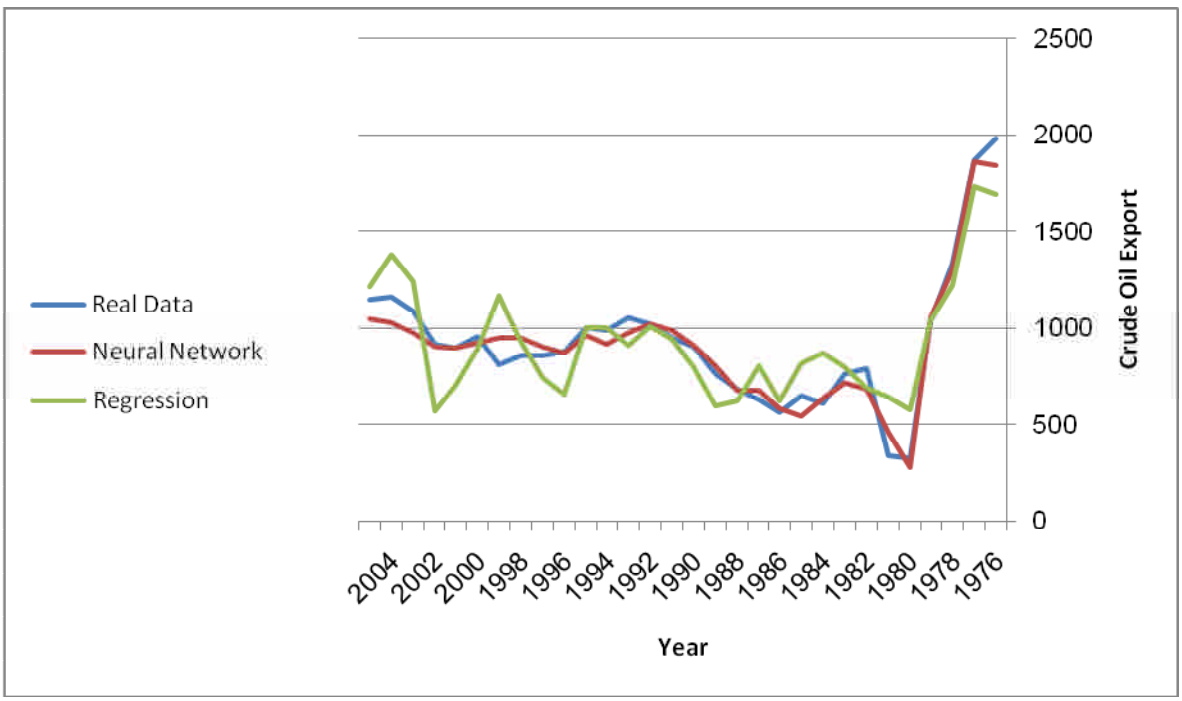

Figure (5): Comparison between Real Data and Data Obtained From Applying both Regression and ANN Methods

Comparison is made between the results obtained from applying both regression and ANN methods through looking at the results intable (1).

Table (1): Comparison between Regression and ANN Results

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method	RMSE	MAE	R^2
Regression	0.006	0.005	0.663
Neural Network	0.002	0.002	0.961

RMSE of ANN model and regression equationcan be easily note from the preceding table the RMSE of regressionequation equivalent to 3 times RMSE of the ANN model. According to the table (1) and performance index, we can conclude that the results of ANN model are much better than the regression equation results and more efficient. We can conclude from the above dissuasion that the results of ANN model are much better than the regression equation results and more efficient.Then we forecast crude oil exports from 2006 until the 2012M.D. by using regression equation and Neural Network model. The results are shown in the table (2)

Table (2): Crude Oil Forecasting From 2006 to 2012 M.D.

Year	2006	2007	2008	2009	2010	2011	2012
Regression	1449.9	1171.3	989.5	855.9	1524.4	1666.9	1499.6
Neural Network	1106.4	1251.5	1194.1	1216.2	1383.8	1457.7	1447.1

We illustrate the result of forecasting in figure (6).

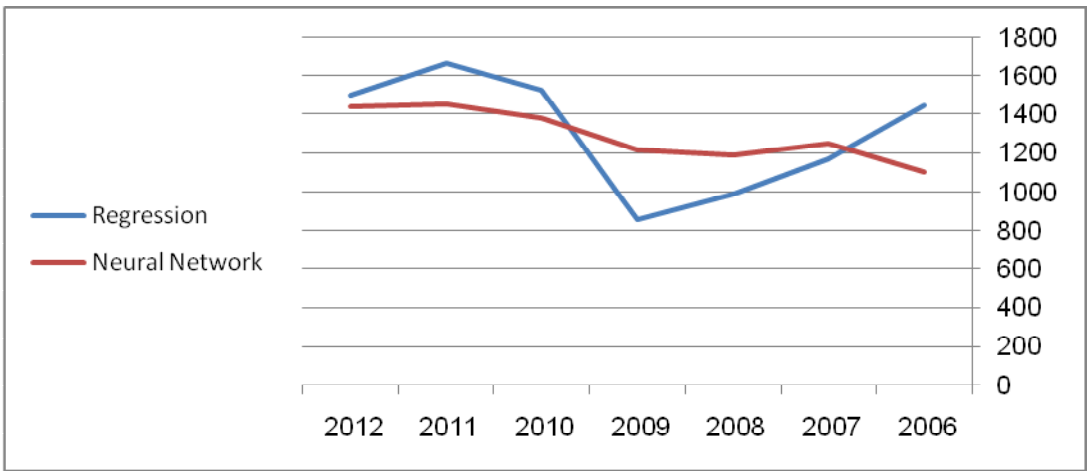

Figure (6): Crude Oil Forecasting From 2006 to 2012

6. Conclusions

The forecasting of crude oil export is a complex process, for several reasons. The most important reason is the existence of different factors, such as agricultural energy consumption, domestic and commercial energy consumption, refinery energy consumption, plants energy consumption, transport energy

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consumption and industrial energy consumption.In this study we conduct a comparison of forecast accuracy between the linear regression model and the Artificial Neural Networks model.From all the discussion of this study the following conclusions can be drawn:
The ANN model used back-propagation algorithm with three neuron in the hidden layer, is the best fit for crude oil export forecasting.

Recommendations

In general, it can be said that the introduction of local approximation techniques in crude oil exports forecasting. ANN provides an alternative methodology to forecasting financial and economic data which has a limited efficiency in this field. So we recommended the following:
We recommend taking advantage of the high-capacity of artificial neural networks as a forecasting technique in other fields, such as medical research, genetics research, industrial research, energy, and military research.
We recommend that Statisticians should adopt ANN approach as a method of Statistical prediction and forecasting as well as conducting further research on Neural Networks to investigate their suitability for use in other statistical applications.

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Simulation of customer behavior using artificial neural network techniques

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Abstract

In recent years, service industries and companies have faced big customer data which its analysis takes a lot of time. Hence, there is an urgent need for systems able to extract useful information from a mass of information. One technique to do this is data mining. Today, data mining and neural network techniques can be used to analyze customer behavior and find hidden information in that behavior. Prediction of behavior of loyal and new customers of a service company has a significant impact on that company's marketing techniques and the profit earned by that. In this paper we discuss a data mining technique for identification of customers' favorite products based on their purchase and analyze the results. Finally the aim of this research paper is to predict customer behavior using artificial neural networks and data mining techniques.

Keywords: Data mining, customer behavior prediction, demand forecasting, customer relationship management

1. Introduction

Nowadays, large companies and enterprises in many parts of the world are doing their own operations and many data can be produced from different parts. Therefore, decision makers of companies need access to these resources to make strategic decisions [4]. Data mining is a suitable tool which can be used to extract the best patterns and information from raw data. With an Increase of the contention in the world and in order to survive, companies must predict the market status in the future. This makes them make big

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decisions in their working environment which is quite helpful for their advancement [5].
One of the practical ideas of data mining is the area of marketing. Researchers have devised specific techniques and appropriate patterns to understand which goods to which extents are more useful and which advertisements have a key role in selling out more. So, in order to make a clearer decision and providing more services, the current data can be changed to practical information. The results of research shows that behavior of past customers has a high impact on finding behavioral patterns to make a new strategy. [7-10] have provided such patterns in which using data mining techniques, the hidden information of the database have been extracted and by predicting valuable customers and their future behaviors, a plan has been devised to provide goods and services in the time of demands which enhances the income of the company and lessens the stock [6].
In another work, researchers have devised a pattern to predict waiting time of the manufacturing process based on customer orders [3]. Kusiak and Smith utilized data mining techniques to design products and production systems and recognized some parameters such as better utilization from unstructured information, integration of data mining techniques with current functionality and feasibility of data mining models for users as ahead challenges of data mining [4].
In a research the results of which is provided in the following, we have tried to predict the behavior of customers using organizational database and neural networks in data mining and based on that, the appropriate basket of goods is recommended to customers.

2. Data mining

Data mining is the process of searching and data analysis in order to find potentially useful information [11]. This procedure contains selection, detection and modeling a large part of data which is used for detection of unknown patterns and extraction of intelligible data from large databases. Data mining comprises a variety of methods and techniques containing statistical analysis, decision tree, neural networks and the like. Although the used tools for data mining have a long time history and are available to the professionals and researchers of this field for a long time, their advance in computer software and hardware especially mining tools such as data visualization and neural networks renders data mining more pleasant and applicable [8]. Data mining has applications in time and cost saving, making feasible understanding the knowledge for which no previous analysis is possible, proposing a new solution and answering some questions which were not previously interpreted and optimal usage of data [6].
In papers of this research area there are different categories in the context of data mining and in one of the most important papers the data mining techniques have been divided into eleven steps [1] which is shown below:

1. Transforming business problem to a data mining problem.

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2. Selection of appropriate data.
3. Data recognition
4. Generation of model set
5. Data troubleshooting
6. Data transformation for information extraction
7. Model generation
8. Model evaluation
9. Model implementation
10. Evaluation of results
11. Restart (Figure 1)

3. Data mining applications in analysis of customer demands

Attention to customer demands has become a very critical issue for managers these days. It is so important that the life cycle of a company depends totally on customers and recognition of their interests and tastes. On the other hand, in traditional styles, due to low number of customers and possibility of face to face connection with them, the salesperson gains much information about interests, preferences and in case of continuity of purchase habits of customers, the volume of loyalty of customers. In the new method, considering wide spread of technology penetration in the societies and the growing the number of customers, the possibility of discovery and generation of knowledge (containing properties, demands and customer behavior) is rare. In this way, the only wealth of the company to access knowledge of its customers can be gained by the archived digital data of the company database based on customers' purchase. So, in order to discover customer's data, the importance of using knowledge discovery and data mining is critical in companies. This issue has two important advantages: firstly, the discovered knowledge is generated away from personal judgment of and is based on objective data. Secondly, the discovered knowledge base on data mining, unlike the previous method, is not tied up in minds of an expert and can be shared to other persons as well.

4. Problem statement

In our proposed method, database of a dairy products company is utilized. In this company in addition to different types of yoghurt, probiotic yoghourt is produced as well. The word probiotic comes from a Greek word which means "for life". Probiotic is usually a mixture of some microorganisms that when used by a person or an animal, can improve digestion microfloure features of the host organism. Probiotics can help stimulating growth of advantageous bacteria of intestine and subsiding pathogenicity of harmful microbes and their operation mechanism relies on their survival in digestion system.
The problem considered in this paper is appropriate forecasting of customer purchase of all kinds of probiotic yoghourt. Marketing and production managers can, in case of having trustable knowledge in this area, program the production volume of

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the abovementioned products. To help solve this problem, in the current research we tried to concentrate on this issue by using artificial neural networks as well as generation of rules from data mining algorithm.

In order to forecast purchase volume of probiotic yoghourts, using MATLAB software, we generated artificial neural networks. MATLAB is based on the mathematical concept of a matrix and is a powerful calculation system which is helpful in carrying out scientific calculations and engineering problems. This system is designed to do simple matrix calculations. One of the main points in MATLAB is that it can be utilized in an interactive form which means that when given an order it can produce the answer very quickly [2].

In this artificial neural network the Train LM algorithm is used. This method, just similar to other Newton like methods, tries to reduce the computation burden. It is the fastest implemented method in MATLAB and possesses a very high efficiency. The generated network is called back-propagation network [2].

In the studied company three probiotic yoghourts are produced: Bucket 2.2 low fat probiotic yoghourt, 800 gr. Low fat probiotic yoghourt and bucket 2.2 high fat probiotic yoghourt. In the following, the methodology and results of our research are presented and analyzed.

5. Research methodology

In this research, a part of database has been used as input data for training our neural network and two records (containing data of two customers) have been used as test data. The results of training and test of the neural network for different products is presented in the following. It is noteworthy that the purchased number of all product kinds is a number in range 1-5. One and five show the least and highest number of purchases, respectively. Customers of intended company buy their required products in bulk. The number of purchased products between 0 and 100 lies in range 1, between 100 and 200 in range 2, between 200 and 300 in range 3, between 300 and 400 in range 4 and between 400 and 500 lies in range 5. (1: very low, 2: low, 3: average, 4: high, 5: very high).

The following signs and abbreviations are used: MSE is mean squared error, Elapsed time is the training time and Performance denotes the performance of the network.

6. Research results

6.1.The output of neural network using MATLAB

The output of the neural network for 2.2 low fat bucket probiotic yoghourt is shown in table 1

MSE = 0.2735

Elapsed time = 0.545856 seconds

Performance = Goal met

For this product, the neural network has predicted appropriate results. These results are near actual values and also, mean squared error is negligible. Also, the network performance has been favorable and the goal is reached. The gained numbers

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demonstrate achievement to the desired outcome.

The output of artificial neural network for low fat 800 gr. Probiotic yoghourt is shown in table 2.

MSE = 1.3160

Elapsed time = 0.950611 seconds

Performance = Maximum gradient reached

For 800 gr. Low fat probiotic yoghourt the results are almost desirable. The output of the network is not that satisfactory for the first customer. But for the second customer, outputs are in the actual range. The mean squared error is rather low. The gained numbers demonstrate relative achievement to the results. The output of artificial neural network for bucket 2.2 high fat probiotic yoghourt is shown in table 3.

MSE = 0.3082

Elapsed time = 1.736262 seconds

Performance = Goal met

The predicted values of artificial neural network are also satisfactory for this product such that the calculated numbers are near the actual ones and also, the mean squared error is low. The performance of network for this product is very great and goal is reached. The calculated numbers show that we have reached appropriate results.

Accordingly, using designed neural network we can predict the value of the company demands to produce this type of yoghourt and also, we can find out the daily, weekly and monthly usage of our customers from this type of yoghourt. Furthermore, we can make sure if purchasing this product is advantageous or not and how to arrange the production plan of the company to make the maximum profit. In what follows, using Clementine, which is a statistical and data mining software, and GRI algorithm we aim to generate rules and then, we analyze the results.

6.2. Rule generation using GRI algorithm

The GRI algorithm discovers association rules in data. For instance, the customers who buy razors and after-shave lotion, also proceed to purchase a shaving cream. GRI generates rules with the highest information based on support and confidence measures and is able to accept numerical and classified data but the object needs to be categorized. The working environment in Clementine is shown in Figure 2.

A part of the calculated results are shown in Table 4.

The generated rules based on GRI algorithm which are shown in table 4 imply the following relations for the customer behavior in buying different products.

1- If the customer purchases 800gr. 6% fat super yoghourt and 250 gr. traditional shallots yoghourt in very low volumes and

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fresh 450 gr. 1.5% fat yoghourt in low volumes, then with a high probability he will buy low fat 800 gr. probiotic yoghourt in very high volumes.

2- If the customer purchases 750 gr. succinct mix yoghourt and super 800gr. 6% fat yoghourt in very low volumes, and 450 gr. fresh yoghourt in low volumes, then, with a high probability, he will buy low fat 800 gr. probiotic yoghurt in very high volumes.

3- If the customer purchases 750 gr. succinct vegetables yoghourt and super 800gr. 6% fat yoghourt in very low volumes, and 450 gr. fresh yoghourt in low volumes, then, with a high probability, he will buy low fat 800 gr. probiotic yoghurt in very high volumes.

4- If the customer purchases 800 gr. 6% fat super yoghourt in low volumes and 250 gr. traditional shallots yoghourt in very high volumes, then, with a high probability, he will buy bucket 2.2 high fat probiotic yoghurt in low volumes.

5- If the customer purchases 750 gr. succinct mix yoghourt in very low volumes and 250 gr. traditional shallots yoghourt in very high volumes, then, with a high probability, he will buy bucket 2.2 high fat probiotic yoghurt in low volumes.

6- If the customer purchases 250 gr. traditional shallots yoghourt in very high volumes, then, with a high probability, he will buy bucket 2.2 low fat probiotic yoghurt in low volumes.

7- If the customer purchases 800 gr. 6% fat super yoghourt in low volumes and 450 gr. 1.5% fresh yoghourt in very low volumes, then, with a high probability, he will buy bucket 2.2 low fat probiotic yoghurt in low volumes.

So, many different rules can be produced and based on these rules, which are hidden rules in the database, the company is able to make plans and decide about its product to attract more customers, produce higher quality products and make more profit.

7. Concluding remarks

Possessing a variety of tools and techniques and also using knowledge of other knowledge fields and their usage in means of tools and novel patterns, data mining has become a new and appropriate method for analysis of a bulk of current and historical data in large scale databases. Using data mining we can generate organizational knowledge which can be an important issue for managers in making organizational decisions and providing competitive advantages. One of the smart techniques which are growing fast, is neural networks. The results of this paper demonstrates that using artificial neural networks and the available data of the customers database based on data mining patterns, we can predict the purchase volume of customers with a high efficiency. Also, based on extraction of hidden patterns we can predict the relationships between purchasing different goods by a customer with a high confidence. Provisioning of enough confidence in this area can help managers and decision makers in planning the production rate based on information extraction.

In this paper, an initial effort has been made for an industry with low data volumes to use neural networks as a technique of data mining. Future research can be conducted based on higher volumes of data, mixing internal and external data of the organization, doing research for products of other industries and using other techniques of neural networks.

8. Acknowledgements

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10. Figures

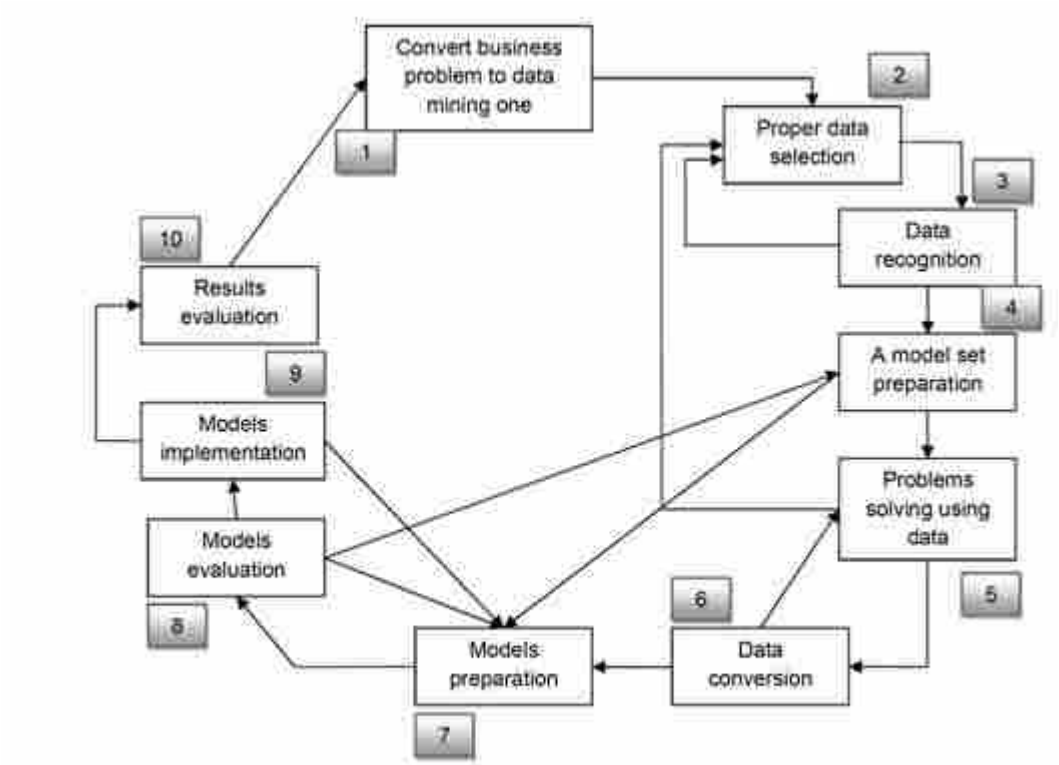

Figure1. Data mining techniques scheme

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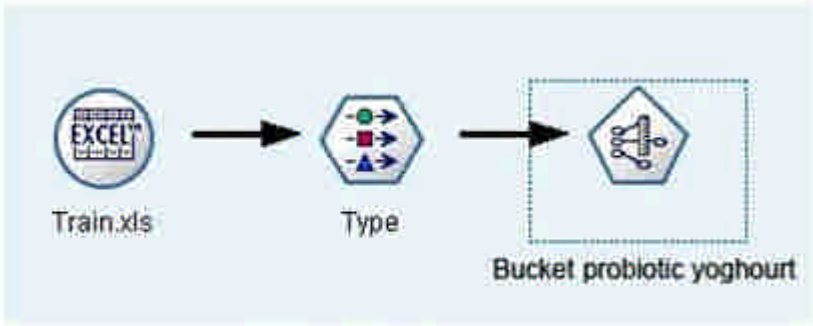

Figure2. Using Clementine software

11. Tables

Table1. 2.2 low fat bucket probiotic yoghourt

Customer number	Actual value	The ANN calculated value
1001	2	1.5803
2006	3	2.6358

Table 2. low fat 800 gr. Probiotic yoghourt

Customer number	Actual value	The ANN calculated value
1001	5	2.4167
2006	5	5.0009

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Table 3. **Bucket 2.2 high fat probiotic yoghourt**

Customer Number	Actual value	The ANN calculated value
1001	3	2.8178
2006	2	1.1847

Table 4. The generated rules of GRI

Consequent	Antecedent	Support %	Confidence %
800 gr. Low fat probiotic yoghourt=5	800gr. 6% fat super yoghourt=1 and 250 gr. traditional shallots yoghourt =1 and fresh 450 gr. 1.5% fat yoghourt=2	8.33	100.0
800 gr. Low fat probiotic yoghourt=5	750 gr. succinct mix yoghourt=1 and super 800gr. 6% fat yoghourt=1 and 450 gr. fresh yoghourt=2	8.33	100.0
800 gr. Low fat probiotic yoghourt=5	750 gr. succinct vegetables yoghourt=1 and super 800gr. 6% fat yoghourt=1, and 450 gr. fresh yoghourt=2	8.33	100.0
Bucket 2.2 high fat probiotic yoghourt=2	800 gr. 6% fat super yoghourt=2 and 250 gr. traditional shallots yoghourt=5	4.17	100.0
Bucket 2.2 high fat probiotic yoghourt=2	750 gr. succinct mix yoghourt=1 and 250 gr. traditional shallots yoghourt=5	4.17	100.0
Bucket 2.2 low fat probiotic yoghourt=2	250 gr. traditional shallots yoghourt=5	4.17	100.0
Bucket 2.2 low fat probiotic yoghourt=2	800 gr. 6% fat super yoghourt=2 and 450 gr. 1.5% fresh yoghourt=1	4.17	100.0

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Combining dynamic system and balanced score card (BSC) in performance evaluation (case study: Mahan plane company)

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Abstract
Balanced score card as a comprehensive set of performance evaluation provides a structure for evaluation of organization strategies and management system. But it can not identity the delay between the operations and their effects on the performance and without considering BSC, inefficient strategies evaluate them. The methodology presented by this paper clarifies the close relationship between BSC and dynamic modeling of systems. BSC-based simulation is used as an efficient tool for evaluating various strategies of the organization and compensating its weakness. If the modeling is done carefully and the validity of the model is proved, this model can be used to determine the goals indices in a definite time and as a tool to investigate and diagnosis the inefficient strategies. This paper deals with the explanation of combining BSC combination and dynamic system to increase the efficiency of BSC and overcoming its weaknesses in Mahan Airplane Company.

Keywords: Dynamic system; Balanced score card; simulation; performance evaluation

1. Introduction

Kaplan and Norton introduced BSC tools in the organization [9]. Their assumption to evaluate the performance of the organization was such that the evaluation of the performance of the organization should not be restricted to the traditional financial criteria and it should be completed by other criteria including customer satisfaction, interior processes and learning and development. The results of evaluating the supplementary dimensions should ensure to achieve financial results. BSC provides rapid measurement tools besides a comprehensive tool for top managers and by applying new techniques add their competition advantage and increase its stability and permanence. BSC provides a structure to evaluate organizational strategies and management system and dynamic system is a tool to investigate and analyze the behavior of a system over time considering cause and effect relationship and based on the existing dynamics. The lack of required coordination and flexibility in technology era and strong competition markets make the organization problematic and according to the results for analysis of the conditions is done to increase the required information of the policy makers have important effect on presenting knowledge and selecting good ways to achieve the goals. Also, permanent improvement of the organization is dependent upon the ability of the organization in evaluating and measuring the

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performance of key organizational processes [1]. The organizations identity the importance of stable evaluation and applied various systems over the time. But due to the globalization of business, review and supervision on organization processes, their supply chain performance and strategic goals of the organization are important. On the other hand, the studies showed that only 5% of labor forces of the organization are informed about the strategies of the organization, 25% of the managers have motivation to communicate with the organization strategies and 85% of execution teams take less than one hours to discuss about the strategies of the organization. There is a 50% relationship between the budget and strategy of the organization [1]. It is required to have an efficient model that by concentrating on strategic management guide all the elements of the organization for the view of the organization and investigates the performance of the organization in the present and future time. BSC model based on dynamic system model can simulate the future behaviors of the organization with various issues of various strategic goals and present better strategies for performance. In another view, for the life of the organization, a chart like product life is considered, because an organization can consist of introduction, growth, maturity and decay as BSC is considered as organization improvement tool, it can be said that consideration of this model to elimination of the final stage of the life chart is the decay of the organization and it causes the stability and success of the organization. Performance evaluation framework is divided into process and structure group and the frameworks can form evaluation systems. BSC provides a framework to explain and transfer strategy continually. Cause and effect relations in the strategy map show how the unobserved assets are changed into tangible financial results. BSC performance requires the active participation of one by one of the staffs and their understanding of organization strategy. The organization strategies are classified into three groups:

1- Operational strategy of reducing the costs, 2- Production and product strategy, 3- The strategy based on the customer's satisfaction as each of them guides the organization to a specific BSC.

Cause and effect relationship is shown in four aspects of BSC in Table 1. By BSC, we can create continual improvement. This is not a top-down statement and it is a top-down communication (classification of the customers- varied costs and marketing via data bank) Table 1.

More emphasis should be on strategy and by balanced evaluation method as navigation tool, all the resources and activities of the organization are in line with its strategy and the management should be on estimation of the strategies of the organization. We can say that BSC is not a static concept and it is a dynamic tool to achieve the benefits in the expected activity of the organization. The basis of Kaplan and Norton theory was learning and organization growth indices that are the result of interior processes of business. Business process indices are the result of customer index while these indices are resulting from financial indices. Thus, a good balanced card with strategic zones should be a mix of delay and advance indices that is the result of mutual cause and effect chain. This procedures show that the strategies are changed into a set of assumptions about cause and effect information. A study was carried out in 1992 and the related results were published in fortune magazine showing that only 10% of the strategies that were well formulated are done successfully and about 90% of the strategies are failed when performed [2] and it allows that non-financial zones evaluation is used to predict future financial performance of the company. Financial evaluation has some information about the financial performance of the company in

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the past. While non-financial evaluation of the company make informed about the future financial performance. BSC means a way to put all the required critical variables for the movement of an organization and balanced shows balance among performance sizes between pre-drop and post-drop sizes and interior and exterior non-financial aspects. The difficult aspect in BSC is the relationship between the approved indices in 4 perspectives in cause chain with each other, Kaplan and Norton emphasized that non-financial strategic goals shouldn't include an illogical set of indices and instead, it should cover a balanced display of financial and non-financial indices and a good BSC should Include all the result and performance indices of cause and effect communications.

BSC time return as the core part of the management system in planning cycle, performance, control and modification was used in all the organization. This model can be used in identification of the problems of their operational problems in the organization and plays an important role in organizational learning and improving the knowledge of the organization.

BSC constituent elements: Strategic map of indices- the evaluations and cause and effect relations. The strategic goals of this organization separated by the goals among four mentioned goals and different kinds of indices are introduced. The strategies and their direction in the organization are shown in Table 2 [3]. BSC model by a comprehensive view to the organization strategies attempts to balance these strategies. Table 2.

Strategy –based organization is binding each staff to the business strategy and total strategy means that any person should understand the strategy of the organization and be motivated to help the organization in achieving its strategic goals [3]. How Bermil changed into a strategy-based organization [3] shows that how Bermil Company by BSC tools made the company and its organization a strategy based organization. Prastacos, Ioannou, Papalexandris used balanced score card in 7phases in a software Company in Greece to create an adaptable system for evaluation and total measurement of the development of the staffs [4].

Fernande, Rajo, whalley performed this model in Biddle air systems in 9 phases [1]. Michalska investigated balanced score card in steel industry and used the measurement of total efficiency of business [6]. By simulating BSC-based dynamic system, we can remove the problems of BSC model as the lack of validity, the lack of recognition of the delay between the operations and their effects on the performance, the inefficiency of strategic plan and the required value for each of the strategic goals. Because dynamic simulation is a good background to evaluate performance criteria and good decision rules with these criteria. The managers of the organization are able to test various scenarios of what-if. BSC-based organization dynamic modeling is done carefully and its validity is proved. This approach can guarantee the development of the organization in all the aspects. This modeling controls business operation and required feedbacks and the decision maker can have true judgments to the organization processes and inputs and a basis for advance view management is true. Nielsen performed some variables such as personnel skills, customer and work in process, and designed system dynamics model for a company for balanced score card [7]. Linard and Yoon by systems dynamics approaches investigated the feedback of performance indices in BSC model and found that comprehensive strategic planning is a pre-requirement for the performance of BSC model and BSC is not a magical solution for bad strategies and on the other hand without the support of top managers of the organization, any change in the organization is not done

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[8].
Young and Kuotu investigated some of dynamic principles to develop BSC model and designed a dynamic model for a hospital [9]. Akkermas and Oorschot developed BSC model by dynamics of the systems and used it in an insurance company [10].

2. System dynamics modeling (dynamic systems)

Dynamic systems are the one their behavior is dependent upon time. The result of modeling dynamic systems is describing the system and its understanding. This is done by quality and quantity models. We can select the policies that are applied on the system via simulation. Dynamic systems are concentrated on the cause relationship study between various elements and the study of total system behavior over the time [12]. Although this methodology is rooted in control engineering, it is used in systems analysis [12]. Dynamic systems can be used as management analysis tool and evaluation management systems and performance measurement are not exception. The structure of a system in dynamic methodology is presented by cause and effect diagram. A cause and effect diagram includes feedback mechanisms. These mechanisms are grouped into negative (balanced) and positive rings (improving). A negative feedback ring shows a goal-based behavior such that the system after initial disturbance follows balanced location. In a positive feedback ring, an initial disturbance leads into many changes and result into the occurrence of an unstable balance. Because ring diagram plays two important roles in system dynamics, at first, use them in the development of the model as an initial plan of cause assumptions. Second, they simplify the presentation of the model; the structure of a dynamic system model is including the existing variables and rate flow. State variables have accumulation in system framework while rate variables show the flows. The structure of the model and the relationship between the variables are shown by state-rate diagram. Math maps are created of state-rate diagram of system dynamics by differentiation equations system and its numerical solution is done by simulation. Today in high level graphical simulation plans such as Ithink, Stella, Vensim, Powersim, the analysis of these systems are supported.

3. Methodology

Here the stages of two methods of BSC-based simulation and dynamic simulation are explained.
First: BSC-based simulation is including two main stages of using BSC and dynamic simulation and using BSC model and dynamic simulation phases are used in case study of Mahan company. BSC model are including 5 consecutive phases:1- Preparation and selecting project team, 2- The explanation of the vision of company and determining the strategies, 3- Determining the priorities of the strategic goals, 4- The selection of the indices and determining measurement frequencies,5- formulating performance plan.
Second: Dynamic simulation phases: IN this phase by a system thought, it is attempted that by relying on BSC aspects, a model is used for the organization showing the realities of the organization and strategic goals, the strategic map of the indices of BSC approach are used as a basis for modeling dynamic system of the organization. Simulation phases are considered as: 1- Dynamic hypothesis: The problem statement is done by dynamic hypothesis such that based on internal structure of the system and evident, an explanation of the behavior of the phenomenon is written and based on dynamic assumption, the system,

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elements and cause and effect relations are determined.
Determining the system, interior and exterior elements of the system and system boundary
Determining state, auxiliary and rate variables
Determining the dynamic relations and equations between the elements
Performing the model by the related software
Investigating the various scenarios and the results analysis
Now to explain the stages of work, Mahan Plane Company is investigated.

Method: The documents of Mahan Company- human resources-sale, etc requires based on the indices of Mahan Company due to the problems and competitive situation of the organization in the market and it needs efficient strategy performance to select better strategies by various strategies. Thus, after using BSC, by the performance approach in sale unit, strategic goals and their achieving indices are determined and the strategic goals and indices in Table 3 and strategic map are presented. Table 3.

In strategic map, BSC is plotted by considered 6 aspects. Financial aspect is including two main indices of income and costs and income is including the income of selling ticket and load sale and the costs are including the sale costs such as the fixed costs of ticket, etc. organizational processes aspect is including optimization of the existing processes, optimization of time, costs and quality. Customer aspect is including two main indices as satisfaction and dissatisfaction. The staff's aspect is including the satisfaction of the staffs of wage, identity in the organization, the relationship between work and reward, etc. organizational development aspect is including the use of new and advanced technology in the organization and the environment aspect is including the investigation of external environment and interior environment.

Based on dynamic assumption and interior and exterior elements of the mentioned systems, we can determine the state and rate variables in each aspect.

4. Conclusion

In this paper, we attempted to introduce a systematic approach to evaluate the performance by BSC and at first we used BSC and determined the index for each measurement. We reached the combining approach of BSC with dynamic system as good approach and we observed that this approach can removed the problems of BSC approach and increase the productivity in using BSC in the organization. The results of software performance and report system of the model and its performance show that BSC model by a comprehensive view to the organization strategies can balance them and BSC is including various weaknesses and in this paper, it is attempted that by combining these two methods in Mahan company in sale part in a definite time interval, the costs are reduced and by the participation of the staffs and sale managers and the profit increased considerably. This method can be used in various parts of Mahan and performance aspect is evaluated.

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6. Tables

Table 1: Cause and effect relationship in four aspects of BSC

Learning aspect → Interior processes aspect → customer aspect Financial aspect			
Creating a good environment for creativity and innovation	Improving the operation to improve the product and services	Giving value to the customer via giving the goods with good price	Improving financial results via increase the income and more profit

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Table 2: The classification of the organization strategies and their direction

Different kinds of strategies	Directing type
Operational and costs reduction	Internal concentration, close systems
Product leadership and production	Open system with bound
Customer satisfaction	External concentration and emphasis on the knowledge of communication with the customer

Table 3: Strategic goals and the related indices

No	Index	Strategic goals	Aspect
1	Increasing the income of annual sale Decreasing the annual sale costs Personnel costs reduction	Increasing profitability	Financial
2	Increasing the services to the customers Decreasing the cancellation of the flights Reduction of the delays The reduction of the customers complaints	Increasing the satisfaction of the customers	Customer
3	Improving the use of new technology Reducing the costs of interior processes Reducing the time of doing interior processes	Increasing productivity	Interior processes
4	Increasing the maintenance rate of key staffs Increasing the relationship between the wage and performance	Increasing the satisfaction of the staffs	Learning and development

7. Figures

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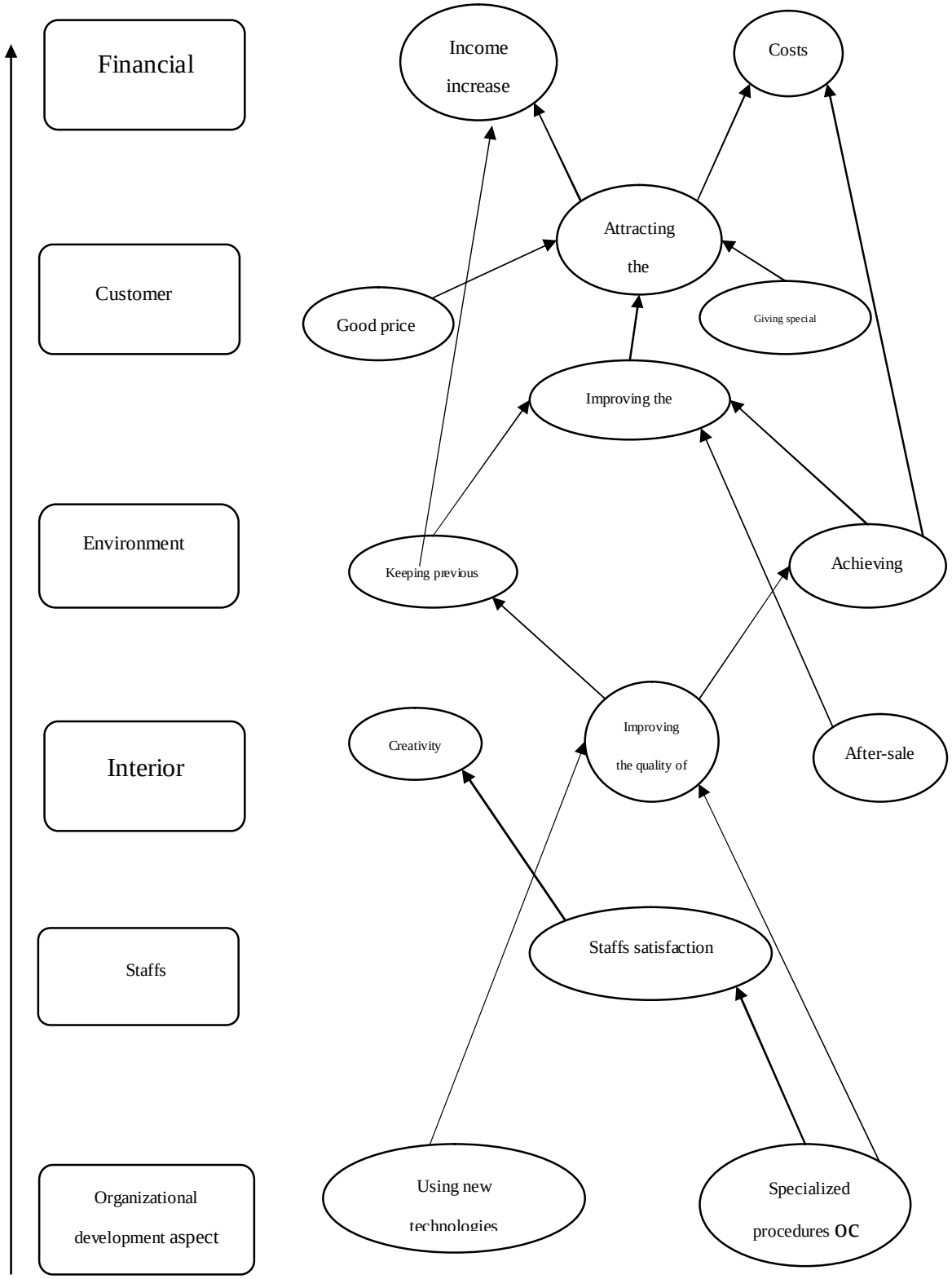

Figure 1: Strategic map of sale unit of Mahan Plane Company

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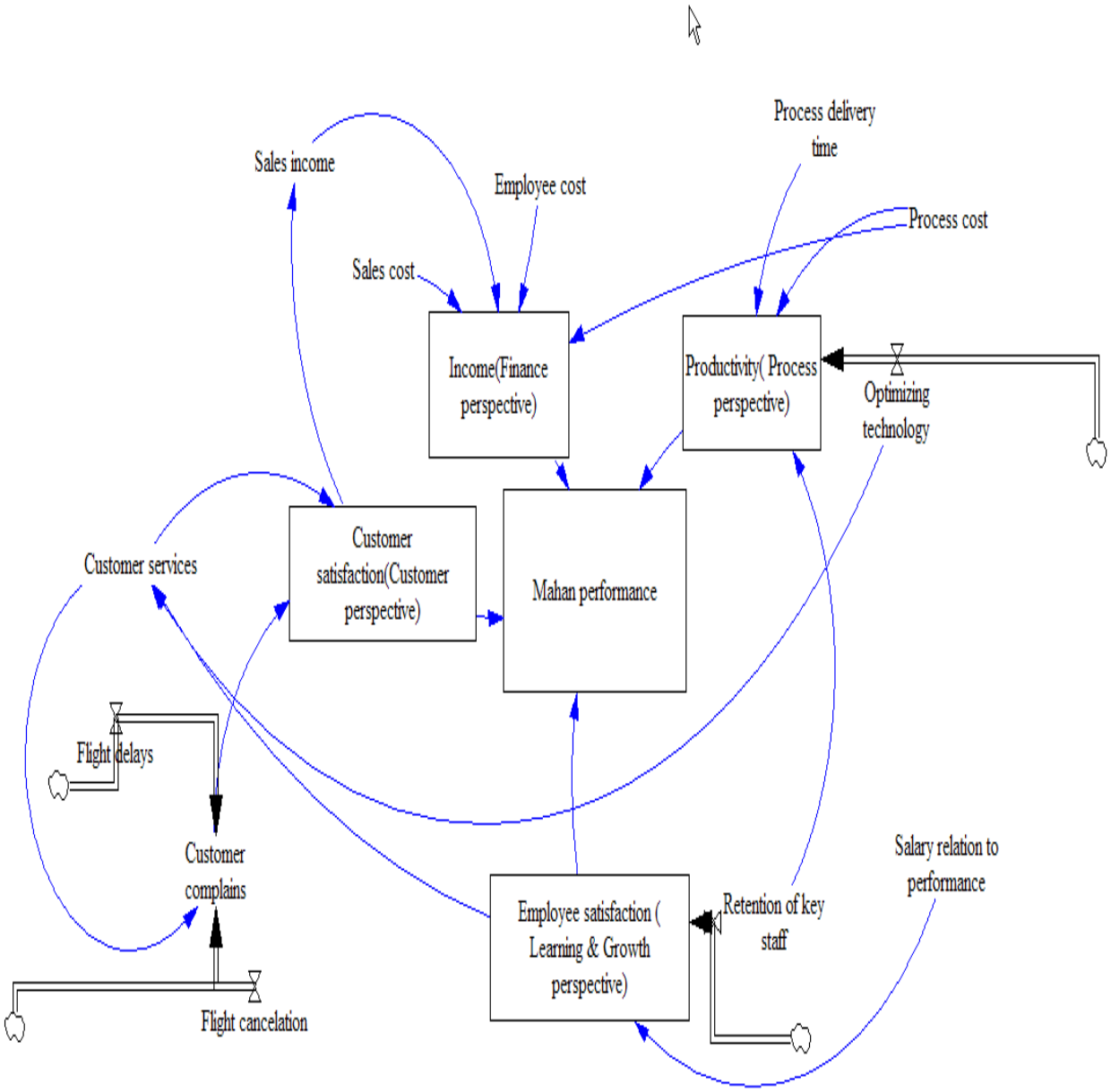

Figure 2: Dynamic model (dynamic system) of investigating the organization indices

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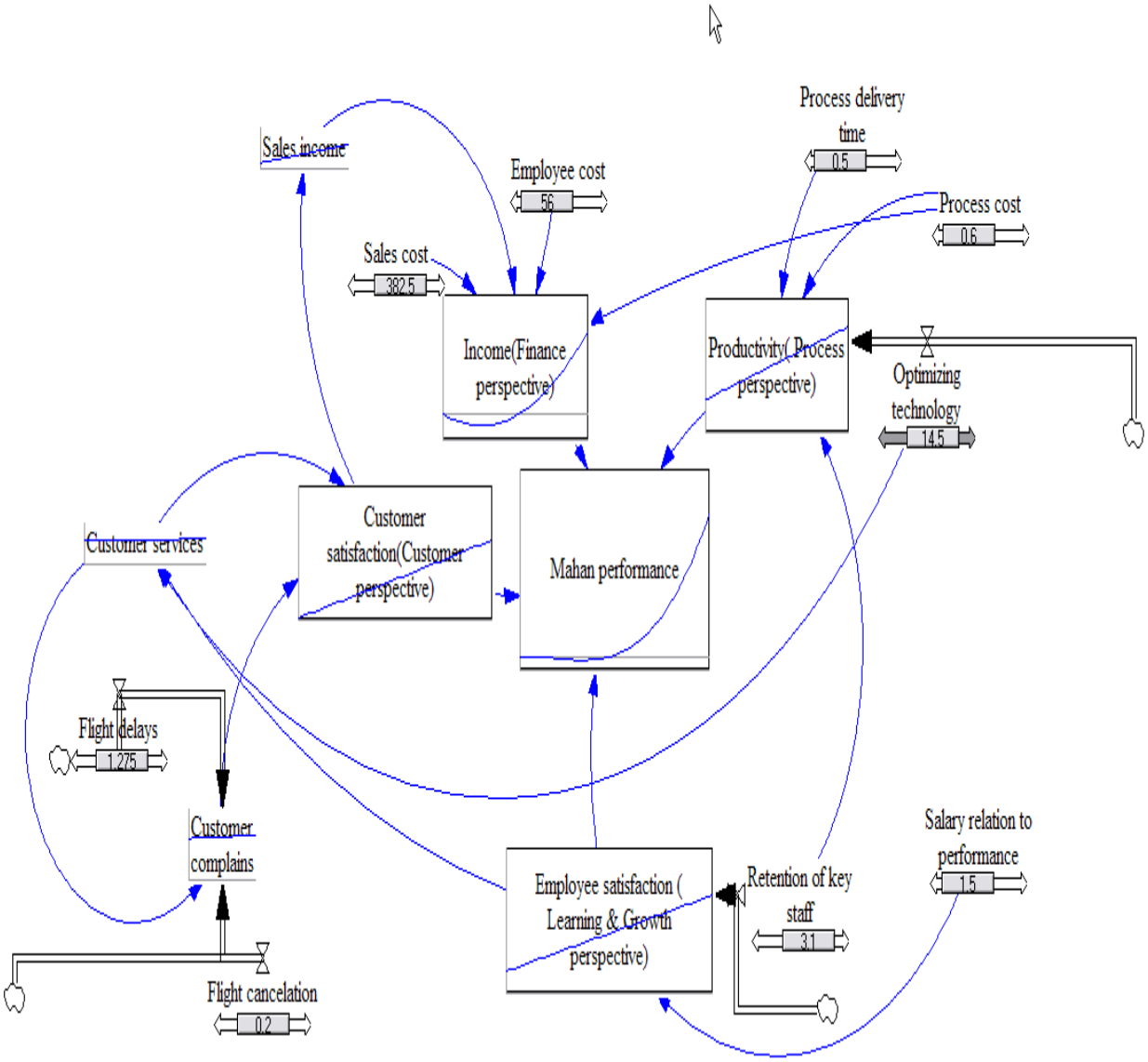

Figure 3: Simulated dynamic model in 12-month time

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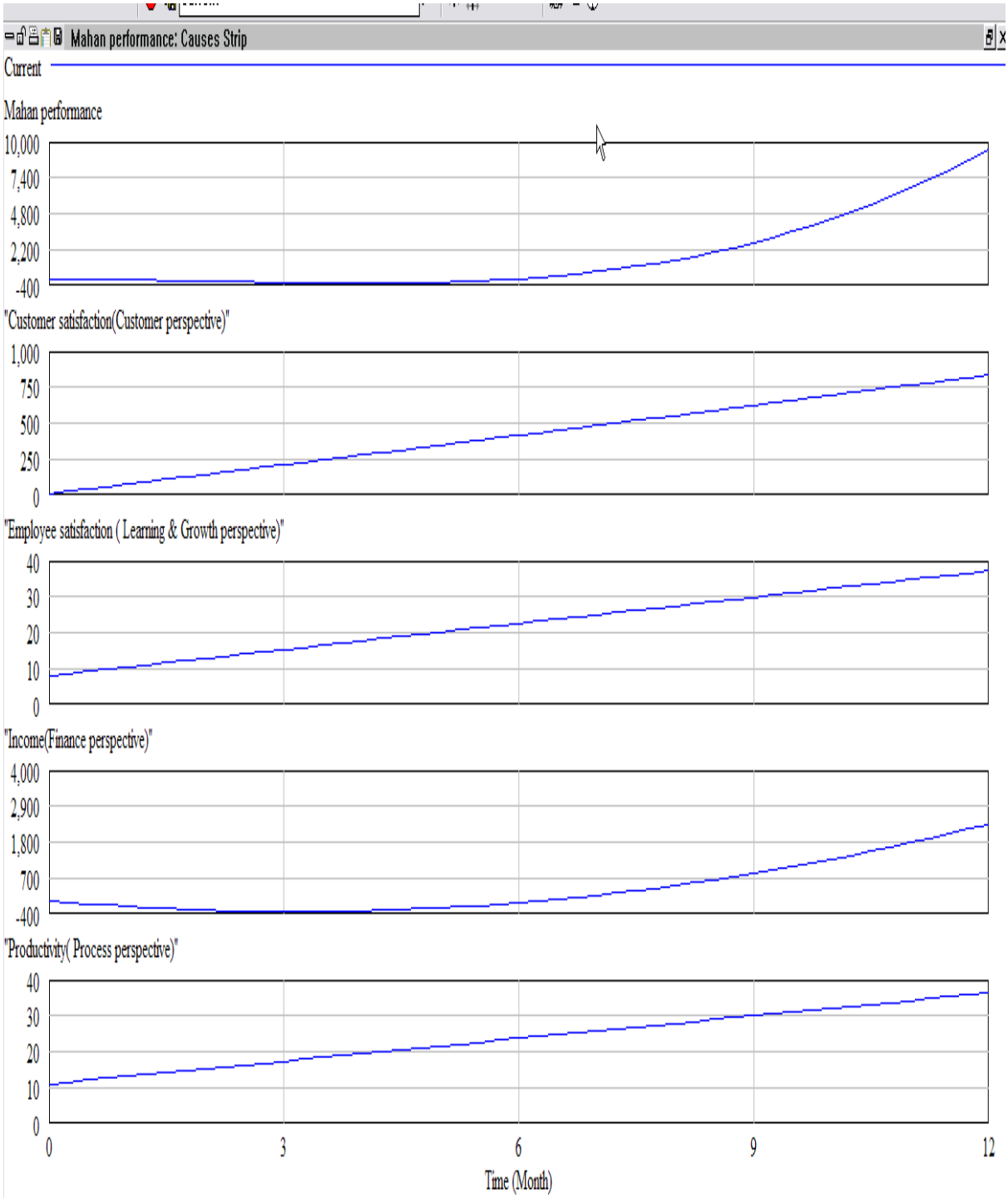

Figure 4: Simulated behavior of the organization performance and each 4 aspects of balanced score card during 12 months

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Table Time Down

Time (Month	"Mahan performance" Runs: Current	Mahan performance
0		5
0.25		16
0.5		35.4881
0.75		64.3473
1		103.462
1.25		153.716
1.5		215.998
1.75		291.193
2		380.192
2.25		483.884
2.5		603.16
2.75		738.912
3		892.033
3.25		1063.42
3.5		1253.96
3.75		1464.57
4		1696.12
4.25		1949.53
4.5		2225.7
4.75		2525.52
5		2849.9
5.25		3199.74
5.5		3575.94
5.75		3979.42
6		4411.08
6.25		4871.83
6.5		5362.58
6.75		5884.24
7		6437.72
7.25		7023.93
7.5		7643.79
7.75		8298.22
8		8988.12

Figure 5: The simulated table and time for the performance variable of Mahan Company performance

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Bullwhip-Effect and Countermeasures:

Case Study of an Asian-European Automotive Supply Chain

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michael.essig@unibw.de**ABSTRACT**

The effect of a higher demand variation over a supply chain is described as "bullwhip-effect". Since Forrester (1958) discovered around 45 years ago that variations of demand (and based on that the variations of orders and stocks) are increased up the supply chain from customer to supplier, researchers look for reasons and try to find countermeasures. While in-depth academic analysis has been conducted for retail markets, very little research has been done on this in global business-to-business networks. We used data from a case study of one Asian-European supply network in order to identify endogenous causes and counter-measures for demand variation. We analyzed the effects and clustered counter-measures with respect to information and behavior uncertainties. This study provides in-depth insights into the dependencies of supply structures to endogenous, even macroeconomic developments. At the same time this study recommends counter-measure strategies to the bullwhip-effect for practitioners and their global supply chains.

Keywords: *Bullwhip effect, Global supply chain management, Automotive industry, Case study*

INTRODUCTION

Lacking coordination of demand and supply information is one of the main causes for demand and stock variation which propagates upstream with amplification occurring at each echelon of the supply chain. Lee, Padmanabhan, and Whang (1997a) and Lee, So, and Tang (2000) popularized the term "bullwhip-effect" for this phenomenon of demand distortion. The bullwhip

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effect has been documented as a significant problem for supply management in an experimental context (Sterman 1989) and in a wide variety of companies and industries (Buzzell et al. 1990; Kelly 1995; Holmstrom 1997; Metters 1997; Warburton 2004). The bullwhip effect has a number of negative effects that cause significant inefficiencies, e.g. excessive inventory investments throughout the supply chain, poor customer supply service and lost revenues due to shortages, misguided management decisions regarding procurement, production, and logistics capacities (Lee et al. 1997a; Carlsson and Fuller 2000).

Early findings have shown that a close cooperation in one supply chain may decrease costs and optimize the flow of goods and information (Forrester 1958, Forrester 1961). Many proposed counter measures have a history of successful application (Clark 1994; Gill and Abend 1997; Hammond 1993; Towill 1997). Particularly in-depth academic analysis has been conducted on the bullwhip effect for retail markets. Changing the perspective, one approach of this paper is to shed light not to a supply chain connected to retailers and end customers, but on the bullwhip-effect in a global (Asian-European) business-to-business network. As the problem is of high importance for the automotive industry (Tsou, 2012), we have chosen a case from this industry branch.

In-depth case analysis allows analyzing counter-measures to the bullwhip-effect from a holistic view. It is possible to evaluate different causes in a combined and integrated way. Operational causes are demand signal processing, inventory rationing, order batching and price variations (Lee et al. 1997a; Chen et al. 1998; Cachon 1999). In the last years, also behavioral causes of the bullwhip effect have been investigated (Croson and Donohue 2006). The application on a case study of a global supply chain allows illustrating the counter-measures with respect to both – operational and behavioral – causes of the bullwhip-effect.

One important tool for optimizing a supply chain in respect to the bullwhip-effect is simulation (e.g. Banks and Malave 1984). On the other hand, if everybody reacts to the bullwhip effect with the same counter measure, e.g. exponential smoothing technique, the demand variation will simply go up through the supply chain (Carlsson and Fuller 2000). This supports our proposition that a holistic and integrating case-based view on the problem might help to get more theoretical insights and practical knowledge about causes and countermeasures of the bullwhip effect. Therefore this paper does aim to analyze a global (Asian-European) business-to-business supply chain with respect to causes and countermeasures of the bullwhip-effect. It is qualitative in nature and reveals in-depth insights into the problem illustrating the structure, time and cause-effect chains of the problem. This paper addresses the following guiding research questions, which are – according to case study methodology – "how" and "why"-questions (Yin, 2010):

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RQ1: Why is there a bullwhip-effect in the analyzed supply chain? (causes)

RQ2: How is the demand and stock variation influenced by applied countermeasures? (effects)

To answer both questions, this work analyzes the purchase, sales, and forecast data of the case company for a period of four years, also considering the effects on transport modes and lead times in the supply network. .As a result this work evaluates the applied management strategies and provides recommendations for further research. The remainder of the paper is structured as follows: Firstly, we present a brief review on about 40 years of research in this field. Then we introduce the methodology. This is followed by the case content and findings. In this section we highlight and evaluate three managerial countermeasure initiatives. This paper concludes with a brief discussion and reflection of our findings.

REVIEW ON THE BULLWHIP EFFECT

After introducing the problem of this paper, this section provides a brief review on the bullwhip-effect research. Analyzing the bullwhip-effect, the researchers focus on linear supply chain models, whereas the flow of goods is strictly linear with a reverse flow of information (Chen et al. 2000; Lee et al. 1997a; Metters 1997). If the variance of the orders of one echolon in the supply chain is higher than the variance of the received orders of the same echelon, then we have a bullwhip effect (Cachon et al. 2007).

Already in the 1960s, Forrester defined in a simplified form the equations describing the relation between inventory and orders (Forrester, 1961). Since then research worked on a mathematical formulation, simulation and optimization (a.o. Disney and Towill, 2002, Warburton, 2004). However, even mathematical models demonstrate that the bullwhip effect is an outcome of the strategic interactions among rational supply chain members (Lee et al. 1997b). This poses further questions about the appropriate assessment of a specific operational or behavioral contingency.

Five main causes of the bullwhip effect have been identified: 1) the misinterpreting of demand information (forecasting), 2) supply shortages, 3) nonzero lead times, 4) batch ordering, and 5) price variations e.g. price promotions (Lee et al. 1997a and 1997b; Warburton, 2004). While these causes expect rational decisions of all supply chain members (operational causes), irrationality or opportunistic behaviour (behavioural causes) is another source of the bullwhip effect (Croson and Donohue 2006). As a result of those causes, demand and stock variation propagates upstream with amplification occurring at each echelon of the supply chain. Carlsson and Fuller (2000) summarized the effects of the bullwhip effect following Lee et al. (1997a and 1997b):

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- Exaggerated inventory investments throughout the supply chain as all supply chain members need to safeguard themselves against the demand variations.
- Poor customer service if one member of the supply chain runs out of products due to the variability and insufficient means for coping with the variations.
- Lost revenues due to shortages, which have been caused by the variations.
- The productivity of invested capital in operations becomes substandard as revenues are lost and capital is invested in inventories.
- Decision-makers overreact to the demand fluctuations and make investment decisions or change capacity plans to meet peak demands. Such decisions are probably misguided, as peak demands may be eliminated by reorganisations of the supply chain.
- Demand variations cause fluctuations in the planned use of transportation capacity. This will again produce sub-optimal transportation schemes and increase transportation costs.
- Demand fluctuations caused by the bullwhip effect may cause missed production schedules, which actually are completely unnecessary, as there are no real changes in the demand, only inefficiencies in the supply chain.

Countermeasures to the bullwhip effect focus either on operational or behavioural causes, but can also optimize both sources of the bullwhip effect. At this point, we want to stress four major counter measures: (1) Improved information of each supply chain member in order to enhance the basis for rational decision making; (2) Improved coordination of capacities and batch orders in order to control the behaviour of single supply chain members; (3) Improved structure of the supply chain in order to reduce lead times; (4) "Everyday low prices" to smoothe the demand variation of the end-customers (Lee et al 1997b; Bhattacharya and Bandyopadhyay 2010). As this paper focuses on a case firm in a business-to-business network and its intra-logistic, prices the countermeasure "everyday low prices" is not further regarded.

METHODOLOGY

While many authors focus on retail and consumer industries, very little research has been done on global business-to-business networks. This is surprising, as much of the complex inventory behavior is determined by the replenishment delay (Warburton, 2004). Replenishment in a global supply chain has long transport (shipping) times of about 20-30 days from Asia to Europa. This must pose surplus challenges to the bullwhip problem. Therefore this study has chosen a global supply chain for its case analysis.

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The automotive sector delivers on the one hand side good examples for a global supply chain. On the other hand it is a field with numerous bullwhip effect challenges (Tsou, 2012). Additionally the authors supposed an accelerator effect to the bullwhip variance for suppliers of electronic devices. Therefore we have chosen a 2nd tier supplier of the European automotive industry delivering electronic devices. To illustrate this technological accelerator effect, we follow Anderson et al. (2000). The demand (order) variance of the automotive industry to the case company is dominated by demand-induces changes in desired sales for *modern* automotive models. For example, the production of a modern car requires 10% more electronic devices than needed for an existing product. Suppose that an automobile original equipment manufacturer (OEM) is operating with a given product spectrum and modernizes every year one model. This would result in a "normal" order increase of 10%. If the OEM would push the modernization (3 more models in a year replaced), this would enforce the "normal" bullwhip-effect in dependency of customer-sales data, adding to the normal orders additional 30%.

The applied methodology to the case company follows a three step analysis framework which firstly examines the causes of demand variances, then analysis the (negative) effects for the supply chain and finally proposes evaluates the applied counter-measures (Scholz-Reiter 2005; Chen et al. 2000). For this study we focused on the logistics processes within the case firm ("intra-logistics"). We held several workshops at the European headquarters and interviewed five supply managers in four different organizational units (national subsidiaries, central stock, European and Asian Headquarters). Additionally, we analyzed purchasing, sales and forecast data. We studied the developments in the case firm starting from 2008 up to 2011.

THE CASE OF THE 2ND TIER ELECTRONIC AUTOMOTIVE COMPONENT SUPPLIER

The Asian-European Supply Chain

The supply chain of the case company connects the Asian production units (factories) in China, Japan or Thailand by ship or by plane with the European central warehouse in Germany or national warehouses all over Europe. National warehouses are situated in countries with important automotive OEMs (Italy, Spain, France, Czech Republic, United Kingdom). The companies' clients, mostly 1st tier module suppliers (cockpit, navigation, entertainment) are supplied from those warehouses.

The information flows from the clients (orders) in either a national subsidiary or a national sales office. The orders are then forwarded to the European headquarters. However, also direct orders from national sales offices or subsidiaries to the Asian production facilities are possible. The Asian headquarters coordinate and prioritize all orders from the world. This is more or less

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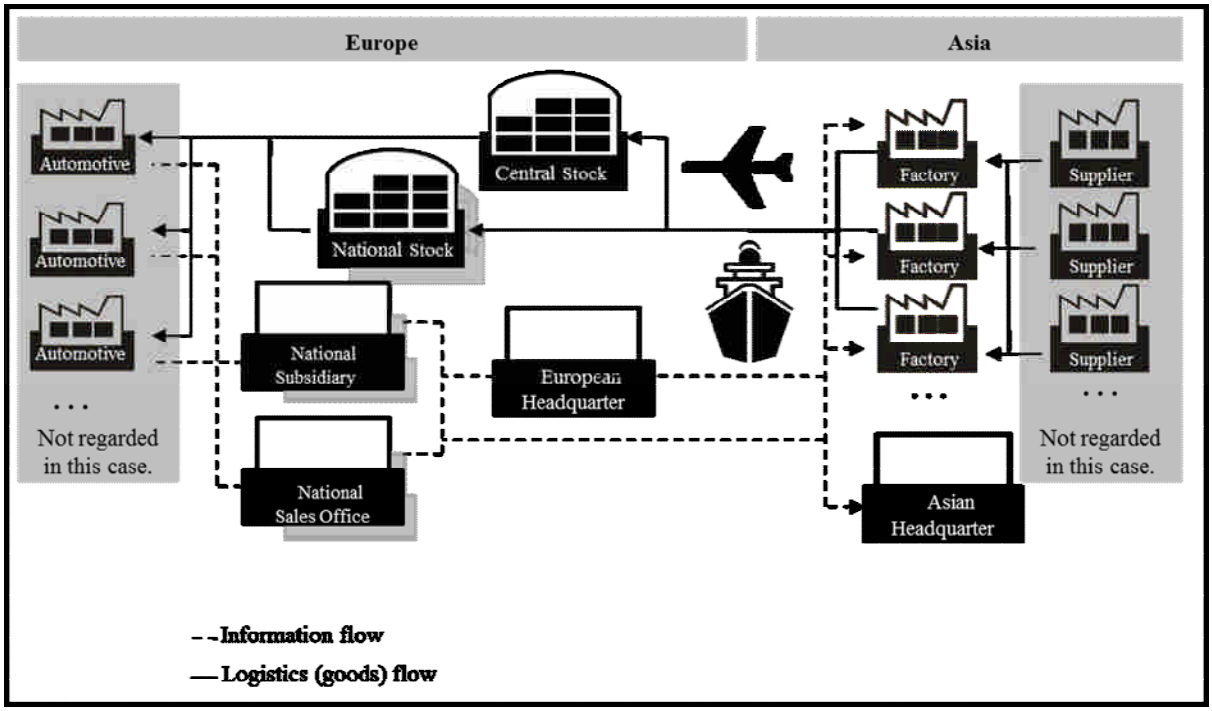
a role to allocate strategically the production capacities to different markets, such as Europe, North-America, South-America, Africa or Asia. The Asian headquarter does not manage single orders or regional stock levels. In total this has led to the supply following supply structure in 2008 (Fig. 1).

Figure 1: Supply chain network of the electronics provider



On a first glance, the characteristics of this structure are many – partly redundant – roles and responsibilities. A controlling of orders and stocks was hardly possible, because of a direct communication link from national sales offices to the factories and several central, national stocks. However, we had to verify, if this structure is really affected by amplifying order and stock variances. In general, the bullwhip effect can be shown comparing the variances of all outgoing goods with the variances of all incoming goods (Cachon et al. 2007).

For the case company, we had insight into the sales, purchase and forecast data from 2008 to 2011. For the year 2009 the aggregated variance of all outgoing goods (sales) compared to the variance of all incoming goods (purchase) showed significant differences. Therefore we could detect the bullwhip effect (particularly for 2009), because sales figures doubled in 2009, while purchases kept relatively stable compared to 2008. For 2010 sales figures decreased (~50%) while now – with a time delay of one year – purchase data doubled. In 2010 the later discussed countermeasures were initiated, which might explain the reduction of sales and purchase variances in 2011 (Fig. 2).

Figure 2: Comparison of the variances (Source: According to Croson and Donohue, 2006)

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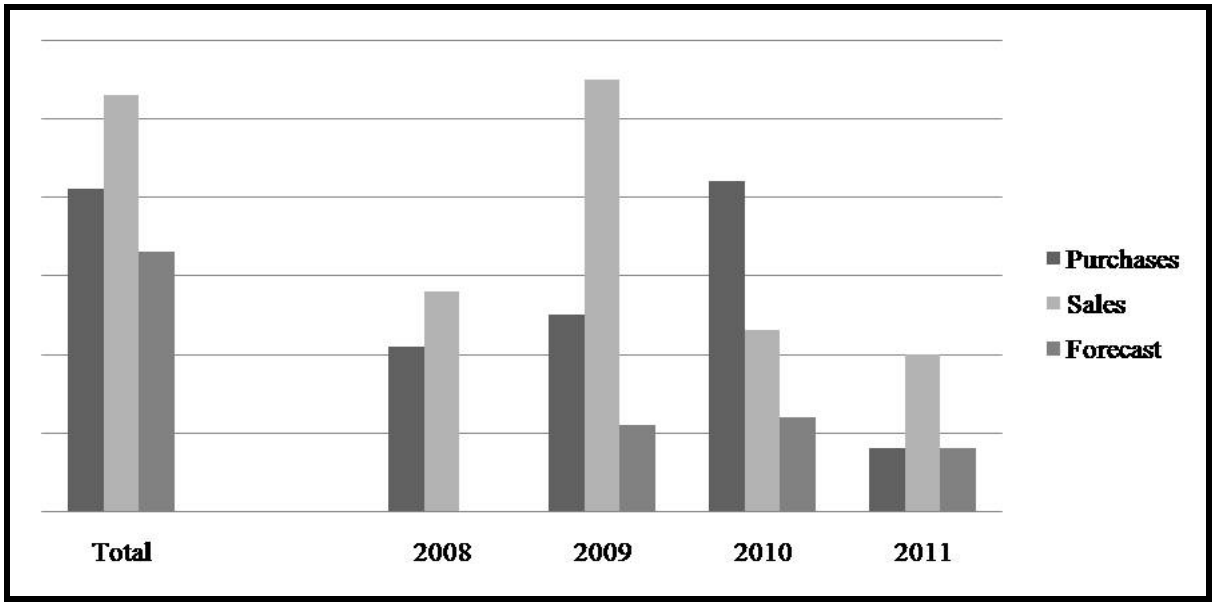

The existence of significant variances between sales (outgoing goods) and purchases (incoming goods) poses the question about the causes and possible assessment of these variances. Due to the specific circumstances of this Asian-European intra-logistics supply chain we do not follow a simulation-based, but rather a holistic and general management approach for this problem.

Causes for the bullwhip effect in the case

In the analysis of the sales and purchase variances it became obvious that it is not one, sole cause. Rather a mixture of causes and even macroeconomic effects led to the variances. Beginning with the macroeconomic situation, in 2008 the worldwide financial and economic crisis caused a significant decrease in the demand for automobiles. This forced European politicians to take action for protecting their national automotive industry. In leading markets such as France or Germany so-called "car scrap"-bonus systems were used to stimulate end-customer demand. The system awarded a customer with a bonus payment for buying a new car model from (a domestic) OEM, scrapping up the "old model". The financial-economic crisis and the "car scrap"-policy led to several effects for the case company:

Firstly, demand decreased due to the crisis in 2008. The case firm had enormous problems with the capital lock-up of their stocks. In the most striking example, products had already been shipped to Europe although it was clear that no client would need that delivery anymore. In order to reduce the capital lock-up in the central and national stocks and to get more stockage space, some – older – electric devices were even scrapped up.

Second, due to the "car-scrap"-bonus systems in leading markets, the demand unexpectedly increased. This led to a bottleneck situation and demand exceeded the supply by several times. In order to somehow satisfy demand, the Asian factories produced at

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the ultimate limit and the electronic products of the case firm were transported to Europe even by costly air freight. As the bonus system ended (2010), demand decreased again, due to a satisfied market situation. Production capacities again exceeded the demand by far. Altogether, the automotive industry and our case firm faced enormous challenges in the period from 2008 to 2010 and the most striking cause for the bullwhip effect was a macroeconomic one.

Discussing the five causes of the bullwhip effect, we show that a mixture of (over-) reactions supported the development of high order and stock variances. 1) No forecasting function was in place to analyze the demand information in a structured way, which led to a misinterpretation of order data by numerous involved decision makers in the subsidiaries, sales offices, and headquarters. 2) The "car-scrap"-policy led to an increase in the demand for new car models, which require disproportionate many (modern) electronic devices built-in. This caused a supply shortage and led to behavioral problems, as national sales offices or subsidiaries tried to satisfy – at any costs – their national customers. 3) The demand and order data showed a very high variance, particularly in the first couple of months of the "car-scrap"-policy. However, the lead-time is about 30 days from Asia to Europe and it happened that parts in the wrong amount was produced and shipped. Failures due to long lead-times were corrected using faster but costly air transport. 4) The communication to the customers at the beginning of the case provided almost no additional order information. As it became obvious, that electronic devices run short due to the bonus policy, customers placed very high batch orders to secure their supply. 5) Only the fifth cause was not of importance, as prices kept stable, due to long-term contracts, even if transport means changed for a short period from sea to air freight.

As a reaction, the case company introduced several countermeasures. Three main initiatives have been realized: a reorganisation of the supply chain structure, a change in the coordination and information system and the implementation of a forecast instrument.

Reorganisation: Implementation of a central supply chain management

The most challenging initiative for the case company was the transformation of the supply chain structure. Considering the flow of goods, a new and strict policy was introduced to ship the goods either directly to the clients or to the central stock. This abandoned national company stocks and reduced "double" safety stocks in the national and in the central warehouses. As a side-effect stock transparency was enhanced, because company stock is centralized in one European distribution centre. Considering the information flow, the objective was similar and aimed to avoid double structures and to reduce the number of interfaces. Therefore the national subsidies were transformed into national sales offices ("one face to the customer"). All sales

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offices are now not allowed to have any own stock anymore. All goods have to be handled via the central warehouse of the European headquarters. At the same time, the European headquarters enforced the role of its central supply chain management department, which is now the connecting link of all European orders to the Asian factories. Altogether, the new supply network gave clear roles and responsibilities to each actor in the network, which reduces operational and behavioural causes of the bullwhip effect.

Process Optimization: Bottom-Up and Top-Down Information Sharing/Decision Making

The enforced role of the central supply chain management department allowed implementing a new method of capacity and batch order coordination. Firstly the national sales offices and the central supply chain management department now have access to the same database. There is a transparent information technology tool in place. The national sales offices place their demand in the system (bottom-up) and the central department is strategically coordinating (top-down). This allows the European Headquarters to consider e.g. key customers. This bidirectional information sharing and central coordination mechanism reduced "blind" orders, risk-averse safety stocks and other behavioural causes of the bullwhip effect to an absolute minimum. Additionally, this also reduced the necessity for costly expedite shipments, as the central coordination also smoothed the demand orders of the sales offices.

Controlling: Implementation of a forecast instrument and governance structure

As a third management initiative, a specialised forecast department has been built up. This department concentrates on the forecast of the automotive demand in Europe, provides additional information for rational decision making, and supports the central supply chain department with forecast data in case of coordination conflicts with either the national sales offices or the Asian factories. A governance model gives guidance to all persons involved. Once a month, all forecast figures are collected and sent to the Asian factories by this department. With these data, the factories can manage their production planning more precise. This also helps to reduce lead times in the factory and provides more flexibility and adaptability in case of unforeseen demand changes.

Altogether the case company has implemented three main initiatives: Reorganisation, Process optimization, and implementation of new controlling-tools and governance rules. This had significant impact on the order information management, stock levels and lead times. Fig. 2 illustrates the decrease in sales and purchase variances in 2011. Altogether, the success bases mainly on the reduction of double or redundant interfaces in the information as well as in the logistical flows. Bidirectional information and

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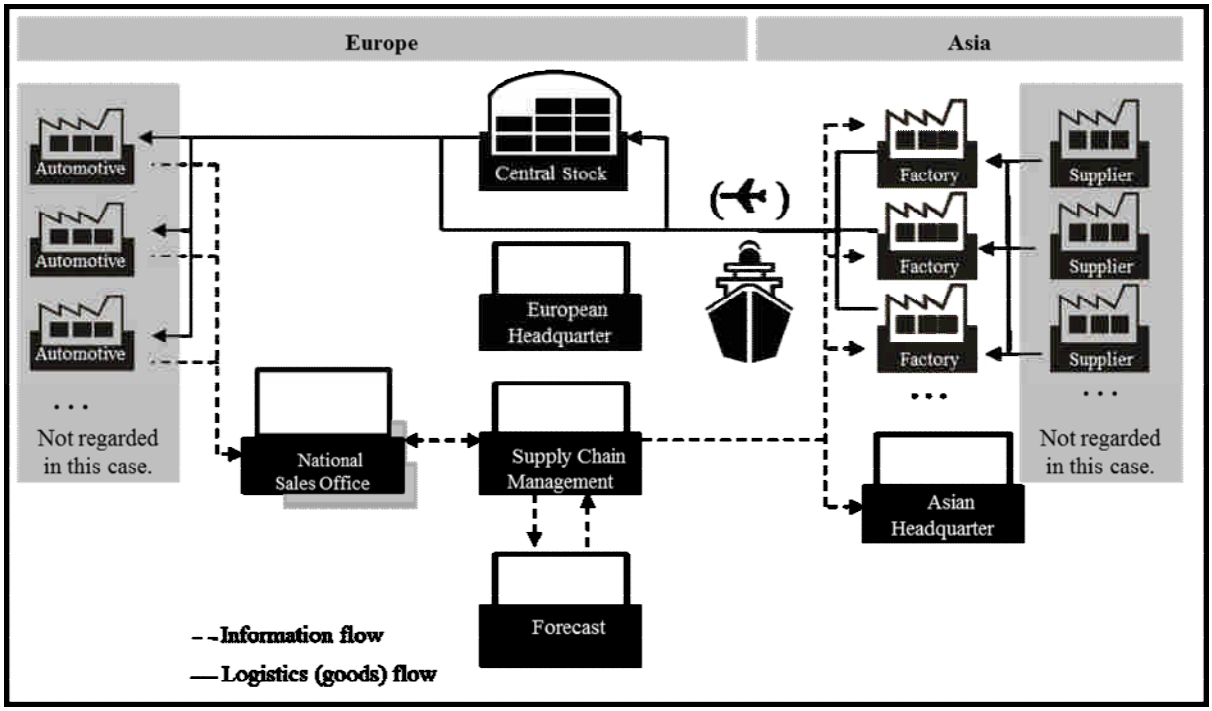
coordination flows are connected to a governance model for top-down decision making in critical issues. The enhanced transparency in structure, governance and decisions also optimizes the behaviour of all involved personnel, considering the "bottleneck-panic" or "blind orders". The structure of the transformed supply network is as follows (Fig. 3):

Figure 3: New information and supply network of the case firm:



DISCUSSION AND CONCLUSION

This paper intended to analyse the bullwhip effect in an Asian-European business to business intra-logistics network in order to identify and evaluate management initiatives for reducing demand and stock variances. Firstly, we presented a brief literature review on the bullwhip effect, which is traditionally examined for retail markets. We adopted the concept on a global supply chain situation in the automotive industry using a case study of a 2nd tier electronics supplier. This provided the basis to present countermeasures against the bullwhip effect in form of three management initiatives.

The bullwhip effect had significant impact on the supply chain of the case firm, demonstrated in the extreme differences of the variance of demand and supply. A joint approach of three main countermeasures (reorganisation, process optimization, enhanced controlling) led to a significant reduction in the variances of sales (outgoing goods) and purchases (ingoing goods). As a side effect and opposed to former times (before 2010), reduced stocks did not increase the danger of stock-outs and did not imply costly air freight transports. The delivery performance has increased and dead stock situations were reduced to a minimum.

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This case study on the bullwhip effect is limited in the sense that only one case was examined from a holistic perspective. However, we are confident that the extracted findings may apply to numerous firms which operate global supply networks. Nevertheless, we suggest further research, on the one hand side to collect broader empirical evidence by examining other and more cases and on the other to align demand and supply in order to reduce the logistical footprint in total.

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ENRICHING SOCIAL CAPITAL AND IMPROVING ORGANIZATIONAL PERFORMANCE IN THE AGE OF SOCIAL NETWORKING

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Abstract

Social capital is a term originally used in sociology. The idea of social capital is increasingly influencing multiple disciplines including psychology, economy, management, and information technology. The role that social capital plays in organizations and its contribution to organizational performance has gained attention of researchers, and different studies have been conducted to characterize social capital in terms of social networks theories. This work presents a discussion on social capital in the context of social networks, and explains how these networks affect the organizational performance. The study was conducted through literature review with a systematic discussion of arguments and propositions. Through this research, we have determined three key constructs (communication, empowerment and organizational structure), which have a close relation with social networks and a positive effect on organizational performance.

Introduction

Web 2.0 sociable technologies and social software have been playing a leading role in recent years, not only in personal life style, but also in the business world. Social networking websites have been on the spot of thecommunication revolution and everyday more organizations are taking advantage of these social technologies to boost their business. Social networking, is a term that has been around for a while,they have been applied in different ways ranging from community organizing to business organization(Demailly, 2009). In recent years, the application of social networking via electronic media have reached the climax, and now different utilities of social networking are being applied both tothe consumer world and the corporate world, with diverse implications for businesses on how it may change the way they work.The corporate world can take advantage of social networks in different ways. For example,a company can create internal and external relationships via social networking.In this context, the social capital of a company can be impacted by the use of social networks. This work presents a

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discussion on social capital in the context of social networks, and explains how these networks affect the organizational performance.

Background

In a constantly changing and expanding world, communication has become key to sustain even the smallest of relationships. At the center of every process, especially business related process, we have trusting and supportive relationships (Goleman, Boyatzis, & McKee, 2002). These relationships are a small part of what has been called Social Capital.Social capital is in essence the network of relationships that include friends, family and casual connections as suppliers of important resources of knowledge, information, and support (Putnan, 1995). Furthermore, social capital can be considered an asset when it is associated with the structure inherent in social relations and networks(Burt, 1997).

The importance of social capital is focused in the social structure and is based on groups, institutions, individuals and social interactions (Wasserman & Faust, 1994). Lin, Ensel& Vaughn (1981)argue that social capital focuses on the fitness of the players (e.g. employees) and their personal relationships. It essentially relates to a composite of social obligations or connections that drives its participants to economic capital under certain conditions.Social capital involves different entities, and it mainly deals with interactions between people (Augusto Felicio, Couto, & Caiado, 2012).

Nahapied and Ghoshal(1998) helped create interest in literature that studied the social capital with a focus on organizational studies. Among these studies Ali, Naseem&Farooq(2011) state that a healthy social capital raises the productivity of workers. Furthermore, they conclude that Social capital is indispensable to economic development; basically no economic development is possible without good social capital. Social capital cannot be obtained in isolation; it is obtained or acquired through a plethora of good relationships and good communication, etc. Nowadays,social capital is greatly influenced by social networks.

The concept of social networksstarted with the formation of groups or communities that interact with each other, establishing an exchange of knowledge that promotes learning and orientation to a topic of common interest (Snowden, 2005). The benefit obtained by an individual through this interaction will depend on the scope of the connections or networks with other individuals (Jackson & Watts, 2002). These groups can be formed on the basis of ethnic, religious, political orientation or any other category that defines the identity of an individual (Boyd & Ellison, 2008). It is based on a model in which entities A and B associate, and the association of entity B to a C entity, assumes the probability of interaction between entities A and C. Having understood the basic concept of social network, it is important to complement this concept with the theories that helped define it.

The way in which individuals, groups or communities are grouped attract new membersand evolve through time. This creates questions about the features or aspects that influence the decisions of individuals to form or join a group, and the pattern of growth and interaction among groups (Backstrom, Huttenlocher, Kleinberg, & Lan, 2006). Some models of social networks can be represented under the concept of social distance (Boguña, Pastor-Satorras, Diaz-Guilera, & Arenas, 2004), in which the degree of affinity or approach that an individual has towards another individual or group in a social network comes in mathematical form. It introduces concepts of players, networks, chains and improvement paths to define a

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model based on a social network, and the relationships that form between its components (Jackson & Watts, 2002).The concept of "diffusion of innovation" studies trends of association according to the association of individuals or groups (Backstrom, Huttenlocher, Kleinberg, & Lan, 2006); the concept of privacy ("Pretty Good Privacy"), based on the reliability of networks (Boguña, Pastor-Satorras, Diaz-Guilera, & Arenas, 2004) and the concept of identity from individual and organizational points of view.

At this point, there is a basic relationship between social capital and social network, as social capital depends on the interaction of individuals within a group. This interaction is possible thanks to the connections between individuals to form relationships, and the diffusion of information between them. This promotes knowledge sharing, leadership of key members and the development of the group as a whole. This structure is adopted by business environments to maximize the relationship between its members through all managerial levels.

Social Capital and Social Networks in Organizations

After further understanding of the meaning of social network and social capital in the context of this research, we must relate them in terms of its impact in an organization. These impacts range from the very simple (hiring an employee, advertising) to very complex (redefining an organization's structure). Social capital is a term first utilized by psychologist to define the context of relationships; furthermore social networks can be related to a business relation.

The role of social capital in the organization can be described as the development of an efficient work area, that is characterized by high job satisfaction, effective and friendly work enviroment, knowledge sharing and a strong relationship between their resources(Danchev, 2006; Potts, 2007). According to Potts (2007) social capital has also the role of fostering relationships between resources and within the organization. In addition, researchers in information technology have highlighted the role social capital has on the development, innovation and sharing of information and technology by serving as a diffuser (Syrjanen & Kuutti, 2004; Song, Heejin, & Kurnia, 2009). Ali, Naseem, & Farooq (2011) agrees with the findings of information technology researchers. According to them social capital is a key contributor of technology changes and its acceptance.

The role social capital has assumed during the twentieth century on modern organization, especially in companies that rely more on technology and are more information-intensive, have acquired more value by enabling effective information sharing and understanding and therefore increasing the company's productivity (Kianto & Waajakoski, 2010; Ali, Naseem, & Farooq, 2011). It has been proved that social capital contributes to a company's bottom line and to its economic development (Kianto & Waajakoski, 2010; Ali, Naseem, & Farooq, 2011). Social capital provides certain benefits to the organization that help the company achieve its goals, such as better group communication and coordination, improved group execution, enriched trust and commitment and information sharing between resources(Adler & Kwon, 2002). The sharing of a company's goals and vision that is achieved by the role of social capital in an organization is key to its development and organizational success (Ofori & Sackey, 2010).

It has been identified, since several years ago, that social capital is a key element in the success of

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an organization's performance (Adler & Kwon, 2002; Molina & Martínez, 2010). According to Cunningham(2002), the focus that social capital applies on the social relationships between individuals provides competitive advantage to the business. It is common to see how organizations deal with competitive environments that require access to information and coordination between resources and only those companies that learn to capitalize and incorporate the social capital in their processes are the ones that achieve high organizational performance (Ofori & Sackey, 2010). An organization achieves synergy when the actions of a group have a better effect than the ones achieved by each of the individuals; as a result,performance is increased(Cunningham, 2002).

Social capital influences and increases the company's productivity by the transmission of information between individuals and by nurturing their motivation through group interaction (Ofori & Sackey, 2010),Social capital, which focuses on creating external links and obtaining information, greatly helps the organization to establish enduring relationship with resources. In addition, it has been found that social capital plays an important role in increasing job satisfaction, empowerment and commitment with the organization and therefore helps get the work done and achieve the company's goals (Potts, 2007; Kianto & Waajakoski, 2010; Ofori & Sackey, 2010).

Social networks, just like social capital, have a direct impact on the performance of an organization. Through the yearsthere have been studies related tothe effectsof social networksonthe performanceof organizations orcompanies. It has been found that social networksaffect attitudes, socialcohesion, knowledge transfer and job performance(Jones & Volpe, 2010).All thesecharacteristicsaffecthowemployeesbuildan environment inwhich they cancreateautonomyin their work,at the sametimeinteracts with theirpeers(Lee & Kim, 2011). Companiesthat facilitatesocialinteractionand the development ofworking relationshipshelp to promotestronger organizational identification among employees,creating loyaltiesamong its members(Jones & Volpe, 2010). These networks have agreat influence, affecting the type ofinformationthat spreadsbetween employees andthe organization, theskillsthat individualsacquire andespeciallythe speed, quality and accuracy withwhichdecisionsin the company ororganizationare made(Carley, 1998).

Social networks promote the sharing of information and provide individuals opportunity to interactwithand expand theirnetwork of acquaintances anddiscuss topicsof interest with fellow coworkers(Ferrerira & Plessis, 2009).Intoday's worldit is difficult fororganizationsto operate withoutacollaborative group.This is why companies need a platform where members cannetwork with each other within the organizationand participatein discussion forums, meetings, and public and privatepost messages. This technologyenables us toconnectwith, andreachsubject matterexperts(Ferrerira & Plessis, 2009).Although there arerisks (e.g. legal, confidential information leakage)in usingthese social networks,positiveresultssuch asdecrease incosts(paper, hardware, travel, etc.), job satisfaction, customer satisfactionandproductivity aregreatlysuperior.

From a Human Resources point of view, social networking sites provide a readily available public forum to find potential employees while incurring minimal cost, allowing even small businesses to engage in such practices. The information on SNSs may provide further evidence related to the veracity of information presented on an applicant's résumé (e.g., education and work experience). In addition,

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potential employers may have access to detailed information that would allow them to draw conclusions or make inferences about the applicant's character or personality that might not be as easily or economically obtained through traditional means (Victoria & Vaughn, 2011). Social networking sites are becoming universal in modern organizations, with many organizations developing their own tools and sites for business purposes(Barnes & Barnes, 2009).

According to recent reports in the popular media, an increasing number of hiring managers are utilizing social networking sites (SNSs) to aide in screening and selecting applicants. A 2009 survey conducted by CareerBuilder.com found that 45% of over 2600 hiring managers reported searching SNSs to learn about job candidates, an increase from the 22% reported in 2008 (Victoria & Vaughn, 2011). It has also been found that one third of employers have declined to offer at least one job candidate a position on the basis of finding unflattering material in an Internet search (Bohnert & Ross, 2010). Although social networks facilitate the screening process employers who choose to use SNSs as an informal method of predicting applicant employability have many issues to consider. Current risks with informal SNS searches include perceptions of invasion of the applicant's privacy, lack of clearly identifiable theoretical constructs used in the screening process, and the absence of data to support the veracity of information used (Victoria & Vaughn, 2011).

Any business focused on employee performance and development must understand the importance of the administrative level's accessibility to the operational level crew, as this builds new and reinforces existing communication channels, and motivates the employees to be active players in business strategies. As the organization expands this access throughout the internal boundaries of the organization, all the employees will feel part of it, and will contribute effectively to reach their goals.

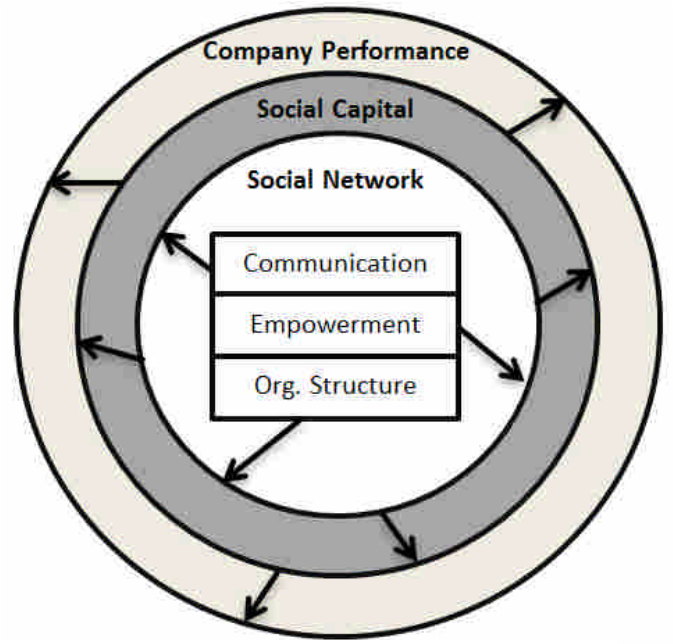

Figure 2

Social Network and S

Social Networks and Social Capital, as previously discussed, and we have shown that they have a direct and meaningful impact in a company's performance. We have identified three key constructs in the

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literature; these constructs have significance to relate social networks with social capital. Figure 1 depicts how these constructs (namely: communication, empowerment and organizational structure) drive forces to impact social capital, and hence company performance. Each construct will be discussed individually for further understanding of their impact on the social capital and the performance of a company.

Communication

Companies are changing and evolving, and the communication within and among them is not the exception. One of the impacts in the evolution of technology, specifically the Web 2.0, is the way companies communicate; further evolution will result in corporations having to change the way they communicate. Social Networking brings with it a broad new range of new technology innovations, explicitly in communications (multimedia, presence, interactivity, etc.)(Demailly, 2009). Furthermore, social networks have redefined the concept of communication including the progression of interpersonal communication (Kossinets & Watts, 2006).

So why is social network such a popular communication tool? Social-network technologies are immediate; they support and allow real time dialogue allowing employees and companies to be more proactive. Another important factor is easiness; it takes practically no time to learn how to use them and it is also environmentally friendly (it is paperless). Finally, most social network technologies are inexpensive, most of them even free.

Networking, from a communication point of view, is a critical component of the present business world and it is key for employees to reach their potential. Social Networking can greatly contribute to this by expanding networking possibilities, not limiting them only to local networking opportunities, but opening a whole new world in global networking. Employees think globally when their network expands;they pay attention to what their online contacts do. The utilization of social network features allows them to gain greater depth of knowledge in their particular area of interest. Basically, social networking allows employees to have access to multiple mentors and advisors, not just information. Social Networks can become a true self- development tool accessible at any time in any place (Demailly, 2009).

Empowerment

A functional organization not only depends on a hierarchical structure, procedures and policies. It also depends on the initiatives, attitudes and sense of ownership of their components towards the organization as a whole. This could be a psychological effect rather than any other formalism, as employees as well as managers must be on the same state of mind to achieve it. When businesses talk about empowerment, it could be associated with leadership, or delegating authority to other parties. The idea behind empowerment is that managers share authority to those who show leadership attributes, to motivate employees and develop decision-making skills, as well as promote teamwork and accountability of its outcomes (Zhang & Bartol, 2010). All this cannot be achieved without a serious commitment from senior management that enables these processes to be carried out.

The hierarchical structure of the organization must be supported by a parallel, logical structure

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that builds the foundation of the relationships and interactions between their members. Managers are called to build these relations or connections between their employees, as well as with other teams, to promote trust between groups. As social media applications and technologies are implemented in an organization for internal communication, the boundaries between upper and lower management could be flattened, building a sense of close relationship between managers and employees. Considering that no immediate control could be exerted over the contents published, the organization must establish rules to guarantee a fair use of it. This maintains a healthy environment of trust, cooperation and mutual benefit that reinforces the organization's social capital(Putnam, 1993).

Although we can identify exceptions where individuals can perform in isolation and get positive results, it is a common practice that leaders and managers work as nodes to connect employees and integrate them in the initiatives of the organization(Kirkman & Rosen, 1999). This builds a "social network" that drives cross-functional teams' efforts towards organizational goals. They're based on responsibilities, policies and procedures established by management, but with flexibility and space for ideas, collaboration and creativity. As leaders are empowered, they're granted access to privileged information that could help them improve their participation and exposure in the organization, and increase their overall performance. In this sense, technology plays an important role as a vehicle of organizational changes, workforce integration and competitiveness(Cadet de Suarez, Quero García, Rodríguez Figueroa, & Benítez, 2009).

The informal use of online social communities for business purposes has soothed the bureaucracy of organizations' communication protocols, and has been adopted by many companies as components of their business relationship tools. In order to maximize the potential of the workforce, management grants their employees access to their social network. Although concern rises in terms of security and privacy, social networking brings another way of empowerment for the organization, as each leader must get in touch instantly, spread information, share knowledge and build a stronger work environment. As a result, managers expect to obtain a better performance, feedback and trust from their employees.

Organizational Issues

The benefits provided by the use of social network in a business, such as increased communication and information availability and sharing, had made companies more transparent to their customers and above all to their employees. Social networks have made possible that informationcould be accessed and shared in a way that was not allowed before by a company's policies. Due to this, employees and stakeholders are paying more attention to the company's actions to evaluate if they are consistent with the organizational culture.

Today, a company's organizational culture along with its strategies is of great importance to its success. As a result, companies need to work on their strategy and organizational structure to align to these new changes that are based more on communication and collaboration. They need to embrace employee interaction and promote relationships that make the employee feel part of the decisions taken. The old pyramid organizational structure (錯誤! 找不到參照來源。) in which bosses made all the decision and employees only execute activities needs to be flattened to promote integration of managers

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and employees (Demailly, 2009). The intention is to accept the new and more flexible forms of communication, which result from social networks platforms, where the employee has access and communication with high managers they would not usually have access to.

As AT&T managers highlight, in order to be active in social networks the company needs to mold its organizational model to one that is based on a coordinated approach (錯誤! 找不到參照來源。) (Demailly, 2009). In this sense, adaptive structure, informal work relationship and synergy exists within a team. Also, internal and external communications are encouraged and guidelines and best practices for social networks are established. As the company modifies its organizational model, roles and responsibilities may also change. Information technology groups are of great importance, and are expected to work with other area managers to create and enable required applications. At the same time, area managers are expected to promote and use social networks and therefore to assume certain responsibilities, performed traditionally by IT employees.

With the development of the technology, managers and employees are assuming activities that once were considered the domain of human resource professionals and administrative personnel. This activity change should improve the overall organization effectiveness. All employees inside the company can respond more quickly when they have relevant information accessible and when they are empowered to use it. Organizations will no longer need personnel to record information and process forms, and this can be replaced with time spent on firm's competitiveness issues. Connecting people and data removed many of the physical barriers that previously hindered interactions and slowed business processes. The HR functions may focus on the development of social networks of employee groups in and out of the organization, to provide the synergy that combines human capital with social capital (Lengnick-Hall & Moritz, 2003).

As Piskorski(2011) indicates in his study, successful companies in the social network arena are those that focus first on fulfilling social needs of their partners, in this case employees, and then linking those strategies to the business goals. Meeting social needs include developing strategies that encourage the interactions and connections among people. In the social network era, a successful organization is one that promotes interaction and collaboration between employees and therefore knowledge sharing. A company characterized by a structure in which employee empowerment is encouraged, will survive to these new changes.

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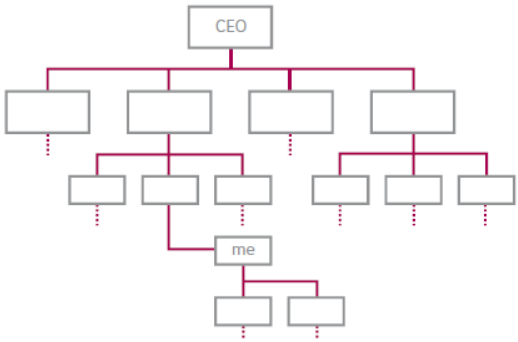

Figure 2: Pyramid organizational structure

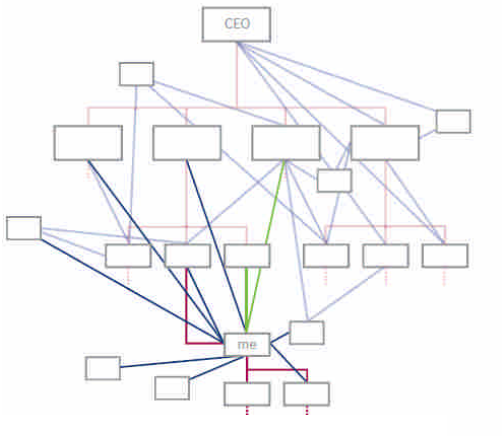

Figure 3 Coordinated approach.

It has been proved that social networks have a positive effect on firm performance and competitive advantage (Tung, 2012). Social networks can be used internally to enhance communications with employees. This is the case of Best Buy's CEO, which uses Facebook and Twitter to communicate with Best Buy's employees in the different stores around the world, something that years ago would have been very difficult based on geographical location. For this reason, it is imperative that companies that are interested in surviving these new technological changes embrace new strategies and organizational changes.

Social networks bring benefits to a company in terms of better communication and information availability.Nonetheless, it is important to highlight that if it is not used correctly it can also harm a company. Therefore, it is important that Human Resource Departments create and implement policies to ensure the proper use of social network practices among employees. Best Buy's Human Resources department developed and implemented a social media policy in which employees need to identify themselves as Best Buy's employees before discussing company related information online (Dunn, 2010). In addition the policy states that nonpublic financial or operational data cannot be published online; it needs to be kept private.

As organizations consider the development of an internal social networking site, it is important to recognize that individuals from across the lifespan are becoming more attuned to the benefits of this technology. A growing and diverse user base is in place. From a business perspective, it is unwise to remain disconnected and on the sidelines. The organization must examine its operational policies and procedures with the legal advisor before implementing a social networking site. The use of disclaimers is very important because it states that the views of the individuals using the site are not the views of the organization (Barnes & Barnes, 2009).

Human Resources departments have an important role in the social network environment. Not only they are responsible of creating the policies and best practices for the use of social networks. They also play an important role in the modification of the company's strategy and organizational structure. At the same time social networks also bring benefits to this department, asit can be used in activities such as recruitment of employees (Gunderson, 2010).

The three discussed constructs, communication, engagement and organizational structure,have a

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direct impact (from a social network point of view) on the social capital of an organization. As previously discussed, a positive social capital has a direct correlation with a positive organizational performance. Having this in mind, a manager must take into consideration and integrate all three factorsin order to maximize the benefits obtained from social media. As organizations search for competitive advantage, they must analyze the effectiveness of communication between managers and employees, and measure the performance of the organization in terms of how acquainted are the employees about organizational plans. The inclusion of social networks in the organization facilitates the linkage between their members, and shrinks the organizational distance between managers and employees. This virtual approach also promotes a better communication between them, resulting in the diffusion of ideas, knowledge and empowerment of all the parties involved.

Management of Human Capital with Social Networks

Today's managers, leaders and executives need to embrace social networks, and the changes it brings to the organization as part of the day-to-day business. In order to achieve organizational successin the new technological era, leaders must adopt these new tendencies. Managers must not only acknowledge them, they must incorporate them to the organization's structure.

It is undeniable that social network is the way to communicate nowadays. Companies should not ignore it; instead a manager should promote the use of these tools to improve internal communications. Communication, as we have mentioned before, is the basis for business relationships. The advancements in technology bringpeople a new way of communicating, a new way of sharing, and a new way of empowering employees.In essence it has revolutionized the way we communicate. Social networks facilitate the availability and sharing of information between managers and employees. For this reason it is imperative for managers to understand and apply social networks into their everyday communication plans.

Managers should also acknowledge the benefits of empowering employees through social networks. They must be aware of the performance of their organization and focus on their teams to bring them the tools and empowerment they need to be effective. Empowering employees is more than a privilege, as it isautonomy to make decisions and be accountable of their outcomes. Empowering employees reinforces teamwork and promotes new relationships as well strengthens existing ones. It also makes employees feel part of the company's decision-making process, which increases their motivation and therefore the organizational performance. In fact, Social Network is a key tool to achieve this.

Social Networks not only have an impact in the way a company communicates or how it empowers its employees. It can also have a deep impact on how the structure of a company can be re-arranged. To obtain the full benefits of social network in a social capital context, managers should be willing to align a company's organizational structure to support these advancements in technology. The organizational structure should be flattened to promote relationship building between managers and employees.As mentioned before this organizational model is known as the coordinated approach. This flattening results in a reduction of hierarchical levels, decentralization, and the creation of innovative organizational structures. When faced with revolutionary changes, such as the integration of social

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networks, management needs greater internal structure flexibility to facilitate the transformation of current structures (Batra, 2006).

The other aspect managers need to take into consideration is the change in roles and responsibilities that result from the use of these technologies. This impacts training, development and recruitment efforts, in order to select the correct people and enhance the technical skills of current employees. Having the technology in place is not enough; employees need to know how to use it (Lengnick-Hall & Moritz, 2003). As we can see, the social network revolution affects the entire organization and the Human Resources department needs to take an active role to prepare the organization for these new changes.

As with most things in the business world, social network does not come free of challenges. Some of these challenges include: security, intellectual property, adoption, lack of appreciation, and risk of losing employees, among others. As the company's intranet opens up to new business and expands as social networks expand, fewer restrictions are incorporated. Fewer restrictions, of course, mean less security (Demailly, 2009). Companies that embrace social networks must implement information technology policies so they can have a controlled but at the same time open network. These policies should also take very seriously the protection of intellectual property, as this is a priority for every new-age (and to a great extent old-age) company.

Adoption and lack of appreciation is a big challenge. Although low cost, social networking presents a time cost challenge. Companies hesitate to fully integrate social networks into their communication platform because they fear that employees will waste too much time on them. Executives and managers whose responsibility is to make adaptations sometimes tend to resist changes (Demailly, 2009).

Some people assume that networking skills cannot be taught, or classify networking as "soft skills", and therefore less of a contributor to the bottom line. Others see it as career advancement skills rather than a competency that boosts organizational outcomes. Most organizations have been dilatory on establishing an enterprise wide strategy for building networking competency. Not only private corporations are embracing these initiatives,government's leaders have also joined the efforts and understand the necessity. What really distinguishes high performers from the rest is their ability to maintain and leverage personal networks and willingness to adopt new changes (Baber & Waymon, 2010).

Results

It has been demonstrated that social network, along with the benefits it provides in terms of communication, empowerment and organizational structure positively impacts the social capital of an organization and therefore its performance. It is important to keep in mind that all organizations are different, even if their hierarchical structures are similar. For this reason the extent to which social network technologies integrate in a work environment depends on the flexibility of the industry, and the disposition and interest of management to create an agile work environment. The successful integration of the three constructs with the help of technology resources will bring empowerment, better communication

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channels and competitive advantage to the organization. This will positively influence the company's social capital and enhance their overall performance in a positive way.

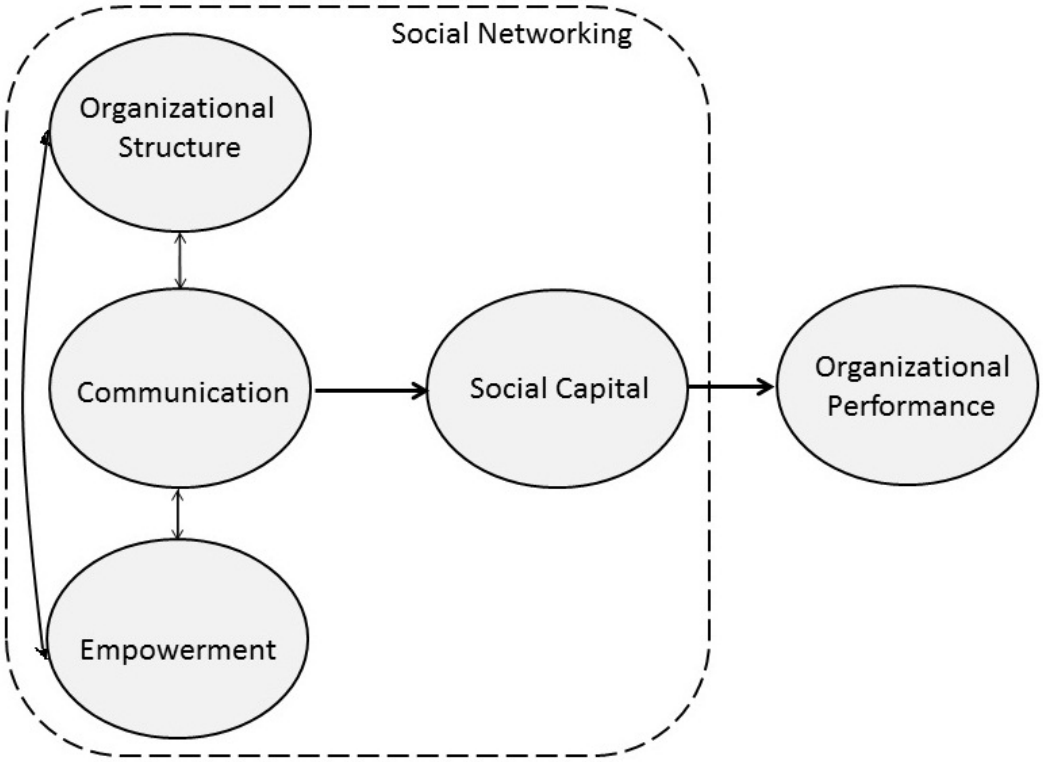

Figure 4: Conceptual Framework

A successful organization must face and accept changes if they want to survive and stay competitive. Social Networks provide a framework that helps companies expand its collaboration resources. The evolution of Social Network Sites (SNS), along with Information and Communication Technologies (ICT) has opened a wide world of alternatives to enterprises looking for innovative ways of intra-organizational communication, in a way that employees feel part of the company. Due to its easiness in use and fast response rate, social networks fit perfectly in organizational environments that promote collaboration and communication across all the hierarchical levels. Having empowered and motivated employees with the right information is critically important for companies that pursue a competitive advantage.

The benefits a company can obtain from effectively implementing social networks outweigh its risks. Because of this, organizations must do what is necessary to adapt social networks in their organizational culture. Policies and procedures must be implemented to ensure proper use of this technology and maximize its benefits. Organizations that ignore these technological trends face the risk of staying behind or disappear.

Concluding Remarks

This work presented a model to study the relationships between social networking, human capital and firm's performance. The study was conducted through literature review with a systematic discussion of

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arguments and propositions. Through this research, we have determined three key constructs (communication, empowerment and organizational structure), which have a close relation with social networks and a positive effect on organizational performance.The use of social networks, however have detractors. Future studies should analyze if exists negative implications of social networks in a company's performance and social capital. This study is focused in internal factors of human capital and organizational performance.Other studies can be conducted to analyze external factors of social networks such as brand building, product promotion and customer service, and their impact to the company's performance.

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County-of-Origin and Purchase Intensions of Ethnocentric Customers

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Abstract

This paper woks on the relationship between COO and Ethnocentrism and COO effect on the Purchase decision. Study also determines the effect of demographic variables on Ethnocentrism. Data was collected via survey from customers in four cities of Pakistan. Consumer ethnocentrism was measured by CETSCALE. Results demonstrated that COO does effect the purchase decision of customers for selected categories of products. Demographic variables have effect on the ethnocentrism mean score and ethnocentrism is related to COO. Model is testing only COO effect on purchasing and hence a single cue study. In future study this limitation can be removed by adding other extrinsic cues like price etc. As the study considers just the products, same study can be replicated for services sector also. As the sample size is smaller, it can be increased for generalizing the results. Finding helps in understanding the Consumer Behaviour in Pakistan and for MNEs, it provides guideline to enter in Pakistani market.

Keywords: Ethnocentrism, Country of origin, Pakistan, Consumer behaviour, Demographic Variables

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Introduction

With the Globalization, international trade has also been increased across the nations. With Globalization, made in different countries products are available in the market and now customer have the wide variety of choices to select the products from domestic and foreign products. This phenomena makes the study of consumer attitude more important to be studies (Netemeyer et al., 1991).COO is a multi-dimensional concept (Parameswa et al, 1994), with dimensions of technological, political, economic and social (Martin et al, 1993).

COO is mostly used in combination with other extrinsic cues as well as with intrinsic product cues. COO effect is not static and it keep on changing with time. Darling and Wood (1990) studies proves the COO's dynamic nature. There are certain factors which determines the important of COO. These factors includes brand name (Jo et al, 2003), Consumer home country (Okechuku, 1994), country of corporate ownership (Thekor&Lavack, 2003) and time (Darling & Wood, 1990). COO effect is product specific and depends on the technology, familiarity, degree of availability and ethnocentrism (Han, 1990). COO image is related to only product image but not overall image of the country(Roth and Diamantopoulos, 2009).

Various studies results that COO is rooted in consumer ethnocentrism (Lantz and Loeb, 1996; Lee and Ganesh, 2000). The concept of consumer ethnocentrism origin can be traced back to the work by Sumner (1906), (Cited in Balabanis and Diamantopoulos, 2004), who introduced ethnocentrism as a general

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construct. Sumner emphasized that consumer ethnocentrism is of dichotomous structure in which customers favourable attitude toward the in-groups or toward their own group members and have unfavourable attitude toward out-groups or towards the people which are not in his group.

Literature Review

Consumers perceives the products on the basis of both intrinsic and extrinsic information of the product (Ulgado & Lee, 1998). These extrinsic cues are helpful in decision making of customers (Marchant and Ward, 2003). Country of origin effect is concern with the customers perceptions that how they perceives products from certain country (Chinen et al., 2000) and Country-of-Origin (COO) is the "overall perception consumers form of products from a particular country, based on their prior perceptions of the country's production and marketing strengths and weaknesses" (Roth & Romeo, 1992). Nagashima (1970) one of the researchers who investigated the COO phenomena defines COO as "the picture, the reputation, the stereotype that businessmen and consumers attach to products of a specific country".

Studies have proven that COO influence the decision making and also product assessment (Solomon, 2004) as the customer believes that product Made in certain country have certain distinguishing features (Roth and Romeo, 1992; Yu and Albaum, 1999). Product type effects the COO effect(Ahmed and d'Astous, 2001) and majority of studies on COO has been on luxury items (Ahmed andd'Astous, 2001; Piron, 2000). COO is also related with product quality (Lusk et al., 2006). COO also has significant implications for business (Laroche et al., 2005).

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Although Systematic research on the country-of-origin effect began since 1965 with the article by Robert Schooler however Williams (1896 cited in O'Shaughnessy, 2000) considered the "Made in Germany" label to be a competitive advantage. But still it has been Schooler (1965) amongst the very first researchers to observe what later on came to be termed as the COO effect. Schooler (1965) named the COO as "foreignness" of a product that make the product less preferable for the consumers in different countries, and stated that the name of the county written on the product effect the evoluation of the product. This holds true for products in general (Anderson & Cunningham, 1972) , for different classes of products (Nagashima, 1977), for any specific specific types of products (Krishnakumar, 1994), and for any specific brands (Gaedeke, 1973).this different evaluation of the product also hold true the product's source countries. The customer evaluates the product according to more developed countries or less developed countries.

Nagashima (1970) used the semantic differential method for compared Japanese and American attitudes toward foreign and domestic products. this study concluded that the level of biasness is different for different countries.Johansson *et al.* (1985) used multi-cue method to examining the impact of COO effect. They used 13 different cues at the same time. The conclusion of that study was "country of origin effects may be less significant than has generally been believed, and they may occur predominantly in relation to evaluation of specific attributes rather than overall evaluations".Papadopoulos (1993) made a significant contribution to the country-of-origin literature by criticising the concept of country-of-origin

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as being narrow and misleading, since it assumes asingle place of origin for a product when a product may well be manufactured in one country but designed, assembled, branded etc in another country. Papadopoulos (1993) proposed the "Product Country Image".From the start COO concept, the COO effects have been the involved in number of studies. Most of these studies concluded that COO does affect product evaluation (Bilkey and Nes, 1982; Thakor and Katsanis, 1997).

Demographic variables played important role for determining the effect of COO. E.g. Male and female evaluates the products differently (Wall and Heslop, 1989; Wall *et al.*, 1989). Evanschitzky et al. (2008) argues that when COO and demographic variables are combined together, they explain the buying behavior towards foreign against the domestic products.Researches shows that older people are biased towards the foreign products as compare to less aged people (Bailey and Pineres, 1997; Smith, 1993).Different results has been shown by different researches for Education factor.). Imported products are favored by the higher income group people (Wall *et al.* 1990).

Various studies results that COO is rooted in consumer ethnocentrism (Lantz and Loeb, 1996; Lee and Ganesh, 2000). The concept of consumer ethnocentrism origin can be traced back to the work by Sumner (1906),(Cited in Balabanis and Diamantopoulos, 2004), who introduced ethnocentrism as a general construct. Sumner emphasized that consumer ethnocentrism is of dichotomous structure in which customers favourable attitude toward the in-groups or toward their own group members and have unfavourable attitude toward out-groups or towards the people which are not in his group.

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Sharma et al. (1995) and Rawwas and Rajendran (2006) demonstrated that consumer ethnocentrism may lead to underestimation of specific attributes and overall quality of foreign products or overestimation of domestic products. Watson and Wright (2000) argues that postulated that Consumer ethnocentrism's specific attributes along with overall quality of the product can provide an explanation as to why consumers prefer domestic over foreign products even when there is no obvious reason for such a preference .

Furthermore, Balabanis and Diamantopoulos (2004) argued that similarity between countries of origin in terms of culture and level of economic competitiveness is unrelated to preference or rejection of foreign products. They found that Consumer ethnocentrism is sometimes negatively related to preferences for foreign products, yet it is mostly unrelated, leading to the conclusion that, overall, Consumer ethnocentrism is a more consistent predictor of preferences for domestic products rather than for foreign products. In other words, Consumer ethnocentrism leads to consumers preferring domestic products but not necessarily rejecting foreign ones.

CE and COO effect

Lantz and Loeb (1996) used the social identity theory on Canadian and American customers to study the relationship of ethnocentrism and country-of-origin. Social identity theory is defined as "that people feel a desire and propensity to build a positive identity for themselves which may be manifested by their

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identification with various groups" (Tajfel, 1981), groups which may include family, friends, the community, race, religion or nation. Moreover, Han (1989) found that CE influences the behaviour of Customers significantly. It effect the behaviour indirectly and also directly.

If we look at the definition of Ethnocentrism, we can relate the ethnocentrism to the Social Identity theory. Ethnocentrism involves the in-group and out-group orientation where the in-group is preferred and is seen in opposition to others (Lantz and Loeb, 1996). The nation is the in-group of interest as regards the country-of-origin effect and the threat to the in-group is of an economic nature, given the heightened level of international competition due to the globalization of the world economy. Verlegh (1999) argues that for studying the COO, the social identity theory provides the social psychological perspective although the Ethnocentrism depends upon individuals and greaterly depends upon the situational factors, it is usually regarded as a salient aspect of the self.Supphellen and Rittenburgh (2001) found that if the foreign product has better attributes, even the ethnocentric customer are forced to purchase them. According to Supphellen and Rittenburgh (2001), factor in purchasing is not the COO.

Conceptual Model

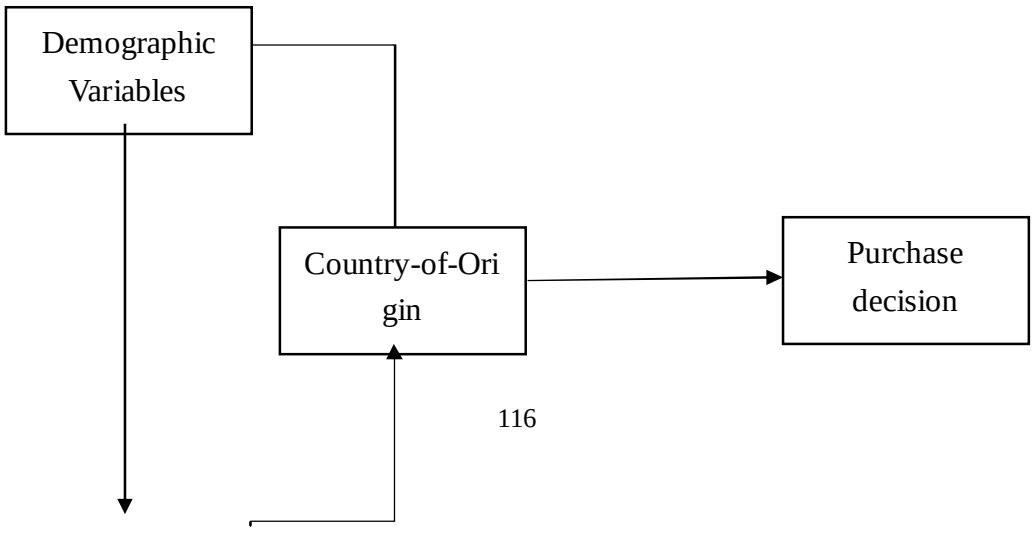

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Figure 1.1, Conceptual model. Source: Self Constructed.

According to conceptual model, demographic variables effects the COO as well as to Ethnocentrism and ethnocentrism is related to the COO. COO effects the purchase decision of customers.

Study Methodology

Methodology is "a way of thinking about and studying social reality" (Strauss & Corbin, 1998). According to Oliver (2004), "methodology is that part of the research process that shows the approaches and ways of collecting data, but it very much depends on the research paradigm adopted."

The study is conducted in Pakistan with data gathered from four major cities of Pakistan i.e. Islamabad, Lahore, Peshawar and Abbottabad with data gathered from Customers. To get the data of our research, combination of two scales was used. For COO effect, scale of Ghazali, at al. (2008) was used and for measuring ethnocentrism, Consumer Ethnocentric Tendencies Scale (CET-SCALE), introduced by Shimp and Sharma (1987) was used. Both were converted to 5-point liker Scale. Three different products categories were selected. The first category was of fabrics and clothing, Electronic products and Cosmetic products. Selection of foreign countries was on criteria that those countries product available in market and consumers have experience of using the products from those countries.

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For fabrics and clothing countries selected are Pakistan, China, USA, India and Korea. For Electronic products, countries includes Pakistan, Japan, Germany**,** Malaysia and China. In the category of Cosmetics products, countries were Pakistan, India, China, Malaysia andUSA were selected on the basis of foresaid criteria.

Questionnairewere translated into Urdu and to remove any errors they were again translated to English. They were also Protested in order to get rid of any error. Two step sampling technique was used to. In first step, ProportionateGeographical Sampling technique was adopted with each city assigned 25% of quota and in second step sample (Customer) were randomly selected. Total of 240 questionnaire were distributed and 178 were return fully completed which makes it 78% of response rate.

Hypotheses:

Hypothesis for the study are:

Studies have shown that COO effects the customers in number of ways and can influence their purchasing intentions (Kaynaket al., 2000; Li et al., 2000; Huddleston et al., 2001). Upon this argument, hypothesis is:

H1: Country-Of-Origin may have significant and positive influence on product purchase decision for Pakistani Customers.

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Literature is rich with COO research and its effect on other variables and other variables research on it. Sharma et al., (1995) proposed that COO and ethnocentrism are highly related. Watson and Wright (2000), talks about similar culture and it effect on purchasing etc. upon these argument, our second hypothesis is:

H2: Country-Of-Origin is positively related to Ethnocentrismfor Pakistani Customers.

Watson and Wright (2000), and Sharma et al. (1995) found that demographic variables are related to consumer ethnocentrism and on the basis of subgroups in demographic variables, CE scores differs. So our last hypothesis is:

H3: Ethnocentrismrelated to consumers' age, gender, education and incomefor Pakistani Customers**.**

Hypotheses Testing

To test the hypothesis, different test were conducted. Details of hypotheses testing is given below.

To check the first and second hypothesis i.e. "Country-Of-Origin may have significant and positive influence on product purchase decision for Pakistani Customers" and "Country-Of-Origin is positively related to Ethnocentrismfor Pakistani Customers", Spearman's correlation coefficient analysis between ethnocentrism, COO and purchasing intentions of all the three products was analyzed. Table 1.1 shows

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the significant correlation results of COO with different countries products i.e. fabrics, electronics and Cosmetics product (Correlation tables for Ethnocentrism and three selected categories of products are shown in table 1.2, 1.3, 1.4 and 1.5).

Table 1.1, Correlation result of COO with other variables (Significant Only).

Variables	Ethnocentrism	Fabrics_pak	Electronics_Japan	Cosmetics_USA
COO	0.615**	0.164*	0.188*	0.348**

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

**. Correlation is significant at the 0.01 level (2-tailed).

Results shows that COO shows significant correlation with Pakistan_Fabric variable where r=0.158. It's been positive correlation between these two variables the people who look for the COO information, when they purchase the Fabrics they look for Pakistani Fabrics. The results also demonstrated that there is moderate and positive correlation between COO and Electronics_Japan where r=0.206. There is positive but moderated significant correlation of COO with purchase intention of Cosmetics from USA where r=0.336, where as the correlation of COO and Ethnocentrism is significant, positive and strong. So COO is strongly effected by the ethnocentrism. So. H1 and H2 are accepted. These findings are similar to finding of Ghani et al., (2007) on research in Pakistan.

For H3, four independent One way ANOVA test are conducted, the results of those tests are:

Ethnocentrism and Age

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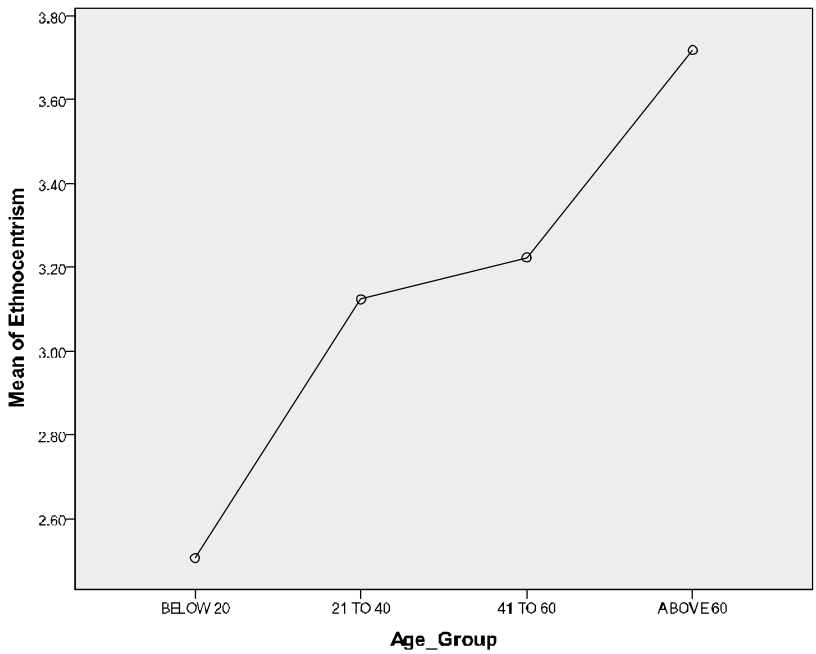
Significant results are found in the mean ethnocentrism and different. Significant different lies between people of age 21to 40 years and people of age below 20 years of age. Another significant difference lies between the people of age 41-60 and below 20 years of age. The last but most prominent difference is in among the people of age above 60 with below 20 years age people. Results are shown in Table 2.5.

Graph 1.1, Age Group and Ethnocentrism, Source: Survey Data (2011)



Ethnocentrism and Gender

For gender differences, the female are more ethnocentric but no significant difference was recorded. Male mean is 3.06 and female mean is 3.17. graph shows the values of ethnocentrism on the basis of gender. Also results are shown in Table 2.6.

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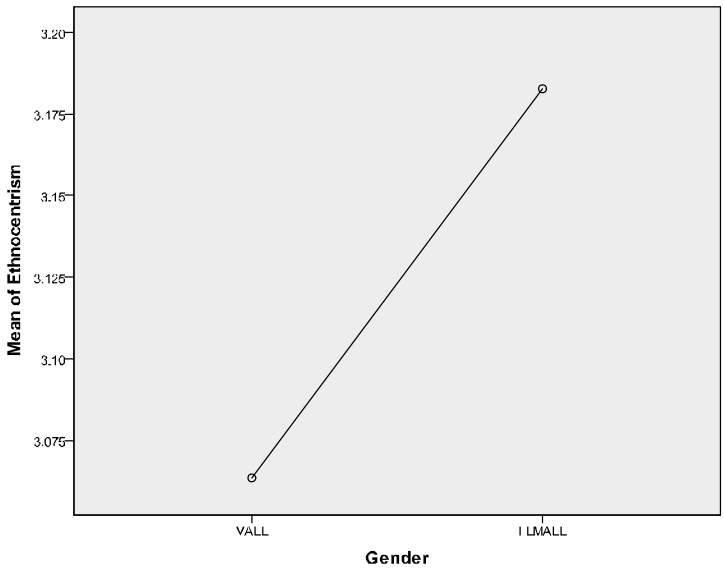
Graph 1.2, Gender and Ethnocentrism, Source: Survey Data (2011)



Ethnocentrism and Education

Significant results were found for education. People with less than 10 years of education (below metric) were having significant difference with all other groups where as people with metric have significant difference with people having education of M.Phil and PhD or above. People having 12 years of education (HSSC) shows significant mean difference towards people having education of M.Phil and PhD or above. significant mean difference is found between graduated people and PhD or above educated people. Same hold true for Master people. Graph shows the results. Results are also shown in Table 2.7.

Graph 1.3, Education and Ethnocentrism, Source: Survey Data (2011)

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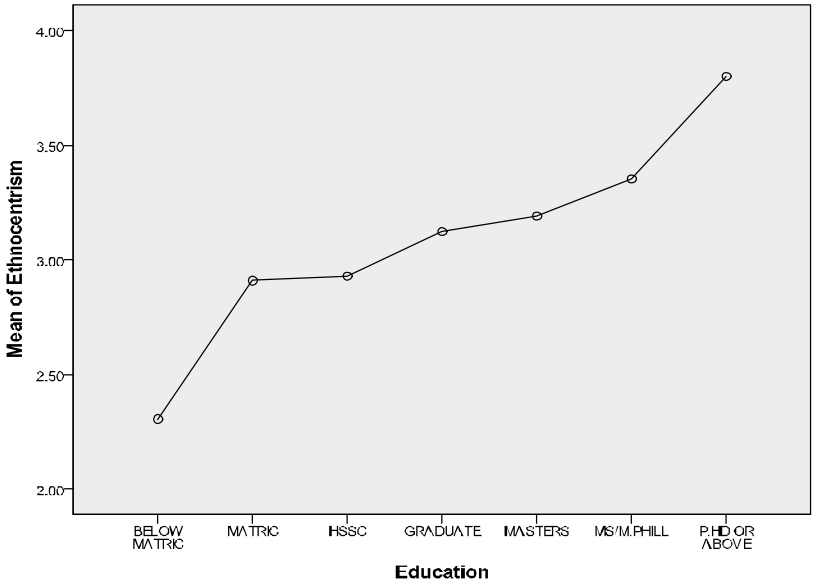

These findings are aligned with the finding of Watson and Wright (2000), and Sharma et al. (1995).

Ethnocentrism and Income

Significant results were obtained from one-way ANOVA test. The mean difference on the basis of Ethnocentrism between the groups of 41000 to 60000 PM income people with below 20000PM income people. People of income 81000-100000 shows difference to people of income below than 20000 and with income of 21000-40000PM. Same results are shown by the people having income of above 100000PM. Table 2.8 shows the results.

Graph 1.4, Income and Ethnocentrism, Source: Survey Data (2011)

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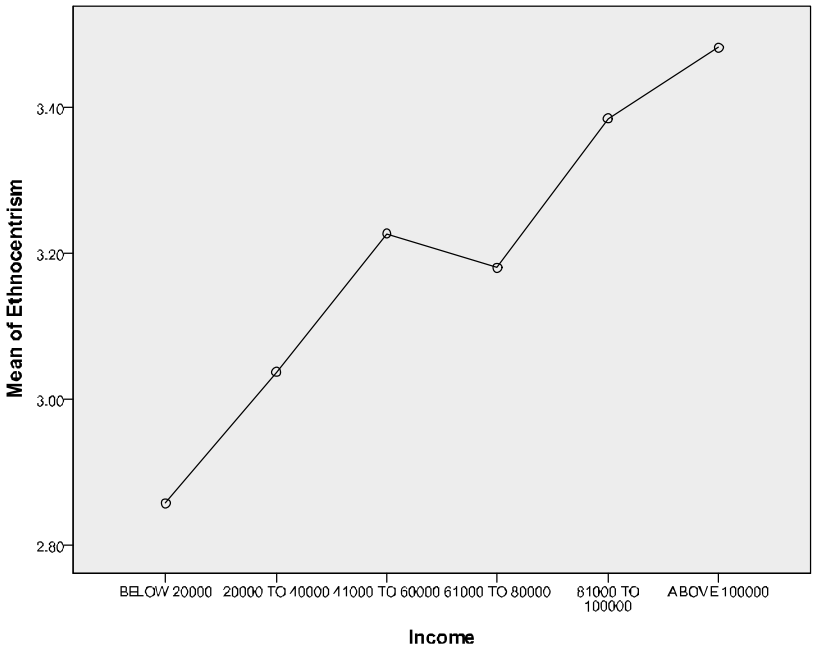

Findings of the study

Study found that people with high COO scores preferred different products from different countries. They like the Fabrics made in Pakistan, electronic products made in Japan and Cosmetic of USA. Study also found effect of demographical variables on Ethnocentrism.COO and ethnocentrism are found to be significantly correlated.

Implication

The study helps in understanding the COO and ethnocentrism phenomena with implications on Pakistani customers. The relationship between the ethnocentrism and demographic variables is also studies in detail.

Study results in finding that CO is important factor in purchase decision so manufacturing units should be shifted to the place to cash COO effect. Study also helps new MNEs in entering Pakistani markets.

As ethnocentrism effects the COO and ethnocentrism itself is effected by demographic variables, so

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organizations have to consider Ethnocentrism and demographic variables in making communication and segmentation strategies.

Limitation and Future research

Model is testing only COO effect on purchasing and hence a single cue study. In future study this limitation can be removed by adding other extrinsic cues like price etc. As the study consider just the products, same study can be replicated for services sector also. As the sample size is smaller, it can be increased for generalizing the results.

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Tables

Table 1.2, Correlations COO and Ethnocentrism, Source: Survey Data (2011)

		COO	Ethnocentrism
COO	Spearman Correlation	1	
Ethnocentrism	Spearman Correlation	.615**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.3, Correlations COO and Fabrics products, Source: Survey Data (2011)

		COO	Fabrics_Pak	Fabrics_China	Fabrics_USA	Fabrics_India	Fabrics_Korea
COO	Correlation	1					
Fabrics_Pak	Correlation	.164*	1				
Fabrics_China	Correlation	.138	.363**	1			
Fabrics_USA	Correlation	.102	.136	.419**	1		
Fabrics_India	Correlation	.061	-.060	.291**	.582**	1	
Fabrics_Korea	Correlation	.084	-.111	.288**	.599**	.756**	1

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

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.3, Correlations COO and Electronics Product, Source: Survey Data (2011)

	COO	Electronics_Japan	Electronics_Germany	Electronics_Malaysia	Electronics_Pak	Electronics_China

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COO	Correlation	1					
Electronics_Japan	Correlation	.188*	1				
Electronics_Germany	Correlation	.069	-.053	1			
Electronics_Malaysia	Correlation	-.067	.247**	-.251**	1		
Electronics_Pak	Correlation	-.086	.186*	.110	.015	1	
Electronics_China	Correlation	-.058	-.057	.057	-.094	.418**	1

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

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.4, Correlations COO and Cosmetics Product, Source: Survey Data (2011)

		COO	Cosmetics_Pak	Cosmetics_India	Cosmetics_Malaysia	Cosmetics_China	Cosmetics_USA
COO	Correlation	1					
	Sig. (2-tailed)						
Cosmetics_Pak	Correlation	.014	1				
	Sig. (2-tailed)	.851					
Cosmetics_India	Correlation	-.100	.305**	1			
	Sig. (2-tailed)	.185	.000				
Cosmetics_Malaysia	Correlation	.014	.409**	.480**	1		
	Sig. (2-tailed)	.853	.000	.000			
Cosmetics_China	Correlation	.059	.308**	.393**	.551**	1	
	Sig. (2-tailed)	.433	.000	.000	.000		
Cosmetics_USA	Correlation	.348**	.129	.082	.123	.259**	1
	Sig. (2-tailed)	.000	.086	.277	.101	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.5, Multiple Comparisons, Source: Survey Data (2011)

(I) Age_Group	(J) Age_Group	Mean	Std.	Sig.	95% Confidence Interval

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		Difference (I-J)	Error		Lower Bound	Upper Bound
BELOW 20	21 TO 40	-.61834*	.13389	.000	-.8826	-.3541
	41 TO 60	-.71779*	.16334	.000	-1.0402	-.3954
	ABOVE 60	-1.21254*	.19725	.000	-1.6019	-.8232
21 TO 40	BELOW 20	.61834*	.13389	.000	.3541	.8826
	41 TO 60	-.09945	.11812	.401	-.3326	.1337
	ABOVE 60	-.59420*	.16180	.000	-.9135	-.2749
41 TO 60	BELOW 20	.71779*	.16334	.000	.3954	1.0402
	21 TO 40	.09945	.11812	.401	-.1337	.3326
	ABOVE 60	-.49475*	.18691	.009	-.8636	-.1258
ABOVE 60	BELOW 20	1.21254*	.19725	.000	.8232	1.6019
	21 TO 40	.59420*	.16180	.000	.2749	.9135
	41 TO 60	.49475*	.18691	.009	.1258	.8636

*. The mean difference is significant at the 0.05 level.

Table 1.6, Multiple Comparisons, Source: Survey Data (2011)

(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BELOW MATRIC	MATRIC	-.60343*	.26402	.024	-1.1246	-.0823
	HSSC	-.62477*	.22872	.007	-1.0763	-.1733
	GRADUATE	-.81596*	.21636	.000	-1.2430	-.3889
	MASTERS	-.88388*	.21552	.000	-1.3093	-.4585
	MS/M.PHIL	-1.04593*	.23197	.000	-1.5038	-.5880
	P.HD OR ABOVE	-1.49489*	.32392	.000	-2.1343	-.8555
MATRIC	BELOW MATRIC	.60343*	.26402	.024	.0823	1.1246
	HSSC	-.02134	.20324	.917	-.4225	.3798
	GRADUATE	-.21252	.18923	.263	-.5860	.1610
	MASTERS	-.28044	.18826	.138	-.6521	.0912
	MS/M.PHIL	-.44249*	.20689	.034	-.8509	-.0341
	P.HD OR ABOVE	-.89145*	.30646	.004	-1.4964	-.2865

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HSSC	BELOW MATRIC	.62477*	.22872	.007	.1733	1.0763
	MATRIC	.02134	.20324	.917	-.3798	.4225
	GRADUATE	-.19118	.13570	.161	-.4590	.0767
	MASTERS	-.25910	.13435	.055	-.5243	.0061
	MS/M.PHIL	-.42115*	.15940	.009	-.7358	-.1065
	P.HD OR ABOVE	-.87012*	.27663	.002	-1.4162	-.3241
GRADUATE	BELOW MATRIC	.81596*	.21636	.000	.3889	1.2430
	MATRIC	.21252	.18923	.263	-.1610	.5860
	HSSC	.19118	.13570	.161	-.0767	.4590
	MASTERS	-.06792	.11202	.545	-.2890	.1532
	MS/M.PHIL	-.22997	.14110	.105	-.5085	.0485
	P.HD OR ABOVE	-.67893*	.26651	.012	-1.2050	-.1529
MASTERS	BELOW MATRIC	.88388*	.21552	.000	.4585	1.3093
	MATRIC	.28044	.18826	.138	-.0912	.6521
	HSSC	.25910	.13435	.055	-.0061	.5243
	GRADUATE	.06792	.11202	.545	-.1532	.2890
	MS/M.PHIL	-.16205	.13980	.248	-.4380	.1139
	P.HD OR ABOVE	-.61101*	.26582	.023	-1.1357	-.0863
MS/M.PHIL	BELOW MATRIC	1.04593*	.23197	.000	.5880	1.5038
	MATRIC	.44249*	.20689	.034	.0341	.8509
	HSSC	.42115*	.15940	.009	.1065	.7358
	GRADUATE	.22997	.14110	.105	-.0485	.5085
	MASTERS	.16205	.13980	.248	-.1139	.4380
	P.HD OR ABOVE	-.44896	.27932	.110	-1.0003	.1024
P.HD OR ABOVE	BELOW MATRIC	1.49489*	.32392	.000	.8555	2.1343
	MATRIC	.89145*	.30646	.004	.2865	1.4964
	HSSC	.87012*	.27663	.002	.3241	1.4162
	GRADUATE	.67893*	.26651	.012	.1529	1.2050

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	MASTERS	.61101*	.26582	.023	.0863	1.1357
	MS/M.PHIL	.44896	.27932	.110	-.1024	1.0003

*. The mean difference is significant at the 0.05 level.

Table 1.7, Multiple Comparisons, Source: Survey Data (2011)

(I) Income	(J) Income	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
BELOW 20000	20000 TO 40000	-.18007	.12078	.138	-.4185	.0583
	41000 TO 60000	-.36986*	.13184	.006	-.6301	-.1096
	61000 TO 80000	-.32296	.17886	.073	-.6760	.0301
	81000 TO 100000	-.52745*	.13820	.000	-.8002	-.2547
	ABOVE 100000	-.62445*	.16898	.000	-.9580	-.2909
20000 TO 40000	BELOW 20000	.18007	.12078	.138	-.0583	.4185
	41000 TO 60000	-.18979	.13983	.176	-.4658	.0862
	61000 TO 80000	-.14289	.18484	.441	-.5077	.2220
	81000 TO 100000	-.34737*	.14585	.018	-.6353	-.0595
	ABOVE 100000	-.44438*	.17529	.012	-.7904	-.0984
41000 TO 60000	BELOW 20000	.36986*	.13184	.006	.1096	.6301
	20000 TO 40000	.18979	.13983	.176	-.0862	.4658
	61000 TO 80000	.04690	.19224	.808	-.3326	.4264
	81000 TO 100000	-.15759	.15513	.311	-.4638	.1486
	ABOVE 100000	-.25459	.18308	.166	-.6160	.1068
61000 TO 80000	BELOW 20000	.32296	.17886	.073	-.0301	.6760
	20000 TO 40000	.14289	.18484	.441	-.2220	.5077
	41000 TO 60000	-.04690	.19224	.808	-.4264	.3326
	81000 TO 100000	-.20449	.19666	.300	-.5927	.1837
	ABOVE 100000	-.30149	.21939	.171	-.7345	.1315
81000 TO 100000	BELOW 20000	.52745*	.13820	.000	.2547	.8002
	20000 TO 40000	.34737*	.14585	.018	.0595	.6353
	41000 TO 60000	.15759	.15513	.311	-.1486	.4638
	61000 TO 80000	.20449	.19666	.300	-.1837	.5927

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	ABOVE 100000	-.09701	.18772	.606	-.4675	.2735
ABOVE 100000	BELOW 20000	.62445*	.16898	.000	.2909	.9580
	20000 TO 40000	.44438*	.17529	.012	.0984	.7904
	41000 TO 60000	.25459	.18308	.166	-.1068	.6160
	61000 TO 80000	.30149	.21939	.171	-.1315	.7345
	81000 TO 100000	.09701	.18772	.606	-.2735	.4675

*. The mean difference is significant at the 0.05 level.

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The factors of the lack of reimbursement of the microfinance institutions: Empirical evidence in the case of the Tunisian micro- borrowers

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Abstract

This research studies the relevance of explanatory factors of the lack of reimbursement in microfinance conceived on the side of the socio-economic and demographic characteristics of the micro-borrowers. In fact, these factors have generally been little discussed in the literature. This research, falls under this objective to explore the context of the microfinance as regards lack of reimbursement and to find solutions to minimize this risk of insolvency. In other words, the issue is connected to the identification of the influence of the characteristics specific to the micro-borrowers on the probability so that an individual carries out a lack of reimbursement.

To study the determinants of the reimbursement rate of the micro-borrowers, this paper is divided into three principal parts. First of all, on the basis of the theoretical framework, we will focus ourselves particularly, on the explanatory factors of the lack of reimbursement in microfinance which are related to the particular characteristics of the micro-borrowers, and we will try also to formulate the fundamental assumptions of our research. Then, we will discuss our sample and our results of estimates in order to treat our fundamental question of research. At this level, we will try to empirically analyze the validity of the assumptions by the presentation and the analysis of the principal results, in order to identify the explanatory factors of the lack of reimbursement on the side of the micro-borrowers.

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Keywords: lack of reimbursement, microfinance, micro-borrower, Tunisia.

1. The problems of lack of reimbursement on the side of micro-borrowers and the formulation of hypotheses

The theoretical literature shows that, the microfinance is a tool to eradicate poverty. This discipline made proof, through various approaches, of its capacity to provide financial services for populations excluded from traditional finance (Vincent, 2005). However, Microfinance provides examples of successes but remains also distinguished by certain cases of bankruptcies, (Sharma and Zeller., 1997[7]). In fact, the evaluation of the situation of refunding of the micro-borrowers passes by the evaluation of their particular characteristics which influence the probability of realization of a lack of reimbursement (M. Jonathan, 1999).

The objective of this paragraph is to identify the influence of the factors related to the particular characteristics of the micro-borrowers on the lack of reimbursement. Then, it is necessary through this work to stop on this idea and to examine the explanatory factors of the lack of reimbursement of the micro-borrowers. Indeed, many empirical researches found a relation between several variables characterizing the micro-borrowers with the lack of reimbursement. This makes it possible to put the characteristics of the micro-borrowers at the center of attempt in our research. Therefore, it is important to categorize the micro-borrowers according to the factors affecting refunding and to define a standard profile of solvent micro-borrowers.

Thus, while wondering about the influence of the particular characteristics related to the micro-borrowers on the probability of the lack of reimbursement, consulted research show that they interact differently according to the area and the person. For that, the field of research suggests a classification of research according to the demography, professional experience or the socio-economic

[7] The analysis of Sharma and Zeller (1997) and Godquin (2004) show that, the probability of no payment increases with the size of the loan granted to the borrower.

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origin. At this level, Zghal (2004) proposes an application of research to specific groups of micro-borrowers. The specification of a group is done according to a whole of characteristics such as age, gender, formation, location, marital status, branch of industry, nature of the project, number of dependent children, the amount of loan etc…

In its structure, the lack of reimbursement is bad for the microfinance institution as for the *micro-borrower*. It is a phenomenon to be avoided, (Elizabeth Littlefield and Rosenberg, 2004). For this reason, many studies continue to concentrate on the factors which influence such a defect, (Shaw. J., 2004).

1.1. Problems involved in the socio-economic characteristics of the micro-borrowers

In what follows, we base ourselves on the follow-up of the micro-projects, geographical area, amount of the loan , branch of the industry, nature of the project and the distance between the institution and the residence of customer as crucial factors of the socio-economic characteristics being able to condition the defect of refunding.

1.1.1. The follow-up of the micro-projects

Honlonkou and al. (2001), Khandker (1998), Meehan (2000) have leads to the results according to which the lack of follow-up of the financed projects, inappropriate periods of withdrawal, diversion of the appropriations to the consumption or the refunding of the usurers and the perception of the public financing called "cold money" are all assimilated as a deciding factors of a lack of reimbursement of the microcredit. Moreover, Honlonkou and al. (2006)[8], Morduch et al. (2002) also showed that, the frequent visits of the personnel of the microfinance institution had a positive impact on refunding. By opposition, Zeller and Meyer (2002) and Maria Nowak (2005), find that the visits of the

[8] Honlonkou and al. (2006), tried to identify certain causality between the defect of refunding and the personal characteristics related to the borrowers of an institution of microfinance.

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personnel of the microfinance institution could involve a rise in the costs of transaction. Consequently, the latter think that, the rise in the costs of transaction is connected to the costs of transport, and it will have a negative impact on the rates of refunding. But the microfinance institution increase its reimbursement rate by the adoption of an adequate supervision after obtaining the credit through the monitoring of the borrower in residence, application of penalty and interest on arrears in the event of no refunding; dissuasive suggestions such as the publication of photographs and names of the failing ones and sending a letter of congratulations at the end of refunding (Zeller and alii, 1998; M. Sharma M., 1998; Zaman., 2000).

1.1.2. The geographical area

With regard to the relation between the geographical area of the micro-borrower and the lack of reimbursement, Servet (2006) and Sajeda et al. (2003), find that the risk of no refund of a microcredit depends also on the geographical establishment of the concerned project. In the rural zones in particular, the borrowers can be far away from the counters of the microfinance institution.

More significant this distance is, more the risk of credit is high insofar as the follow-up of the loan is less rigorous because of the generated cost. Moreover, according to Morduch (2005) in rural areas, the financing of the agricultural projects assume specific risks related to the economic and naturalness context. We can conclude that, the urban zone decreases the probability of lack of reimbursement. Moreover, by studying the influence of the geographical expansion on banking efficiency, F. Bedecarrats and R. Marconi (2009) show that, it is more delicate to remotely control the micro-projects which are geographically outdistanced compared to the seat. Indeed, when microenterprises are located far from the microfinance institution or from their seats, the cost of information would increase the costs of communication and travel for the two parts. However, in many configurations the microfinance institution seeks the customers in more moved away geographical areas because the recipients of microcredit do not have bank accounts and thus they must move to refund.

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1.1.3. The amount of the loan

An additional determinant of the defect of refunding in microfinance, is related to the amount of the loan. Therefore, we note that while trying to identify the causes of unpaid through the synthesis of several studies, (Honlonkou and al., 2006 and Morduch and al, 2002) we have found that the insufficiency of the amounts of credit to finance the projects is an important factor of a bad performance of refunding. In the same way, Sharma and Zeller (1997) found that the coefficient of the amount of the loans is significant and negative. This result was also confirmed by M. Labie and M. Mees (2005) and M. Labie M. and J. Sota (2004, p.19). Indeed, the negative sign is theoretically explained by the fact that the amount of the loans increases the profit associated with the moral risk. However, V. Hartarska and D. Nasdolnyak (2007) showed that, the majority of the not refunded loans with maturity were completely refunded a year later. In this context, the moral risk is interpreted as the choice of a project with a longer maturity (and a higher awaited value) than that of the loan rather than the choice of a riskier project. The negative sign relating to the amount of the loan can also be associated with the problems whose borrower can face to refund a higher amount over a given period (usually a year). It may be that for a given maturity, the loans of significant size do not meet with the requirements of the borrowers and are not appropriate to the local economy (R. Mersland and R. Strøm, 2008; 2009).

For a particular borrower and a duration of a given loan, it is shown (Lhériau, 2005, p.23-24) that, the probability of refunding decrease with the size of the loan. The speed of the evolution of the probability of no refund with the size of the loan changes according to the initial equipments of the borrowers and the costs which they associate with the strategies of moral risk and the strategic defect. In addition, the microfinance institution cannot reach a perfect rate of refunding on the basis of the several inciting mechanism. In order to not exceed the new target threshold of defect, the microfinance institution will grant higher loans to the borrowers slightly risky (R. CulI, A. Demirguc-kunt and J. Morduch, 2006).

1.1.4. The branch of the industry

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Khawari (2004) identifies other factors affecting refunding in microfinance and they are focused on the bond between the financed branch of the industry , the nature of the project of the micro-borrowers and the lack of reimbursement. We note that, according to their studies, the microfinance institutions finance frequently the activities belonging to the innovating sectors in the service, small trades, craft industry and agriculture. Indeed, Ndimanya (2002, p.14), Honlonkou et al. (2006) found that, the percentage of credit allocated with agriculture influences negatively the performance of refunding. This idea can be explained by the threats attached to the rain agriculture. This result justifies the weak engagement for the financing of the agriculture.

M. Zeller and M. Sharma (1998) led a study on the performances of refunding in Bengladesh and showed that the reimbursement rate is high when the borrower not considering agriculture as a principal activity. Moreover, Zeller (1994) analyzed the rationing of credit by proving that it is dependent on a whole of determinants such as in particular the branch of the industry to be financed. This author also recommend that the needs and the risks change according to the branch of the industry of the borrower. At this level, M. Zeller, G. Schrieder, J. von Braun and F. Heidhues (1993) stipulate that, the agricultural loans are risky, expensive and are particularly difficult to set up. Contrary, M. Zeller, G. Schrieder, J. von Braun and F. Heidhues (1997) think that the practice of the breeding combined with agriculture increases the risks and makes dubious the probability of refunding. The results of their studies confirm that these two activities which are more exposed to the risks affect negatively the rates of refunding. In the same way, Sharma and Zeller (1998) discovered also that the number of years of experiment of the borrower in agriculture had a negative impact on the capacity of refunding. Lastly, more the borrower is old, less he is innovating and this impact is close with that to the age of the owner.

A. Honlonkou, D. Acclassato and V.C. Quenum (2001) discovered on that on the side of the borrower, the possession of equipment, approximated by the level of richness exerts a positive effect on the performance of refunding. The level of richness of the owner is also conditioned by the possession of domestic animals being able to be easily resold. In addition, the practice of the breeding

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would have a positive influence on the capacity of refunding.

1.1.5. The nature of the project

With regard to the relation between the nature of the project of the borrower and the delay of refunding, we note that the executives of the institutions of microfinance consider that the projects of creation are profitable projects, and they indicate that, the projects of extension are associated with a reimbursement rate more than for creation.

1.1.6. The distance between the institution and the residence of the customer

By examining the relation between the distance separating the bank from the borrower and the lack of reimbursement, B. Coleman (2006) showed that the effect of this distance is positive for the men and negative for the women. The negative result of the female gender can be explained by the absence of means of displacement of the latter. This report will have negative repercussions materialized by weak contacts with the cases and therefore, the no respect of their engagement. Later, A. Honlonkou and al. (2006) show that the distance of the borrower from his case could negatively affect refunding. The positive influence of the distance between the microfinance institution and the micro-borrower is unexpected, but it can be justified. More the customer is outdistanced more fund administrators seek to ensure sufficient conditions for repayment. This increases the performance of the borrowers to refund. Moreover, the capacities of supervision of the agents of credit charged to collect the funds are higher when the dwelling of the borrower is outdistanced from the bank (Labie, 2004).

The preceding discussion materialized by, the follow-up of the micro-projects, the geographical area, the amount of the loan, the branch of the industry, the nature of the project and the distance between the institution and the residence of the customer, suggest that, these factors influence significantly and positively the lack of reimbursement of the micro-borrowers. Our objective is to check this influence. Consequently, in the light of what was advanced, the subjacent assumption which we will

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test is as follows:

Assumption 1.1: *There is a positive relation between the lack of reimbursement and the socio-economic characteristics of the micro-borrowers represented by, the follow-up of the micro-projects, the geographical area, the amount of the loan, the branch of the industry, the nature of the project and the distance between the institution and the residence of the customer.*

1.2. Problems involved in the demographic characteristics of the micro-borrowers

The problems associated with the demographic characteristics of the micro-borrowers can be concretized by a whole of factors which can assign the lack of reimbursement such as particularly: the gender, the age, the marital status, the number of dependent children, the educational level and the former experiment with the microfinance institution.

1.2.1. The Gender

With regard to the relation between the gender of the borrower and the lack of reimbursement, Gary, Dunford, Wamer Woodworth (1999) showed that the borrowers of female gender do not realize significantly a higher performance of refunding. Even if the coefficient is positive, it is not significant. The fact that on average the women present a probability of defect weaker can be partially justified by the fact that they receive on average smaller loans. Therefore, the gender influences refunding and the men have a tendency to better refund than the women.This result goes against what is usually marked in the literature which supposes that the reimbursement rate of women is definitely higher than those of men because the first appear more disciplined vis-a-vis the expectations of the banks. However, M. Chirwa and Milner J. (1997) noted that, the gender is not a significant factor of the reimbursement rate in the context of Malawi. Moreover, B. Granger (2006) stipulates that, Grameen Bank is had by the poor (particularly and primarily women) whereas, the other banks are had by the rich person (primarily men). In addition, Enda considers that the woman refunds her credit better. G. Vincent (2005) and Hofmann and Kamala (2001, p.9) specify that the programs of microfinance show the wisdom

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of the poor and particularly women who are regarded as excellent recipients and who are sometimes better than the other borrowers (men). Moreover, this criterion can have a higher weight at the time of the arrival of an event: the marriage, death of a husband, divorce, saving or some female activities. The financing of the women seems to be less risky.

At this level, Servet (2006) and Pitt and Khandker (1998) indicate that the women refund better than the men and exploit more the resources of the microfinance to the profit of the family and the children. The authors affirm that does not want to say that the women are poorer than the men but their incomes are lower than those of the men. Consequently, we regard the gender as a determining factor of the defect of refunding.

1.2.2. The age

Concerning the relation between the age of the borrower and the lack of reimbursement, Servet (2006) finds in several investigations that, the young people are compared to very risky borrowers. So the risk of delay decreases with the marriage of the borrower and thus, a married customer is less risky than a single person. In fact, it is the family stability of married which pushes the latter with being powerful in its refunding. It is logical to think that the experiment also plays in the favor of the borrower and thus, to envisage a weaker reimbursement rate for the youngest borrowers. Indeed, this criterion of age was frequently used by the Tunisian Solidarity Bank for the choice of the borrowers (Benarous, 2004). This bank prefers to grant credit to young people and it is a significant criterion insofar as the bank seeks a population of young, courageous, and motivated contractors. Thus, the project constitutes the only guarantee for the banker. It is an objective element and it is a significant index of its profitability. In addition, the criterion of age is significant in the strategy of Enda because the young people have a significant role in the development of the companies of which they are not only the recipients but also, the potential actors.

1.2.3. The marital status and the number of dependent children

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According to the relation between the marital status and the number of dependent children of the borrower and the lack of reimbursement, we note that, the women, more often unmarried, will have a priori fewer guarantees to obtain external financings (S. Brana. 2008). In other words, the marital status of the borrowers can condition the capacities of the latter to refund their loans. More, there are children in the family of the borrower, more this one is insolvent.

1.2.4. The educational level and the former experiment with the microfinance institution

Concerning the relation between the educational level and the former of experiment of the borrower and the lack of reimbursement, we note that the reimbursement rate was influenced by the human capital. Indeed, formal education makes it possible to structure the ways of thinking and to reinforce the cognitive capacities of the active micro-borrower and the future contractor (Y. Hardy, 2007), and it can be assimilated as a significant source of competences, capacity to solve problems, motivation, knowledge, self-confidence, etc…

The accumulation of these competences makes it possible to the individuals to adapt to the new changes such as the taking risk, and to the entrepreneurial act which can lead to a new activity with high added value. Thus, contractors profit from their knowledge and their contacts better generated by the education system to acquire necessary resources and to identify and exploit the occasions of businesses. In other studies, as that of Lasch et al. (2004) the most educated contractors are able to identify and/or to carry out the outputs of these opportunities. In the same way, according to Servet (2006), the majority of the studies on the determinants of the rates of refunding integrate variables related to the educational level and the former experiment of the borrower with his bank. Brigitte Helms (2007) shows that these experiments can contribute to the integration and the accumulation of a new knowledge and also make it possible to the individuals to become more productive and creative and, consequently, more likely to define and structure a new solutions to the existing problems (F. Bthier, S. Larivière and F.Martin, 2004) and to discover and exploit opportunities.

The preceding discussion materialized by the gender, the age, the marital status,

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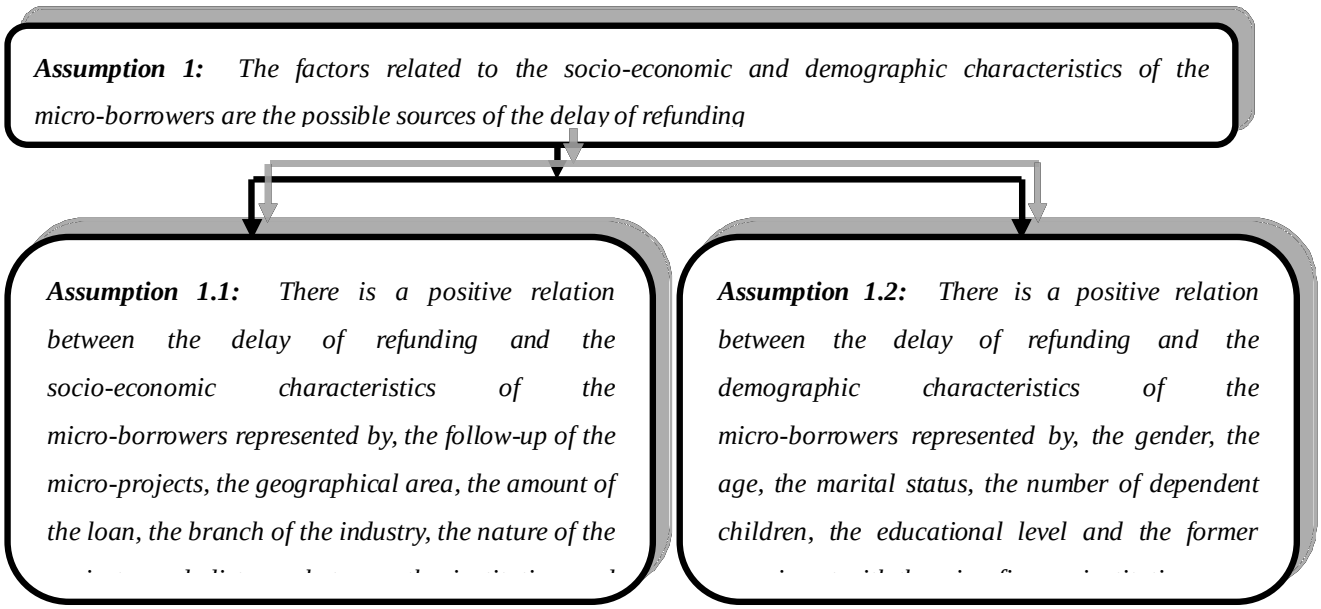
the number of dependent children, the educational level and the former experiment with the microfinance institution, suggests that, these factors influence significantly and positively the lack of reimbursement of the micro-borrowers. Our objective is to check this report. Consequently, in the light of what was advanced, the additional assumption A1.2 that we will test is as follows:

Assumption 1.2: *There is a positive relation between the lack of reimbursement and the demographic characteristics of the micro-borrowers represented by, the gender, the age, the marital status, the number of dependent children, the educational level and the former experiment with the microfinance institution.*

On the basis of the arguments presented above, the conceptual model suggested in this study is presented in following figure:

Figure 1: Factors of the lack of reimbursement from the side of the micro-borrowers



2. The results of the estimates

We formulated a principal assumption (A1) according to which the particular characteristics of the micro-borrowers are the possible sources of the lack of reimbursement. More clearly, the empirical part of this paper has as objective to study the relation between the particular characteristics of the micro-borrowers with the dependent variable, the probability of the lack of reimbursement. With this intention, our primary stage consists in determining the nature of the joint

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effects and the marginal effects of each factor which generates the lack of reimbursement. Thus, we resort to the logistic law whose function of repair is written as follows:

$$F(x) = \frac{\exp(x)}{1+\exp(x)} \quad (1)$$

Concerning the marginal effects of each indicator measuring the particular characteristics of the micro-borrowers, elasticities **βi** of the model are determined by the following formula:

$$\frac{\partial P}{\partial xi} = \beta i * Pr\ (1 - Pr) \quad (2)$$

At this level, the estimators of the parameters **βi,** are those of maximum of likelihood (log likelihood). In addition, we proceeded for the delight of the quality of prediction of the model, to evaluate its quality to predict the values 0 and 1 of the lack of reimbursement. With this intention, we fix a threshold of probability equalizes to 0.5. what gives the two following central assumptions:

A_0: Delay =1 if Delay ≥ 0.5
A_1: Delay =0 if Delay < 0.5

Thus, under the null assumption, the model can be specified with a predicted probability higher than the threshold and consequently the micro-borrowers carry out a lack of reimbursement.

Table n°1: Diagnosis of the quality of the logit model for the probability of the delay of refunding

Classification	**Rate of prediction**
Percentage of good predictions for the bad micro-borrowers (Delay =1)	0.76
Percentage of good predictions for the good micro-borrowers (Delay=0)	0.66

Source: our calculations starting from the data base of microfinance institutions, 2010.

On the basis of the table n°1, our results show that the micro-borrowers carrying out a lack of reimbursement (bad micro-borrowers) are 541 cases out of 710 which were well predicted with a rate of prediction of the model equal to 0.76 (correct forecasts).With

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regard to the micro-borrowers not having a lack of reimbursement (goods micro-borrowers), they are 192 cases out of 289, which have well predicted with a rate of prediction of the model equal to 0.66. Thus, it is relatively a good model and the choice of the logit model seems to be justified in this case. The estimate of this model for purpose unites was carried out according to the maximum of probability, and which gives the following results:

Table n°2: Result of estimate with the dependent variable: Lack of reimbursement

Characteristics of the micro-borrowers	**Joint effects**		**Marginal effects**
	Coefficient	z-stat	Predicted delay = 0.809
Marital status	-0.055	-0.35	-0.009
Branch of industry	-1.03	-1.2	-0.017
Nature of the project	0.14	0.92	-0.024
Former experiment	0.32***	8.23	0.056
Number of dependent children	0.102	1.34	0.017
Amount of the loan	-2.81***	-10.6	-0.48
Geographical area	-0.38	-0.91	-0.065
Distance	0.015*	2.34	0.017
Follow-up of the micro-projects	-0.74***	-4.15	-0.12
Educational level	0.0018	0.02	0.0003
Constant	17.1**	9.4	
Chi-deux	*157.21*		
p-value	*0.0000*		
R2	*0. 22*		

(*), (**), (***) Coefficients respectively significant with the threshold of 10%, 5% and 1%.

The estimates exposed by the table n°2 emphasize the crucial role played by the characteristics of the micro-borrowers in the determination of the reimbursement rate and this idea is consolidated empirically by the presence of an acceptable explanatory capacity of the model (fairly coefficient of determination) and thus, an acceptable quality of adjustment.

This result implies that the variables selected are dependent on the particular characteristics of the micro-borrowers. In other words, we can conclude that this percentage is sufficient as a percentage to explain the qualitative variable. Moreover, the test of total significativity of Chi-square

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shows that, the model is overall significant (p-value=0.000), which makes it possible to reject the null assumption which stipulates that the coefficients are equal to zero.

The results of our empirical investigation show that, on the one hand, the analysis of the effects of the variables relating to the geographical area, the branch of the industry, the nature of the project, the marital status, the number of the dependent children and the educational level of the micro-borrowers , on the lack of reimbursement are not statistically significant.

By opposition, in the case of our sample, the microfinance institution would gain as regards refunding, if it is interested in the visit of the agent to the micro-projects of the micro-borrowers, the amount of the loans granted to the customers, the distance separating the institution from the residence of the micro-borrower and the former experiment with its microfinance institution. Therefore, the microfinance institution can be based on certain criteria more than of others before granting the credit with an aim of increasing the probability of refunding.

For better justifying the choice of the logit model, we have to propose an approximated value of the realization of the estimators of the various parameters of the explanatory variables in the case of a probit model and a simple model for 999 Tunisian micro-borrowers. In this case, the most probabilistic model is that which tests better the significativity of the joint effects of the explanatory variables and also the probability of accepting the assumption of non nullity.

With this intention, one notes that Blinear is the estimator in a linear model and Bprobit is the estimator in a probit model. So the table below summarizes the choice between the three models in question.

Table n°3: Criterion of selection of the logit model

Characteristics of the micro-borrowers	**Estimate using the linear model (Blinear = 0.252BLogit)**	**Estimate using the probit model (Bprobit = 0.63BLogit)**
Former experiment	0.0802	0.2016

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Amount of the loan	-0.70812	-1.7703
Distance	0.0252	0.063
Follow-up of the micro-projects	-0.186	-0.46

Our results affirm the predictive capacities of the logit and linear model in comparison with the two other models and reveal that these two last are skewed and no convergent. This choice is determined on the basis of estimated coefficient and thereafter according to a probabilistic procedure which clearly establishes the no linearity (which must be estimated by the method of the maximum of likelihood as a measure of adjustment) and penalizing the introduction of the additional parameters. At this level, the table shows that, the logit model is very adapted to specify our model as well as possible.

3. Conclusion

The results obtained from this analysis validate our assumption according to which the defect of refunding results from the particular characteristics related to the profiles of the micro-borrowers. Thus, the results show that, the refunding of the microcredit rests on specific characteristics related to the vulnerable micro-borrowers and excluded from the traditional financial system.

This makes it possible to advance possible suggestions and recommendations to improve operation of the microfinance institutions likely to multiply the creation of the micro-projects and especially to support employment and the development in other localizations and branches of industry. Thus, this analysis could lead to strategic actions targeted to precede the constraints which limit the chances of the success of the micro-projects.

It rises from these results in term of track of economic policy, the need to increase the number of visits among micro-borrowers, adopt an adequate supervision after obtaining the

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micro-credit , increase and revise the amount of the loan, evaluate the experiment of the customer in entrepreneurship , take into account the geographical distance between the microfinance institution and the customer.

In spite of the central questions raised by our analysis and relating to the socio-economic and socio-demographic characteristics of the micro-borrowers, it is also important to examine the role of the agent of credit in the reduction in the defect of refunding of the microfinance institution.

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FUZZY TOPSIS APPLICATION FOR SUPPLIER SELECTION PROBLEM

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ABSTRACT:

Supplier selection is an important issue in every business management. Since by deciding the best supplier, companies can reduce purchasing costs and have an economic advantage in the competitive market structure. However deciding the best supplier is complicated as involving several objectives and compromising possible conflicting factors. In addition the uncertainty and vagueness of the experts' opinion is the prominent characteristic of the problem. Therefore an extensively used multi criteria decision making tool TOPSIS is used within fuzzy environment. The proposed technique is applied in a real case and the best supplier is determined. The contribution of this study is not only the application of the Fuzzy TOPSIS methodology for supplier selection problem, but also revealing a comprehensive literature review of multi criteria decision making problems. In addition by stating the steps of Fuzzy TOPSIS clearly and numerically, this study is candidate to be a guide of the methodology to be implemented to other various problem areas in the field of business and economic studies.

Keywords: Supplier Selection, Business Management, Fuzzy TOPSIS, Economic Decisions, Criteria

JEL Categories: C61, C63, L62

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1. INTRODUCTION

Supplier selection, which is the process of finding the right suppliers with the right quality at the right price, at the right time, and in the right quantities, is one of the most critical activities for establishing an effective supply chain. It is noted that, manufacturers spend more than 60% of its total sales on purchased items, such as raw materials, and parts (Krajewsld and Ritzman, 1996). In addition their purchases of goods and services constitute up to 70% of product cost (Ghodsypour and O'Brien, 1998). Therefore, selecting the right supplier significantly reduces purchasing costs, improves competitiveness in the market and enhances end user satisfaction (Önüt et al., 2009). Since this selection process mainly involves the evaluation of different criteria and various supplier attributes, it can essentially be considered a multiple criteria decision making (MCDM) problem (Liao and Kao, 2011).

Basically there are two types of supplier selection problems. In single sourcing type, one supplier can satisfy all the buyer's needs. In the multiple sourcing type, no supplier can satisfy all the buyer's requirements. Hence the management wants to split order quantities among different suppliers (Demirtas and Üstün, 2009).

As a pioneer in the supplier selection problem, Dickson (1966) identified23 different criteria for selecting suppliers, including quality, delivery, performance history, warranties, price, technical capability, and financial position (Jolai et al., 2011). With a thorough literature survey, Weber, et al. (1991) reviewed 74 different articles by classifying into three categories; linear weighting methods, mathematical programming models, and statistical approaches. Following Weber et al. (1991), De Boer et al. (2001), identified four stages for supplier selection including; definition of the problem, formulation of criteria, qualification, and final selection respectively (Boran et al., 2009).

According to one of the last classifications made by Sanayei et al. (2010), there are six classes. These are multi attribute decision making techniques (Analytic Hierarchy Process- AHP, Analytic Network Process- ANP, Technique for Order Preference by Similarity to Ideal Solution- TOPSIS), mathematical programming (Linear Programming- LP, Goal Programming- GP or Mixed Integer Programming- MIP), probabilistic approaches, intelligent approaches (neural networks, expert systems),

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hybrid approaches (AHP-LP, ANP-MIP) and others.

This study is mapped as; reviewing the literature according the different criteria and methods used for this problem in the second part. Part 3 explains the Fuzzy TOPSIS method in detail which is utilized to solve the supplier selection problem of a manufacturing firm elaborated as a case study in the fourth part. Part 5 presents the conclusion and directs for further steps of this study with the references following.

2. LITERATURE REVIEW

As mentioned previously there are comprehensive literature reviews performed before such as Dickson (1966), Weber et al. (1991), De Boer et al. (2001) and Sanayei et al. (2010). However, in this part the studies in the literature are review and classified mainly two clusters as the selection criteria and the methodologies used.

Depending on its importance, both in the academic world and real world applications, there have been many studies using different criteria starting from the Dickson's 23 criteria (Dickson, 1966). In a recent study all the criteria that have appeared in literature since 1966 are summarized suggesting that quality, price, and delivery performances as the most important selection criteria in Table 1 (Liao and Kao, 2011).

Table 1: Supplier Selection criteria literature review (Liao and Kao, 2011)

Selection Criteria	1[9]	2	3	4	5	6	7	8	9	10
Price	✓	✓	✓	✓	✓		✓			
Product Quality	✓	✓	✓	✓	✓	✓	✓	✓		
On time delivery	✓	✓	✓	✓	✓		✓			✓
Warranty and Claims	✓									
After Sales Service	✓					✓				
Technical Support						✓				
Attitude	✓									
Total Service Quality				✓			✓			
Training Aids	✓									

[9] 1, Dickson (1966); 2, Evans (1980); 3, Shipley (1985); 4, Ellram (1990); 5, Weber et al. (1991); 6, Tam and Tummala (2001); 7, Pi and Low (2005); 8, Chen et al. (2006); 9, Lin and Chang (2008); 10, Wang et al. (2009)

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Performance History	✓				✓	✓				
Financial Stability	✓				✓			✓		✓
Location	✓				✓					
Labor Relations	✓									
Relationship Closeness								✓	✓	
Management & Organization	✓				✓					
Conflict Solving Capability						✓		✓	✓	
Communication System	✓								✓	
Response to Customer Request										
Technical Capability	✓				✓			✓		
Production Capability	✓				✓					
Packaging Capability	✓									
Operational Controls	✓									
Amount of past Business	✓									
Reputation and Position in Industry	✓									
Reciprocal Arrangements	✓				✓	✓			✓	✓
Impression	✓									
Business Attempt	✓									
Maintainability	✓				✓					
Size										✓

When the methodologies used for solving supplier selection problem are reviewed, it is observed that, various multi criteria decision making methods are implemented. These methods can be classified into three broad categories (Wang et al., 2009).

1) *Value Measurement Models:* AHP and multi attribute utility theory (MAUT) are the best known method in this group.
2) *Goal, Aspiration, and Reference Models:* Goal programming and TOPSIS are the most important methods that belong to the group.
3) *Outranking Methods:* ELECTRE and PROMETHEE are two main families of methods in this group.

AHP, which was first developed by Saaty (1980), integrates experts' opinions and evaluation scores into a simple elementary hierarchy system by decomposing complicated problems from higher hierarchies to lower ones. Yahya and Kingsman (1999) are one of the first known researchers to use AHP to determine priorities in selecting suppliers. Similarly Analytic Network Process (ANP) is also a multi

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attribute approach for decision making that allows the transformation of qualitative values to quantitative ones. Since AHP is a special case of ANP and it does not contain feedback loops among the factors, ANP is used to determine supplier selection for the longer terms (Önüt et al., 2009).

However since the uncertainty and vagueness of the experts' opinion is the prominent characteristic of the problem, this impreciseness of human's judgments can be handled through the fuzzy sets theory developed by Zadeh (1965). Fuzzy AHP method (Cheng 1997; Cheng et al., 1999; Ruoning and Xiaoyan 1992) which is a fuzzy extension of AHP, systematically solves the selection problem that uses the concepts of fuzzy set theory and hierarchical structure analysis. On the other hand, since ANP deals only crisp comparison ratios, uncertain human judgments can be dealt with Fuzzy ANP, in which the weights are simpler to calculate than for conventional ANP (Önüt et al., 2009).

In case of many pair wise comparisons, ANP, AHP, FAHP, or FANP becomes burdensome to cope with. Instead TOPSIS, which is a widely accepted multi attribute decision making tool can be used (Hwang and Yoon, 1981). The concept of TOPSIS is that the most preferred alternative should not only have the shortest distance from the positive ideal solution, but should also be farthest from the negative ideal solution (Wang et al., 2009). Chen et al. (2006) extended the concept of TOPSIS to fuzzy environments by using fuzzy linguistic values. This fuzzy TOPSIS method fits human thinking under actual environment.

Furthermore ELECTRE (Elimination et Choice Translating Reality), which was first introduced by Benayoun et al. (1966), concerns the concordance, discordance and out ranking concepts originating from real world applications. ELECTRE methods have been applied to problems in many areas including energy (Cavallaro, 2010), environment management (Hanandeh & El-Zein, 2010), finance (Li & Sun, 2010), project selection (Colson, 2000), and decision analysis (Montazer et al., 2009). Details and the derivatives of ELECTRE method can be found in the literature (Wu and Chen, 2011).

In addition the PROMETHEE method (Preference Ranking Organization Method for Enrichment Evaluations) is one of the most recent MCDA methods that was developed by Brans (1982) and further extended by Vincke and Brans (1985). PROMETHEE is an outranking method for a finite set of

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alternative actions to be ranked and selected among criteria, which are often conflicting. PROMETHEE is also a quite simple ranking method in conception and application compared with the other methods for multi-criteria analysis (Brans et al., 1986). Since the main focus of this paper is only limited to Fuzzy TOPSIS, a comprehensive literature review on methodologies and applications of PROMETHEE can be found in the literature (Behzadian et al., 2010). Since the literature about supplier selection problem is huge only a few of the recent studies performed by applying fuzzy TOPSIS will be explained in detail.

In 2009, TOPSIS method is combined with intuitionistic fuzzy set to select appropriate supplier in group decision making environment (Boran et al., 2009). Intuitionistic fuzzy weighted average (IFWA) operator is utilized to aggregate individual opinions of decision makers for rating the importance of criteria and alternatives. Önüt et al. (2009) developed a supplier evaluation approach based on the integration of ANP and TOPSIS to help a telecommunication company under the fuzzy environment where the vagueness and subjectivity are handled with linguistic terms parameterized by triangular fuzzy numbers. Contrary to conventional Fuzzy ANP, triangular fuzzy numbers are used in all pair wise comparisons. Wang et al. (2009) proposes Fuzzy hierarchical TOPSIS for supplier selection to simplify the complicated metric distance method and to modify Chen's Fuzzy TOPSIS. Their model is verified and compared with other methods through a numerical example.

In 2010, according to Bhattacharya's developed integrated model combining AHP, Quality Function Deployment (QFD), and Cost Factor Measure (CFM) and tested with data sets that were already in the literature. Chamodrakas (2010) proposed a two stage model consisting of satisfying technique and Fuzzy TOPSIS and applied in a hypothetical metal manufacturing company.

In 2011, an integrated Fuzzy TOPSIS and Multi Choice Goal Programming (MCGP) approach is developed to solve supplier selection problem (Liao and Kao, 2011). The advantage of this method is stated to be allowing decision makers to set multiple aspiration levels for supplier selection problems. Deng and Chan (2011) developed a model by combining fuzzy set theory and Dempster Shafer Theory of evidence. It is stated to be more flexible due to the reason that the *basic probability assignments* can be determined without the transformation step in traditional fuzzy TOPSIS method.

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In 2012, Büyüközkan and Çiftçi (2012) developed an integrated method including DEMATEL, ANP and TOPSIS in fuzzy environment for green supplier evaluation, in which the methodology is used in a real case study. Chen and Chao (2012) used AHP for constructing the structure of criteria and then for the decision matrices, they used consistent fuzzy preference relations. The methodology is applied in an electronic company regarding 15 criteria.

Based on comprehensive literature review, considering multi criteria structure of the supplier selection problem and the vagueness in real environment, fuzzy TOPSIS is thought to be a suitable and simple enough for selecting the best supplier. In the next section the details of Fuzzy TOPSIS is given in detail.

3. FUZZY TOPSIS

The steps of fuzzy TOPSIS can be expressed in some slightly different ways but mainly in a similar way in the literature (Kilic, 2012, Torlak et al., 2011, Çevikcan et al., 2009). Within presented steps, it is benefited from the study of Kilic (2012).

Step 0: The jury of decision makers determine the selection criteria and alternatives

Step 1: The decision makers (D_1, D_2, …D_k) evaluate each criterion (C_1, C_2, …C_n) by using linguistic variables as shown in Table 2 and rate the alternatives according to Table 3.

Table 2: Linguistic Variables for the evaluation of criteria (Kilic, 2012)

Linguistic Variable	Fuzzy Number
Very Low (VL)	(0, 0, 0.1)
Low (L)	(0, 0.1, 0.3)
Medium Low (ML)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
Medium High (MH)	(0.5, 0.7, 0.9)
High (H)	(0.7, 0.9, 1)
Very High (VH)	(0.9, 1, 1)

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Table 3: Linguistic Variables for the ratings of the alternatives (Kilic, 2012)

Linguistic Variable	Fuzzy Number
Very Poor (VP)	(0, 0, 1)
Poor (P)	(0, 1, 3)
Medium Poor (MP)	(1, 3, 5)
Fair (F)	(3, 5, 7)
Medium Good (MG)	(5, 7, 9)
Good (G)	(7, 9, 10)
Very Good (VG)	(9, 10, 10)

Step 2: Linguistic terms are transformed to triangular fuzzy numbers by using Table 2 and Table 3 for evaluation of the criteria and the alternatives. Then the importance of the criteria (w_j) and the rating of the alternatives ($\tilde{x}_{ij}$) from different decision makers are averaged by using Eq 1 and Eq2.

$$\tilde{x}_{ij} = \frac{1}{K}\left(\tilde{x}_{ij}^{1} + \tilde{x}_{ij}^{2} + \cdots + \tilde{x}_{ij}^{K}\right) \qquad \tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij}) \text{ (Eq. 1)}$$

$$\tilde{w}_j = \frac{1}{K}\left(\tilde{w}_j^{1} + \tilde{w}_j^{2} + \cdots + \tilde{w}_j^{K}\right) \qquad \tilde{w}_j = (w_{j1}, w_{j2}, w_{j3}) \qquad \text{(Eq. 2)}$$

Step 3: Normalization is performed by using linear scale transformation. If criterion is benefit then $c_j^* = \max_i c_{ij}$ and Eq. 3 is used.

$$\tilde{R} = [\tilde{r}_{ij}]_{m \times n} \quad \Rightarrow \quad \tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right) \qquad \text{(Eq. 3)}$$

Otherwise, if criterion is cost, $a_j^- = \min_i a_{ij}$ and the following Eq. 4 is used.

$$\tilde{r}_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right) \qquad \text{(Eq. 4)}$$

Step 4: Aggregated weight matrix is obtained then the weighted normalized fuzzy decision matrix is found with the help of Eq. 5.

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$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n} \qquad i = 1, 2, \ldots, m \qquad j = 1, 2, \ldots, n \qquad \text{(Eq. 5)}$$

$$\tilde{v}_{ij} = \tilde{r}_{ij} * \tilde{w}_j$$

Step 5: The distance of each alternative from fuzzy positive and fuzzy negative ideal solutions are obtained as follows:

$$A^* = (v_1^*, v_2^*, \ldots, v_n^*) \quad \text{where } v_j^* = (1,1,1) \qquad \text{(Eq. 6)}$$

$$A^- = (v_1^-, v_2^-, \ldots, v_n^-) \quad \text{where } v_j^- = (0,0,0) \qquad \text{(Eq. 7)}$$

$$d_i^* = \sum_{j=1}^{m} d(\tilde{v}_{ij}, \tilde{v}_j^*) \qquad i = 1, 2, \ldots, m \qquad \text{(Eq. 8)}$$

$$d_i^- = \sum_{j=1}^{m} d(\tilde{v}_{ij}, \tilde{v}_j^-) \qquad i = 1, 2, \ldots, m \qquad \text{(Eq. 9)}$$

Step 6: The fuzzy closeness coefficient CC_i is determined and the highest of them is chosen as the best alternative

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-} \qquad i = 1, 2, \ldots, m \qquad \text{(Eq. 10)}$$

4. APPLICATION IN A GEARMOTOR COMPANY

The Fuzzy TOPSIS methodology is applied in a gear motor company which is also producing frequency inverters and decentralized Drive Engineering motors in Turkey. Although it is the branch of the main company located in Germany and receives many of the raw material from main factory, some

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active and frequently used raw materials such as, bear ring, synthetic or mineral oils, and seal rings are purchased from the suppliers in Turkey. In order to keep the business confidentiality the name of the company is preserved. Since it wants to choose the best supplier and increase its profitability, bear ring which is the most frequently used raw material, taken into account.

In order to determine the criteria and evaluate the alternatives for the supplier selection process, a meeting was performed with both the production manager and purchasing manager. Quality, Origin of the raw material, Cost, Delivery Time, and After Sales Services were chosen as the criteria and three alternative suppliers firms were denoted as A, B, and C.

First of all, based on the meeting performed, the evaluations of decision makers (DM) for the importance weight of the criteria (C) and for the alternatives' (A) ratings are tabulated in Table 4 and Table 5 with linguistic variables.

Table 4: The evaluation of the Decision Makers for the importance weight of criteria

Criteria	**DM1**	**DM2**
C1 (Quality)	High	Very High
C2 (Origin of the Material)	High	Medium High
C3 (Cost)	High	Vey High
C4 (Delivery Time)	Medium High	Medium High
C5 (After Sales Service)	Medium	Medium High

Table 5: The evaluation of the Decision Makers for alternatives' ratings

	C1		**C2**		**C3**		**C4**		**C5**	
	DM1	**DM2**	**DM1**	**DM2**	**DM1**	**DM2**	**DM1**	**DM2**	**DM1**	**DM2**
A1	MG	G	G	G	MG	MG	VG	G	F	G

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A2	G	MG	G	VG	G	G	VG	VG	G	F
A3	VG	G	G	G	VG	VG	VG	G	G	VG

In the second step, linguistic terms are transformed to triangular fuzzy numbers by using Table 2 and Table 3 for evaluation of the criteria and the alternatives and shown in Table 6.

Table 6: Fuzzy decision matrix and fuzzy weights of criteria for each decision maker

Criteria	**C1**		**C2**		**C3**	
Alternatives	**DM1**	**DM2**	**DM1**	**DM2**	**DM1**	**DM2**
A1	(5;7;9)	(7;9;10)	(7;9;10)	(7;9;10)	(5;7;9)	(5;7;9)
A2	(7;9;10)	(5;7;9)	(7;9;10)	(9;10;10)	(7;9;10)	(7;9;10)
A3	(9;10;10)	(7;9;10)	(7;9;10)	(7;9;10)	(9;10;10)	(9;10;10)
Weight	(0.7;0.9;1)	(0.9;1;1)	(0.7;0.9;1)	(0.5;0.7;0.9)	(0.7;0.9;1)	(0.9;1;1)

Criteria	**C4**		**C5**	
Alternatives	**DM1**	**DM2**	**DM1**	**DM2**
A1	(9;10;10)	(7;9;10)	(3;5;7)	(7;9;10)
A2	(9;10;10)	(9;10;10)	(7;9;10)	(3;5;7)
A3	(9;10;10)	(7;9;10)	(7;9;10)	(9;10;10)
Weight	(0.5;0.7;0.9)	(0.5;0.7;0.9)	(0.3;0.5;0.7)	(0.5;0.7;0.9)

Then the importance of the criteria (w_j) and the rating of the alternatives (x_{ij}) from different decision makers are averaged by using Eq 1 & Eq2 and shown in Table 7.

Table 7: Averaged fuzzy Decision Matrix and averaged fuzzy weights of criteria

	C1	**C2**	**C3**	**C4**	**C5**
A1	(6.0;8.0;9.5)	(7.0;9.0;10.0)	(5.0;7.0;9.0)	(8.0;9.5;10.0)	(5.0;7.0;8.5)
A2	(6.0;8.0;9.5)	(8.0;9.5;10.0)	(7.0;9.0;10.0)	(9.0;10.0;10.0)	(5.0;7.0;8.5)

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A3	(8.0;9.5;10.0)	(7.0;9.0;10.0)	(9.0;10.0;10.0)	(8.0;9.5;10.0)	(8.0;9.5;10.0)
Weight	(0.80;0.95;1.00)	(0.60;0.80;0.95)	(0.80;0.95;1.00)	(0.50;0.70;0.90)	(0.40;0.60;0.80)

In the third step, the normalization is performed by dividing each fuzzy value for alternatives by the max fuzzy value in each criterion and shown in Table 8.

Table 8: Fuzzy Normalized decision matrix

	C1	**C2**	**C3**	**C4**	**C5**
A1	(0.60;0.80;0.95)	(0.70;0.90;1.00)	(0.50;0.70;0.90)	(0.80;0.95;1.00)	(0.50;0.70;0.85)
A2	(0.60;0.80;0.95)	(0.80;0.95;1.00)	(0.70;0.90;1.00)	(0.90;1.00;1.00)	(0.50;0.70;0.85)
A3	(0.80;0.95;1.00)	(0.70;0.90;1.00)	(0.90;1.00;1.00)	(0.80;0.95;1.00)	(0.80;0.95;1.00)
Weight	(0.80;0.95;1.00)	(0.60;0.80;0.95)	(0.80;0.95;1.00)	(0.50;0.70;0.90)	(0.40;0.60;0.80)

In the forth step the weighted normalized fuzzy decision matrix is found by multiplying the weights with fuzzy values for each criterion and shown in Table 9.

Table 9: Fuzzy Weighted Normalized decision matrix

	C1	**C2**	**C3**	**C4**	**C5**
A1	(0.48;0.76;0.95)	(0.42;0.72;0.95)	(0.40;0.67;0.90)	(0.40;0.67;0.90)	(0.20;0.42;0.68)
A2	(0.48;0.76;0.95)	(0.48;0.76; 0.95)	(0.56;0.86;1.00)	(0.45;0.70; 0.90)	(0.20;0.42;0.68)
A3	(0.64;0.90;1.00)	(0.42;0.72; 0.95)	(0.72;0.95;1.00)	(0.40;0.67; 0.90)	(0.32;0.57;0.80)

In the fifth and sixth steps together, the distances from positive and negative ideal solutions as well as the fuzzy closeness coefficient CC_i for all of the alternatives are calculated and shown in Table 10.

Table 10: The distances from positive and negative solution as well as the closeness coefficient for

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each alternative

	A^*	A^-	CC_i
A1	2.1064	3.3327	0.6127
A2	2.3204	3.5191	0.6026
A3	1.6321	3.7716	0.6980

Regarding the closeness coefficient values, A3, with the highest value, is selected as the best supplier.

5. CONCLUSION

Since supplier selection is one of the critical tasks for firms to sustain competitive advantage, decision makers should apply effective methods to select best supplier taking both tangible and intangible criteria into consideration. Since the use of linguistic variables in decision making problem are highly beneficial when the assessments cannot be expressed in numerical terms, fuzzy set theory becomes helpful to convert into meaningful results. Therefore, for incorporating the vagueness of the methodology and conforming to the multi criteria structure of the problem fuzzy TOPSIS is implemented to solve the supplier selection problem of a manufacturing company in Turkey. In this case study, 5 criteria; Quality, Origin of the raw material, Cost, Delivery Time, and After Sales Services are taken into account to evaluate the best supplier among three alternative suppliers through the expert preferences of two decision makers.

In further studies, since the multi criteria decision making models are comprehensively reviewed in this paper, other models such as Fuzzy AHP or Fuzzy ANP can be applied for the same problem and the results can be compared. Moreover, hybrid models combining different methodologies incorporating the strong sides of each can be performed to solve this problem. Furthermore, for more complex problems such as multi sourcing problems, in which no supplier can satisfy all the buyer's requirements, mathematical programming models can be utilized. By using linear programming or goal programming

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techniques, the decision maker can split order quantities among different suppliers. However since the problem handled in this study, is a single sourcing type, the complicated models are not required to be performed. In conclusion, there are many different types of supplier selection problems to be dealt regarding the supply chain management; several methods can be used for each various type of problem.

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Employee Absenteeism in manufacturing industry of Jammu: An Analysis of Precursors

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Abstract

Absenteeism has been considered as a serious problem and an expensive occurrence for both employee and employers due to its widespread impact on production and achievement of organizational objective. Hence, it is imperative to understand and identify the impact of different factors leading to employee absenteeism. The present paper is, therefore, an attempt to identify the determinants of absenteeism in manufacturing organizations of Jammu region (India). Taking a sample of 154 employees, the relationship of various socio-economic and organizational related variables, with absenteeism of employees is determined through a pre-tested structured questionnaire. The results from regression analysis identified positive impact of tenure of employees on their absenteeism level whereas promotion, appreciation and organizational climate are negatively related to absenteeism. The results of the study will assist organizations to identify the underlying reasons of the employee absenteeism for the required and timely action.

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INTRODUCTION

Absenteeism has been considered as a serious problem and an expensive occurrence for both employees and employers. The consequences of absenteeism are widespread and consist of both direct and indirect effects on production and achievement of organizational objective (Johns and Nicholson, 1982; Gellatly, 1995; Singh and Khanna, 2011). The reports affirmed that on an average employees were absent for about 10% of the work days in approximately all the organizations per year in India (Annual Survey of Industries 2009 - 2010). Average absenteeism rate per year ranges from 8 to 13 per cent including absenteeism rate of 13 per cent in manufacturing industry (Annual Survey of Industries 2009-10). This leads to loss of INR 70,000 to 80,000 million per year (http://www.assocham.org/prels/shownews-archive.php?id=247) thereby depicting that absenteeism is a crucial phenomenon for both employees and employers. Hence, it is elementary to understand the meaning of absenteeism and identify its precursors. Generally, the term absenteeism has been coined to reflect any failure of an employee to report to or to remain at work as scheduled, regardless of the reason" (Cascio, 2003). But it can be defined in many other ways. For instance, Labour bureau of Shimla, India defined absenteeism as the total man shifts lost because of absence as percentage of total number of man shifts scheduled to work. Another definition proposed in Webster dictionary stated that "Absenteeism is the practice or habit of being an absentee where an absentee is one who habitually stays away from work". This practice of employee to stay away from work is a complex and subtle concept to permit exact counteractive measures. There is not a universal formula to work as panacea for absenteeism in different organizations working under different circumstances and conditions of work. The selection of the remedial technique will depend on extent and the cause of absenteeism. Previous research on employee absenteeism depicts that employee's decision of withdrawal of work for some period of time depends on socio-economic factors, namely, income, gender, martial status, qualification and tenure of work (Goldberg and Waldman, 2000) as well as on organizational allied factors, namely, organizational climate, promotion, bonus, appreciation, satisfaction of employees and grievance of employees with the

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organization (Friday and Friday, 2003; Bajpai and Srivastava, 2004, Luthans, 1995, Robbins, 1989). The present study is, therefore, an attempt to identify the antecedents of employee absenteeism in manufacturing industry.

Preceding research on Absenteeism and its antecedents

To curb with employee absenteeism, so far many studies have been conducted around the globe over the different period of time for exploring the determinants of employee absenteeism. For instance, the study conducted by Blau (1985) and Price 1995postulated that socio-economic factor, namely, gender has a positive impact on the leaves taken by the employees. i.e. females tend to take more leaves than males due to their extended family responsibilities (Maria Nilsson, 2005 and Beverley, 2005).

Not only gender, Blau (1985) and Price (1995) in their study pertaining to socio-economic predictors of absenteeism has also identified that tenure of employees has positive impact on their absenteeism, i.e., as tenure of an employee increases, absenteeism also increases. The study revealed that workers with higher work experience report higher level of absenteeism than workers with less work experience. The authors attributed this to the fact that employees with higher work experience believe that they have been loyal to their organization and are entitled to a few days of absence (Hogue and Rahman, 2003). But the study conducted by Robbins et al. (2003) and Martocchio (1989) identified that tenure is negatively associated with absenteeism. The underlying reason identified in the study is that employees, who have been in employment for long period of time, tend to express higher levels of job satisfaction and organizational commitment, resulting in lower rates of absenteeism whereas the study conducted by Lau et al. (2003) found that there is no association between tenure and absenteeism.

Age is also one of the vital socio-economic factors having significant impact on absenteeism. It has been found that age of employee is positively associated with absenteeism, i.e. if age of an employee increases, absenteeism tends to increase (Blau, 1985 and Price, 1995). The most common reaso cited are health deterioration of older employees and longer recovery period when injured (Robbins et al, 2003). In contrast to this view, researchers such as, Martocchio (1989), Johnson et al. (2003); Lau et al. (2003) identified that age is negatively related with absenteeism. The authors identified that young employees

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tend to take more leaves than their aged counterparts. The reason being that aged employees are usually handling critical roles in the organization and hence, they prefer to attend workplace regularly (Voss et al. (2001). But the study conducted by Hoque and Islam (2003) identified non-significant relationship between age and absenteeism. The reason observed by the authors is that employee absences depends on factors like family responsibilities, health status of employee, etc. and not necessarily on their age.

Similarly, impact of marital status on absenteeism is also contradictory. According to Robbins et al. (2003), research indicates that married employees have fewer absences than their unmarried co-workers. The authors put forth that marriage imposes increased financial responsibilities on employees which make their jobs valuable and important, thereby, making it necessary for them to attend their workplace regularly. Thus, the married employees are less likely to skip their work. On the other hand, Blau (1985) identified that married employees tend to take more leaves than unmarried employees due to their increased family responsibilities. These responsibilities include attending family functions, celebrating anniversaries, birthdays, maternity leaves, paternity leaves, etc. Conversely, Hogue and Islam (2003) and Lau et al. (2003) found that marital status is not a significant factor in determining the proneness of an employee towards absenteeism. According to them, absenteeism depends on situations and family background and not on martial status. In this regard, one of the situations can be that where an unmarried employee avails more leaves because of his extended responsibilities towards his parents.

Pfeifer (2010) in his paper on impact of wages on absenteeism identified that income and absenteeism are negatively related. The study revealed that employees with high level of income tend to attend their workplace regularly as they are generally placed at critical positions. But Dalton and Perry (1981) in their study have identified that absenteeism depends on job design rather than on income of employees.

Moreover, along with socio-economic factors, many researchers have defined organizational related factors which alter absenteeism behavior of employees. These factors can be clubbed as organizational allied factors as these are associated with organizations and includes promotion, bonus, appreciation and organizational climate. In this regard, Luthans (1995) and Anderson (2004) identified that highly satisfied employees avail less leaves than employees with low satisfaction. Inverse relationship has been identified

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between absenteeism and satisfaction because satisfied employees are motivated to attend their work place and completing their tasks efficiently (Woods and Wall, 2003). Contradictory to this, Brief (1998) put forward that satisfaction is not a significant factor having impact on employee absenteeism. He further stated that the impact of satisfaction on absenteeism will be less for organizations having clearly communicated policy on absenteeism entailing low tolerance for absences and close monitoring of absence behavior. In such organizations, fear of disciplinary actions provokes employees to attend their workplace regularly even if they are not fully satisfied.

Promotion is also one of the significant organizational allied factors associated with absenteeism. According to Voss et al. (2001) and Beverley and Josias (2005), promotion has negative impact on employee absenteeism. In other words, if employees are provided with continuous promotional opportunities, they are more likely to be present at their work place for completing the roles and responsibilities assigned to them. By doing so, employees increase their chances of promotion (Blau, 1985).

Along with promotion, bonus has also been identified as a significant factor influencing employee absenteeism. Aamodt (2004) and Robbins et al. (2003) indicated that paying bonus is an effective way of reducing employee absenteeism and inducing them to attend their workplace for completing their tasks efficiently, effectively and on time. But Hassink and Koning (2005) points out that bonus cannot lead to sustainable reduction in absenteeism. Bonus helps in reducing absenteeism for a very short period of time which is usually the time when payment of bonus is due. After that, employee follow same pattern of absenteeism. Hence, the study depicted that there is no strong association between bonus and absenteeism.

Recognizing the efforts of employees also reduces absenteeism among employees. Appreciation encourages employees to work hard and complete the tasks efficiently. It has been identified that after being appreciated, morale of employee heightens and they prefer to be present at their work place and work with more dedication which has been reflected through the negative relationship between appreciation and absenteeism (Hafiza et al, 2011).

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According to Muller (2005), organizational climate is also one of the significant factors shaping absence behavior of employees. Organizational climate represents unique traits which distinguish it from its competitors (Emery, 1999). This distinction is on the basis of perception of employees about fairness of policies and practices, cohesiveness of co-workers, supportiveness of management, safe working conditions and availability of required tools and techniques (Aarons and Sawitzky, 2006; Ashkanasy et al. 2000; Moran and Volkmein, 1992 and Schneider, 1987). Conduciveness of organizational climate retains employees at their work place by enhancing their morale and satisfaction (Murray, 1999). Apart from this, Arthur and Jelf (1999) identified grievance as predictor of absenteeism and reports that level of absenteeism is positively related to grievance. In other words, level of absenteeism will be high in case of employee having grievance with the organization (Muller 2005).

The above discussion on literature depicts that most of the studies have been conducted considering the impact of a single factor or impact of some factors on employee absenteeism. Like some researchers have focused on the impact of age on absenteeism whereas some have focused on the impact of promotion on absenteeism of employees. The unified impact of socio-economic and organizational allied factors has received restricted attention in previous researches conducted so far. Also, the manufacturing industry of Jammu region has remained untouched for the purpose of identifying the predictors of absenteeism in the industry. The present study, therefore, has been designed to conduct in-depth study to identify the precursors of absenteeism in manufacturing industry of Jammu Region.

RESEARCH METHOD

The study is based mainly on primary data collected from the on-roll employees of manufacturing organizations of Jammu (India). As the study is of exploratory in nature, a sample of 154 employees was drawn from eight manufacturing organizations of Jammu region (India). Organizations registered with Directorate of Industries, Jammu (India) have been considered for present study. The reason for choosing employees from manufacturing industry is that the absenteeism has been reported high (10.61% in 2009-10 as compared to 7.91% in 2007-08 as per Annual Survey of Industries 2007-2008 and 2009-2010) in manufacturing industry of Jammu (India). 25-30 per cent of the employees have been selected from

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each organization as according to Creswell (2003) and Sekaran (2000) ideal sample size of 30 per cent is acceptable for research purposes because it provides ability to generalize to a population.

The responses of employees were taken during working hours through a well defined pretested schedule, as employees are not much literate to understand and fill the questionnaires. Moreover, another reason for using the schedule is to ask employees about the required information indirectly so that the correct responses can be acquired. Secondary data, regarding total number of leaves allowed and total number of leaves availed by the sampled employees, have been taken from unpublished records of the respective organizations for measuring the absenteeism of employees. Absenteeism has been taken as dependent variable whereas independent variables includes age, income, tenure, qualification, satisfaction of employees with the organization, bonus, promotion, appreciation, grievance of employees and organizational climate. Conduciveness of Organizational Climate has been captured using five point likert type scale ranging from highly dissatisfied to highly satisfied. Dimensions of climate include communication system, clarity of goals and objectives, availability of tools and techniques, relationships at workplace and workplace protection policies (Taguiri and Litwin, 1968). The cronbach alpha value of 0.87 depicts the reliability of the scale used to measure conduciveness of organisational climate (George and Mallery, 2003).

Definition of the Variables

The following definitions of the terms are used for the purpose of the study:

Absenteeism: Absenteeism has been defined as the leaves availed by the employees out of the total leaves sanctioned to them by the organization. The leaves considered for the present study are the voluntary leaves which are paid excluding sick leaves.

Tenure: Tenure has been referred to the total years of experience in the present organization

Promotion: The total number of promotions received by employees during past three years

Appreciation: Appreciation has been defined as anything which recognises efforts and work of employees. It can be “good job”, “great work”, “well done”, keep it up” or praising an employee among all the employees.

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Organizational Climate: Organizational climate has been defined as faction of properties of the work environment, perceived directly or indirectly by the employees, that is assumed to be a major force in influencing employee behavior. Hence, it includes communication system, availability of tools and techniques, work place relationships and work place protection against hazards.

The responses of employees pertaining to their satisfaction from the organization have been verified based on job recommendation by employees to their relatives, friends, etc. Moreover, as variables, namely, qualification, satisfaction and grievance of employees are categorical in nature, so, they have been converted into dummy variables to make the data fit for the regression analysis and are presented below.

The data has been checked for the existence of problems of multicollinearity and heteroscedasticity. The collinearity diagnostics indicates that VIF<10 and the tolerance value is above 0.1. Both the values lie within the limit range and indicate no multicollinearity (Hair et al. 2008). Further, the correlation matrix also indicates the presence of low correlation between the independent variables (less than 0.5 in all the cases) (Appendix I). Moreover, there is no problem of heteroscedasticity as the correlation between absenteeism and independent variables depicts no high correlation (Appendix II) which further suggests that multiple regression can be used as an appropriate tool for analysis. The regression equation for the model is as under:

Y = f (X1, X2,X3.....X10)

Where Y represents the dependent variable, namely, absenteeism represented by the number of voluntary leaves taken by the employees excluding sick leaves.

X1 = Age, X2 = Income, X3 = Tenure, X4 = Qualification, X5 = Satisfaction of employees, X6 = Grievance, X7 = Promotion, X8 = Bonus, X9 = Appreciation, X10 = Organizational Climate

The demographic profile of the focal group of employees reveal that the sample is predominantly of males employees (93%), married (75%), falling under age group of 35 to 40 years (41.6%) and are working in the organization for more than 2 to 3 years (32%). The majority of sampled employees are matriculates (53%), working as labourers (80%) and maximum of sampled employees (43.5%) fall in the

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monthly salary category of INR 5000 to 8000.

RESULTS AND DISCUSSION

The descriptive statistics for both socio-economic factors as well as organizational allied factors affecting employee was calculated. For analysis, some socio-economic factors, namely, gender, designation and department of employee in the organization, marital status and some organizational allied factors, namely, presence of union were excluded due to the presence of skewness in the distribution. The inter correlation among all the independent variables i.e. socio-economic factors and organizational allied factors used in the study indicates that six out of eight personal variables, namely, age and income ($p<0.01$), age and tenure ($p<0.01$), age and qualification ($p<0.01$), income and tenure ($p<0.01$), qualification and income ($p<0.01$) and tenure and qualification ($p<0.01$) are significantly different from zero. Further, eleven out of sixteen correlations of organizational allied factors, namely, satisfaction and grievance ($P<0.01$), satisfaction and bonus ($P<0.01$), satisfaction and appreciation ($P<0.01$), satisfaction and organizational climate ($P<0.05$), grievance and bonus ($P<0.01$), grievance and appreciation ($P<0.01$), grievance and organizational climate ($P<0.01$), promotion and appreciation ($P<0.01$), bonus and appreciation ($P<0.01$), bonus and organizational climate ($P<0.01$) and appreciation and organizational climate ($P<0.01$) are found to be significantly different from zero. Similarly, sixteen out of twenty four correlations between socio-economic factors and organizational allied factors, namely, income and satisfaction ($p<0.01$), income and promotion ($p<0.05$), income and grievance ($p<0.01$), income and bonus ($p<0.01$), income and appreciation ($p<0.01$), income and organizational climate ($p<0.01$), tenure and satisfaction ($p<0.01$), tenure and bonus ($p<0.01$), tenure and grievance ($p<0.01$), tenure and appreciation ($p<0.05$), tenure and organizational climate ($p<0.05$), qualification and satisfaction ($p<0.01$), qualification and bonus ($p<0.01$), qualification and grievance ($p<0.01$), qualification and appreciation ($p<0.01$) and qualification and organizational climate ($p<0.01$) are significantly different from zero (refer Table 3). Inter correlation between satisfaction level of employee with the organization and grievance of employee with the organization ($p<0.01$) is also significantly different from zero.

The correlation matrix (refer Table 4) unveiled that absenteeism is negatively correlated with age, income

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qualification, promotion, appreciation and organizational climate whereas it is positively correlated with tenure, satisfaction of employees, bonus and grievance.

Table 3: Inter-correlation matrix

Variables	Age	Income	Tenure	Qualification	Satisfaction	Grievance	Promotion	Bonus	Appreciation	Organizational Climate
Age		0.394**	0.242**	0.195*	-0.077	0.028	0.070	-0.007	-0.033	0.071
Income			0.469**	0.51**	-0.381**	0.411**	0.173*	0.268**	0.289**	-0.263**
Tenure of Work				0.188*	-0.287**	0.297**	-0.031	0.308**	0.191*	-0.191*
Qualification					-0.287**	0.350**	0.098	0.233**	0.300**	-0.288**
Satisfaction						-0.696**	-0.107	-0.355**	-0.373**	0.222**
Grievance							0.0882	0.342**	0.407**	-0.319**
Promotion								0.048	0.235**	-0.084
Bonus									0.444**	-0.161**
Appreciation										-0.457**
Organizational Climate										

Note: ** p<0.01; * p<0.05

Table 4: Inter-correlation between the dependent and independent variables

	Age	Income	Tenure	Qualification	Satisfaction	Grievance	Promotion	Bonus	Appreciation	Organizational Climate
Absenteeism	-0.0608	-0.151	0.207**	-0.232**	0.213**	-0.14	-0.422	0.143*	-0.197	-0.168

Note: ** p< 0.01; * p<0.05

Regression Results

Regression Analysis was applied to determine the impact of socio-economic factors and organizational allied factors on absenteeism of employees working in manufacturing organizations of Jammu region

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(India). Absenteeism of employees was regressed on socio-economic factors, namely, age, income, tenure, qualification and organizational allied factors, namely, satisfaction of employees, promotion, bonus, appreciation, grievance and organizational climate.

The F ratio represented in Table 1 explains that absenteeism level (dependent variable) is significant at one per cent level of significance, which further reinforces the fitness of model considered for the present study. The value of adjusted R-Square depicts that thirty nine per cent of the total variance in absenteeism can be explained by socio-economic and organizational allied factors. The analysis divulge that tenure is found to be significant ($P<0.01$) and positively correlated with absenteeism. Promotion is another predictor ($P<0.01$) of absenteeism which has shown negative relationship with absenteeism. Similarly, appreciation and organizational climate are also found to be significant ($P<0.51$) and negatively correlated with absenteeism.

Table 1: Conversion of Variables into Dummy Variables

Variable Name	**Dummy used**	
Qualification	If up to 10 then 1	Else 0
Satisfaction level of employees	If satisfied then 1	Else 0
Grievance of employee with the organization	If employees have grievance then 1	Else 0

Table 2: Results of Regression Analysis

Model	Absenteeism	
Variables	Coefficients	t
(Constant)	34.958	3.355**
Age	-1.536	-0.249
Income	-1.381	-0.568
Tenure of Work	0.944	2.55**
Qualification	-2.789	-2.261
Satisfaction	-2.385	-1.430
Grievance	-1.793	-1.106
Promotion	-6.722	-4.875**
Bonus	1.564	1.123

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Appreciation	-2.563	-1.723***
Organizational Climate	-0.272	-2.779**
F Ratio	7.776**	
R Square	0.453	
Adjusted R Square	0.395	

Note: * p<0.05, ** p<0.01, ***p<0.10

The results disclose that tenure is positively correlated with the absenteeism of employees i.e. as the tenure of an employee in the organization increases, absenteeism also increases. It may be owing to the reason that those with more seniority in the organization, typically, have more security, get better work assignments and are first to get time offs when available. Similarly, newly joined employees perceives lower job security and thus, be likely to attend the workplace even if they wish to take off (Mobley et al, 1979; Troy and Kelly, 2011). Further, the composition recount that promotion is also a significant factor affecting absenteeism and is negatively correlated with it. It implies that if employees are provided with continuous promotional opportunities, their reluctance to attend the work decreases. One of the reasons can be that with promotion, job responsibilities and salary also increases and employees tend to work more for adapting their new roles and responsibilities (Shirom & Roswnblatt, 2006). Another reason for inverse relationship between promotion and absenteeism can be that employees tend to attend their workplace regularly for accomplishing their tasks and responsibilities and shows their best efforts when they know that the employees with the highest efforts will be promoted (Pfeifer, 2010; Lazear and Rosen, 1981). Similarly, appreciation and bonus has also been identified as important organizational allied factor affecting absenteeism of employees. It implies that recognizing employees' efforts also induces employees to attend their workplace regularly and to work effectively, thereby, decreasing their absenteeism level (Kartha, 2011). Recognition at workplace either by way of appreciation boosts the morale of employees and induces them to be present at their workplace and complete their tasks efficiently and effectively (Kartha, 2011). In addition to this, organizational climate is also a significant factor affecting absenteeism and is negatively correlated with absenteeism. The reason may be that when

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employee perceive that the organizational climate is conducive, which can be characterized by fairness of policies and practices, cohesiveness of co-workers, supportiveness of management, safe working conditions and availability of required tools and techniques (Aarons and Sawitzky, 2006; Ashkanasy et al. 2000; Moran and Volkmein, 1992 and Schneider, 1987), employees tend to avoid taking leaves (Fajana, 2001 and Carroll 1998).

Apart from this, there are factors, including, age, income, qualification, and satisfaction of employees, grievance with the organization and bonus, which depicts insignificant impact on employee absenteeism. A non-significant negative relationship has been identified between age and absenteeism. Absenteeism depends on factors like nature of job, professional background, designation, etc. rather than on age (Rhodes and Steers, 1990; Hogue and Islam, 2003). Another socio-economic factor having non-significant negative relationship with absenteeism is income of employees. Absenteeism depends on roles and responsibilities assigned to employees and not on the income level of employees (Brown and Sessions, 1996). Thus, income may not be a significant factor affecting employee absenteeism (Pfeifer, 2010). Qualification is also one of the socio-economic factors having non-significant negative relationship with absenteeism in the present study. The reason can be attributed to the fact that absenteeism of employees depends on effectiveness of job design and person – job fit approach and not on qualification of employees (Luthans, 1995). Along with socio-economic factors, the present study also depicts that organizations allied factor, namely, satisfaction of employees has non-significant relationship with absenteeism. It may be due to the fact that absenteeism depends on commitment level of employees (Rentsch & Steel, 2003). Highly committed employee, though not fully satisfied with the organization, will attend their work place regularly (Hausknecht et. al, 2008). Similarly, the study also depicts that there is no significant impact of employee's grievance on absenteeism as it has been observed that employees tend to follow means other than taking leaves for showing their grievances which includes delayed production, more wastage, etc. (Goodman and Atkin, 1984). The study also depicts that bonus has no significant relationship with absenteeism. In the context of manufacturing industry of Jammu region, bonuses are paid on festivals to employees irrespective of their performance (India) (Source:

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Revealed by organization during survey). Hence, it may not be a factor impacting employee absenteeism which has also been symbolized by non-significant relationship between absenteeism and bonus.

To sum up, the results indicated that socio-economic factor, namely, tenure of employee is positively associated with employee absenteeism whereas organizational allied factors, namely, promotion, appreciation and organizational climate shows negative association with absenteeism of employees. In other words, as tenure of employees' increases, their absenteeism level tends to increase. But more promotions, more appreciations and more conducive organizational climate induce employees to be present at their work place, thereby, reducing their absenteeism level.

IMPLICATIONS AND FUTURE RESEARCH

The findings of the study will be helpful in formulating strategies and policies to induce employees to attend their workplace. It has been identified from the analysis that socio-economic factors of employees have positive impact on absenteeism of employees whereas organization allied factors has negative impact on employee absenteeism. Since Socio-economic factors are individual oriented i.e. specific to individual employee, organizations should keep a check on these factors while selecting an employee. One of the methods in this direction can be that for experienced employees, selection process includes average number of leaves taken by an employee per year in last organization and the reasons for taking leaves. In case of inexperienced employees, the selection procedure may embrace facet to judge psyche of the candidate pertaining to absenteeism. The study has also identified that organizational allied factors including promotion, appreciation and organizational climate are negatively associated with absenteeism of employees and these are factors which can be controlled by the organization through consistent policies and practices. Hence, organizations should focus more on these factors. One of the implications in this regard can be that promotions can be given to employees by considering their absenteeism level along with other factors. This will encourage employees to attend workplace regularly as it has been identified that promotion is inversely related to absenteeism. Another implication can be that the organizations should start appreciating employees for their hard work and efforts so as to induce them to attend their workplace regularly and complete their tasks efficiently. The underlying reason is that,

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continuous appreciation provides psychological satisfaction to employees. Organizations should also try to improve the climate characterised by proper communication system, clarity of goals and objectives of the organization, availability of the required tools and techniques at workplace, cordial relationship of employees with peers and subordinates, support from supervisors and protection against hazards at workplace. One of the implications in this regard can be that organization should emphasize on maintaining systematic communication system for continuous information exchange. This will keep employees updated with all kinds of relevant knowledge and injects transparency in the system. Organizations should ensure that all the employees are provided with all the required information to perform their tasks efficiently and effectively. Not only this, organizations should also ensure that all the employees are equipped with the required tools and techniques necessary to perform their tasks efficiently.

The present study attempts to identify predictors of employee absenteeism in manufacturing industry of Jammu region. Only eight manufacturing organizations were accessible based on the personal contacts within the organization. Hence, a study with increased number of organizations may uncover some more parameters and antecedents of absenteeism.

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An Assiduous Study on Linkage between Competitive Intelligence and Field Leadership for Organizational Development

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Abstract

Today's business environment is complex and cut throat. It is difficult to predict what's going to happen in the future. Organizations thus respond to forecasting needs and scenario planning. The purpose why I' am writing this is merely to make readers understand in a changing business scenario which has a plausible set of futures why is Strategy so important. If articulating a Strategy so important then Competitive Intelligence is the right tool for anticipating and predicting what's going to happen in future thus decisions may be played out.

Competitive Intelligence is the ethical gathering of Information through open sources. This concept was developed in US under the banners of SCIP (Strategic Competitive Intelligence Professionals) way back in 1986. It came to India only after 1990's. On the other hand Competitive Intelligence has its roots embedded in Military Intelligence.

The Premise of this study is to bring about the linkage between Competitive Intelligence (CI) and Field Leadership. The Lessons learnt on the battlefield is what has been derived in the business world and CI is the right feed for it.

Objectives of the Study

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1. To study the linkage between CI and Field Leadership.
2. To Enable the audience to just know the Highlights of the above two concepts and study the Interface.
3. To study the importance of the two in today's business, the study is just to give the authors the insight about the interface reactions between the two.

Review of Literature

Competitive Intelligence as per Larry Kahaner in his famous book clearly mentions that it is the systematic process of extraction of Information through ethical ways. Competitive Intelligence as per Cris West is often misunderstood as a tool that deals with Industrial espionage or Executive spying activity. Lot of studies have been done in this area which outlines just one aspect that Competitive Intelligence is one such practice that the can transform the face of any organization.

According to Business Times CI stands as the only business guide to transforming crude business data into valuable information, it is the cutting edge management tool of the 21st Century. According to Barry Nalebuff, Yale School of management and author of cooperation who says " you need to know what competitors know and what they know you know". You need to know what CI is!

Another very important feature of this research study is know about the concept of Field Leadership. Warren Bennis in one of his articles on Field Leadership- It matters most in trenches has outlined that business leaders are no leaders if they've not learnt any lesson from the trenches. The lessons learnt from these trenches is what is to be imbibed and implemented in the organizations. Army leadership is the best leadership if we talk about depicting the right Leadership. Just as we say "Competent leaders of character are necessary for the Army to meet the challenges in the dangerous and complex security environment we face" (source: http://www.fas.org/irp/doddir/army/fm6-22.pdf) on similar lines Leaders who are Charismatic and transformational can lead the organization to the direction of growth and competitive advantage and meet any contingency no matter how dangerous or unforeseen they are. According to the journal on leadership excellence November 2010 India edition it is important to change the geography of

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Business today and this can be possibly done through knowing the lessons learnt through trenches.

Research Methodology

This study has been focusing on secondary data only however other references include examples and inferences taken from case studies, Journals, Magazines, Newspapers, Websites, perceptions of Practitioners, Academicians and Industrialists.

Data Analysis and Interpretation

The study has been done considering the prime focus area to be secondary data as there is not much research done in the field of competitive Intelligence. As a researcher I have tried to bring about a linkage between the CI and field Leadership. The study will discuss certain variables defined as A, B, C, D and E. Due to constraints of time the study is limited just to bringing about the significance and linkage between the two.

Introduction

Leadership is the process of influencing people by providing purpose, direction, and motivation while operating to accomplish the mission and improving the organization

Source: http://www.fas.org/irp/doddir/army/fm6-22.pdf

A lot of research has already been done by many researchers in the area of Field Leadership but the linkage between Competitive Intelligence which is fairly a new discipline and Field Leadership has been done through this research. Competitive Intelligence is the ethical system of gathering information. The route to extraction of Information is done through open source. There are many ways by which information can be collected such as:

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- Competitors' brochures
- Annual reports of competitors
- Collecting open source information such as articles and news on internet
- Mapping competitors by finding their partners, vendors and customers by searching internet for pages with links to the competitor
- Mapping competitor's products, customers on social media platforms.
- Annual reports
- Press releases
- Analyst reports
- Regulatory reports
- Government reports
- Pricing / pricing lists
- Advertising campaigns
- Promotions
- Tenders
- Patent applications
- Market surveys and consultants' reports
- Financial reports, and brokers' research surveys
- Trade fairs, exhibits, and competitors' brochures
- Overt surveillance
- Hiring competitors employees to acquire specific know how
- Mapping competitors internal networks in connection with projects or consultancy

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- Meeting with suppliers
- Trade shows

Competitive Intelligence is often misunderstood as an activity related to espionage or spying or sometimes it is understood as similar to Market Research. There are many myths about practicing it but the reality is that if this tool is used in organizations it can transform the face of any organizations because in this Global scenario where markets are fast emerging and new markets coming up, there is a need to know what your competitors are doing or what is the next step they would be taking. As an organization you should be informed well before time where are your competitors and what is it that they going to do next. CI is not a watch Dog practice but it helps you generate early warning and create a favourable position of yourself by creating a competitive landscape. Competitive Intelligence is not mere collection of information but converting that raw data to actionable intelligence or information that can fruitfully acted and made usable. Sometimes a threat situation can be converted to an opportunity provided you are well informed. In a Strategic Management process CI has a lot of connection and significance defining, aligning and translating a Strategy is impossible if you are not well informed about your competitors. Below is the diagram on how CI has a Strategic role to play in Organizations and how it helps organizations secure competitive advantage.

Figure- 1

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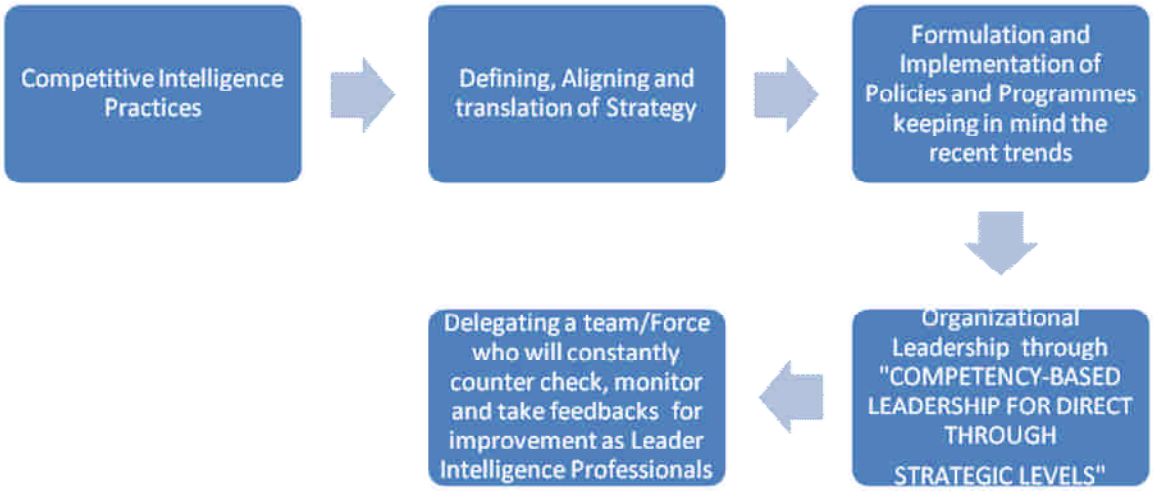

Field Leadership is the type of leadership which is best seen in organizations where there is a dedicated team, a force to withstand and fight the challenges of operating and remote environment. This type of leadership extends more influence beyond the conventional chain of command and helps organizations work on factors like Mental Agility, Sound Judgement, Strategic Innovation, Domain Knowledge and Interpersonal tact. As we say Management philosophy controls practice, the art of practicing it has its linkage and relation to military tactics used on war field. Hence the word "Field Leadership" has been derived from there. In today's fierce business environment using Competitive Intelligence to outwit, outmaneuver your competitors like soldiers in the battlement beating and knocking the enemy off, the right deliverability comes from exercising Field Leadership. Organizations need drivers, the leaders who are Confident, Committed, Operating, Influencing for growth, resilience, creating a positive environment and Agile.

A. Army leadership and its foundations- The Framework for Competitive Intelligence in an Operating Environment

The leadership in the army has evolved with the passage of time but still when we trace the evolution of

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field leadership being practiced by leaders in the army, the connection comes from loyalty towards one's own country laws, the doctrines of faith and loyalty to ones entity, authority and responsibility and the citizenship. Therefore as rightly mentioned by few authors and army men who I interviewed personally were of the same opinion that the foundation comes from the nation's democratic foundation and that brings out the true standards of excellence. Whilst we talk about leaders being grounded firmly in History and societal transitions the same has its role in extrapolating facts and raw data about the foe to outmaneuver the attempts taken to pull down, hence in the business world the role of management philosophy plays a very vital and significant role.

As such CI can act as a weapon to face any cut throat competition with the very practice organizations can unravel the secrets or the facts that can be of immense help to the organization who is looking for a breakthrough. The foundations of leadership thus lie on the basis on three core competencies like leading, developing and finally achieving your set of goals. Competitive Intelligence owns its genesis from Military intelligence used on the battlefield and Military history in the cold world war era. When we suggest a machinery to function within the organizational set up and work synchronically with the Operating environment. By operating environment we mean the combination of external factors like social, economical and political that exerts considerable influence on the business. Below is the diagrammatic illustration of how Competitive Intelligence can be used as weapon by leaders as a framework for facing the challenges in the operating environment.

Figure- 2

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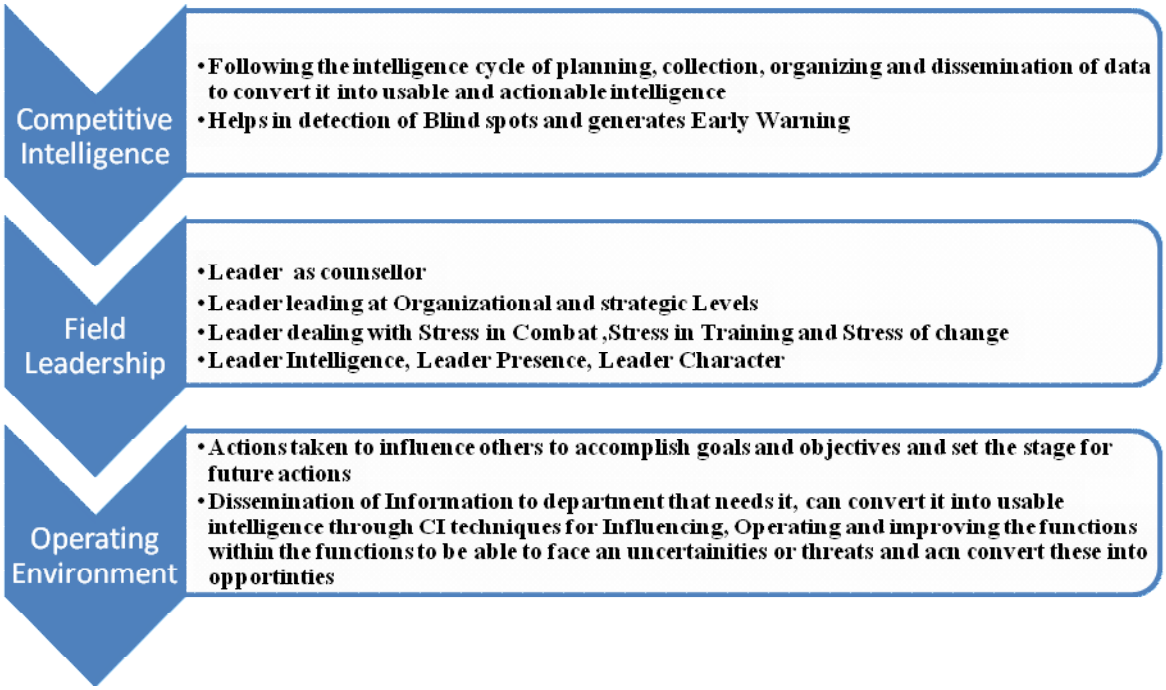

B. Competitive Intelligence Vs Leader Intelligence:

As we you have already gone through the previous pages of my study on what Competitive Intelligence is. In this extreme condition of cut throat and fierce competition the main mantra to succeed is "Globalize or Perish". Hence practicing CI is the need of the hour not only for survival but also to be a benchmarking organization. The systematic process of extraction of information through private and public domain information seeking sources is what is known as Competitive Intelligence. Leader Intelligence on the other hand is checking the action-reaction and counteraction of moves taken by organizations or opponents which at times may trigger off a chain or events which may not be in support of the vision and mission of the organizations. A field leader should be able to study the second and third order of events which is likely to take place in the future to take the right course of action. Leader Intelligence on the other hand also means the conceptual abilities which comes from certain mention tendencies and sound resource competencies. Leaders own behavior and mental ability should be a ready regulator to change course of action when it is required or take actions that may not affect them adversely with reactions that

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did not expect.

"It is not genius which reveals to me suddenly and secretly what I should do in circumstances unexpected by others; it is thought and meditation".

Napoleon Bonaparte

French general (1789-1804) and Emperor of France (1804-1814)

The conceptual abilities to secure Field leadership which is as applicable in Business and that contributes to being an efficient leader is through:

- Agility
- Judgment
- Innovation
- Interpersonal tact
- Domain knowledge

Source: http://www.fas.org/irp/doddir/army/fm6-22.pdf

Below is the relationship framework on interdicting Competitive Intelligence (CI) and Leader Intelligence(LI) and how it helps organizations to attain Organizational Leadership.

Conceptual components	**Effect on CI Practices**	**Effect on LI Practices**	**Outcome in Organizational Perspective**	**Course of Decision**
Agility	Helps the analyst to be proactive and quick decision maker	Is the flexibility of mind and can adapt to uncertain and unforeseen situations	Critical Thinking and finding truth in situations is possible.	Quick and on Time
Judgement	Extraction of	Juggle facts,	Assesment of	Delayed

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	Information through open sources and market research techniques and by forecasting through market surveys, tradeshows, accessing reports, press and media	Questionable data and Gut level feelings should be exercised- Behavioral Science and psycho-analytics related exercises	Situations and uncertainities through framing rules, laws, regulations	Process but timely
Innovation	CI practice is itself a new technique of knowing about your competitors and their moves. Following the Intelligence Cycle.	Creativity in producing ideas. Adaptive approaches or coming up with a new idea	Weight training and exercises, aerobics, games, treadmills and health checkups. Behavioral check, physical check, Psychological tests will enable extraction of information through formal informal channels	Delayed Process and basis is on R&D
Interpersonal Tact	Extraction of Information through ethical ways or through alternative routes to intelligence like hiring detective	Knowing about what others perceive, thinking in the perspective of people. Acceptance of character,	Display of behavioral balance, stability, self control and balance. Recognise diversity, emotional quotient, Balance.	Continuous Process

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	agencies, consulting firms, firms that detects fraud	perceptions, reactions of others		
Domain Knowledge	Complete extraction of Information through Buisness Intelligence tools, Data Mining, Data Warehousing techniques, HUMINT, Economic Intelligence, KIM	Complete knowledge of facts, beliefs, assumptions and tactical, technical, joint, cultural and geopolitical knowledge	Initiation of Tactics, Techniques, Doctrines, Fieldcraft (Less likely to have casualities) and Tactical Proficiency. Establishment of training centres for realistic trainings	Continuous updation

C. The Warrior Ethos: The Role of Ethics in Competitive Intelligence and Field Leadership

Every organization has an internal culture and ethos. A true warrior ethos must underpin the Army's enduring traditions and values…. Soldiers imbued with an ethically grounded warrior ethos clearly symbolize the Army's unwavering commitment to the nation we serve. The Army has always embraced this ethos but the demands of

Transformation will require a renewed effort to ensure that all Soldiers truly understand and embody this warrior ethos

Source: ***General Eric Shinseki, former Army Chief of Staff, U.S Senate***

Since both Competitive Intelligence and leader Intelligence owes its genesis from Military tactics and History. Compliance with standards and norms has been the protocol right from the time armies were

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formed. Ethos and Ethics are two different phenomenon, on one side ethos thrives on Custom's, Usages, Belief's and Assumptions that characterizes a leader unwavering commitment to the nation. It sib the sense of pride, the commitment, the loyalty, the core values that are embedded in a field leader, a warrior who braves through uncertain and battling situations courageously even through multiple deployments. Ethos is something which runs in the blood of the a field leader whilst on the other hand a Competitive Intelligence Analysis adherence and compliance is a pre-requisite, one who takes this profession of practicing CI is well aware of its intricacies. Then one cannot say " Ignorantia Juris non Excusat". Legal Adherence is through following the legal framework concerning the territories strictly, below are some laws framed in this direction:

a) Economic Espionage Act
b) Competition Act
c) Anti Trust Legislations
d) SCIP's code of ethics
e) Copyrights Act

Below is the diagram showing CI and LI practiced in all Leadership levels of Organizations securing field Leadership

Figure 3-

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Key Findings

a) There is strong linkage between Competitive Intelligence and Field Leadership.

b) The study has been done considering two focus areas CI and LI.

c) The aim of this study is just to highlight the linkage between Competitive Intelligence and Leader intelligence with the sole objective of bringing about significance of Field Leadership.

d) The study is just an insight and not recommended for use in practice, hence it is for reference for authors and practitioners, No inference can be sought from this study.

Conclusion and Recommendations

The study focuses on the effectiveness of these two practices CI and LI. In both cases the linkage has been establishes since Military Intelligence is the key focus area on which both derives their evolution. I advocate the prophecy of competitive Intelligence in organizations that are emerging or which don't have a full blown CI unit.

A formal training on CI is required for all executives to know how Competitors function and how can

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they dealt with. Organizational Leadership is possible only when you have a task force, a strong unit who can maneuver like soldiers on the battlefield who can take on any challenge and outsmart competitors. The leader who has value based leadership, Impeccable Character and high professional competence. A well defined strategy is the need of the hour and the inference that organization will succeed in whatever it does is a myth, hence anticipating the second and third order actions beforehand will help organizations to thrive in this fierce competition. A leadership requirement model can be helpful to understand what is required in a leader and how will the organisation's do well if did'nt have a competent leader.

Figure-4 Leadership Requirements Model

Competitive Intelligence and Leader Intelligence perspectives

Leadership Requirements Model		
Attributes *What an Army Leader is* **A. Leader of Character** • Army Values • Empathy • Warrior Ethos **A. Leader with Presence** • Military Bearing • Physically Fit • Composed, confident • Resilient **A. Leader with Intellectual Capacity**		Core Leadership Competencies *What an Army Leader Does* **A. Leads** • Leads others • Extends influence by the chain of Command • Leads by examples • Chain of Command **A. Develops** • Prepares self • Creates positive Environment • Develop others **A Archieves**

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• Mental Agility • Sound Judgement • Innovation • Interpersonal Tact • Domain Knowledge		• *Get Results*

Source: http://www.fas.org/irp/doddir/army/fm6-22.pdf

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SHELF SPACE OPTIMIZATION USING METAHEURISTIC ALGORITHMS

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ABSTRACT

Efficient allocation of shelves in retail is essential to gain and maintain competitiveness. Shelf Space Allocation Problem (SSAP) is an extension of the knapsack problem; the objective is determination of the products and their locations on shelves to maximize expected profit.
Various factors such as location within the store, product adjacencies and number of facings allocated for that particular product affect profitability of a product. Due to the size and complexity of the problem, metahuristic methods are preferred. This manuscript provides two metaheuristic solution algorithms to the model proposed by Ayhan et al. (2007), which is an extension of the model introduced by Yang (2001). This study has shown that for problems of various sizes both Tabu Search (TS) and Genetic Algorithm (GA) can provide better solutions than the greedy algorithm proposed by Ayhan et al.

1. INTRODUCTION

Shelves, in which the products are displayed, are one of the most important resources in retail sector. Retailers can both increase their sales and decrease the inventory holding cost by applying a proper shelf

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allocation method. However, it is difficult to find the most proper way. As the number of brand lines continually increases, allocating products to the supermarket shelf in the best possible arrangement poses challenges to the retailer (Lim, et. Al., 2004).
Shelf Space Allocation Problem (SSAP) can be defined as determination of optimum mix and locations of products for display in a retail setting. It is possible to classify SSAP as an extension of the knapsack problem. Due to the complexity of the problem commercial management systems usually contain only simple heuristics (Yang and Chen, 1999).

Optimum allocation of products into display shelves allow retailers to increase profits in two ways; they lower operating expenses such as shelf replenishment cost and inventory costs and increase sales. Sales quantity of a product depends on various factors including; location within the display, number of facings the product occupies and adjacent products. (Dreze, Hoch and Purk, 1994).

According to Anderson and Amato (1973), demand for a product in a retail setting can be decomposed into random demand that depends on display area, and preference demand. This implicates that relatively more space should be allocated for products with more random demand.
Corstjens and Doyle (1981) developed a model where demand for a product depends on direct elasticity with respect to shelf space, cross elasticity with respect to adjacent product while operating costs depends on products' location within the store. Along with these three factors, profit margins effect the profit obtained from a product. The aim of the retailers is to maximize profits.

Zufryden (1986) proposed a dynamic programming solution to a simplified version of the Corstjens and Doyle model. Although some important features of the Corstjens and Doyle model are lost, this method allows exact solution of realistic problems in a short amount of time.

Yang(2001) presented a similar formulation and suggested heuristics to generate good solutions. His method consists of a greedy algorithm used to generate an initial solution and an adjustment phase that seeks to improve the solution by swapping products.

Lim, Rodrigues and Zhang (2004) have improved Yang's heuristics and compared the original as well as the improved heuristics with three different metaheuristic algorithms. They report that a modified Squeaky Wheel Optimization algorithm that incorporates local search yielded the best results.

Martinez-de-Albeniz and Roels (2011) studied the effect of wholesalers pricing on allocation decisions of retailers and found out that when compared with the inefficiencies due to suboptimal pricing decisions, inefficiencies due to suboptimal shelf space allocation decisions are relatively small.

2. MODEL

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The Shelf Space Allocation Problem can be mathematically formulated as follows:
There are n = 1, 2, …, N shelves and k = 1, 2,… , K different types of products. Shelf n has length of T_n while each unit of product k has length of a_k. At least L_k units of product must be placed on shelves, while U_k is the greatest number of product k that can be placed. Placing item k on shelf n yields a profit of P_{nk} multiplied by cross elasticity factor $R_{nk, nk-1}$ where nk-1 is the item placed next to the item. Let X_{nm} be the *m*th item placed on shelf n, then the objective can be formulated as:

$$\max \pi = \sum_{i=1}^{n}\sum_{j=1}^{m} P_{Xij} \cdot R_{Xij\,,\,Xij-1}$$

subject to:

$$\sum_{j=1}^{m} a_{Xnj} \le T_n \quad for\ each\ n \left(\text{Shelf space constraint}\right)$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m} \begin{cases} 1 & for\ k = X_{ij} \\ 0 & otherwise \end{cases} \le U_k \quad for\ each\ k \quad (\text{Upper limit for } k\text{th item})$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m} \begin{cases} 1 & for\ k = X_{ij} \\ 0 & otherwise \end{cases} \ge L_k \quad for\ each\ k \quad (\text{Lower limit for } k\text{th item})$$

In order to have a known benchmark to compare with, the test case used by Ayhan et al. (2007) was solved with two different metaheuristic algorithms in the following section. The test case involves 3 shelves and 7 products. Product lengths vary between 2 and 6 units while each shelf's length is 30 units, meaning at most 15 items can be placed on a shelf.

3. METAHEURISTICS

Lim, Rodrigez andZhang(2004) showed that metaheuristics can be used to generate good solutions for Yang's SSAP within reasonable time. In this study two different metaheuristics were used to solve the extended version of the problem. First is a Tabu Search (TS) algorithm, which is first proposed by Glover (1986). It is a neighbourhoodbased,iterative metaheuristic, and can be applied to manyoptimisation problems. In every iteration of Tabu Search, anattempt is made to improve the current solution by searching itsneighbourhood, and choosing the solution with the best value. Toavoid local minima a mechanism called the tabu list is introduced (Czapinski, 2012). Since tabu search application for the three dimensional bin packing problem shows promising effective results (Crainic, et al., 2009), it is beter to employ tabu search algorithm for the shelf space allocaiton problem as well.

For the shelf space allocation problem, in each solution, its neighborhood consists of N*M(N*M-1) possible swaps of two items plus N*M*K possible alterations of an item. Even for our small test case, this amount to 3*15(3*15-1) = 1980 swaps and 3*15*7 = 315 alterations. Since it was not feasible to search

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the entire neighborhood, only a portion of the neighborhood is randomly chosen to be examined. In this study neighborhood consists of 200 randomly chosen neighbors. A move is considered to be tabu, if it involves change of an item that was recently changed. Size of the tabu list is 10 and a tabu move is allowed only if it yields a solution better than the best known solution. This process is repeated 200 times. Pseudo code for the implementation of the tabu search is given below; actual computer code is available upon request.

```
//initialization
initialize counters
generate random solution
//iterations
for 200 iterations
   for 200 neighbors
      generate neighbor by random move
      if (move in tabu list & best solution not improved)
         discard and generate another
   find best solution in the neighborhood
   if best solution is improved
      update best solution
   update tabu list
//finalization
return best solution
```

The other metaheuristic used is Genetic Algorithm (GA). It is a computer run process whichmimics natural evolutionary processes. Afull set of individuals, each representing a potential solution to the problem, forms a population which progresses through evolutionarystages called generations. Every individual fulfils the parameters of the targetfunction (the function being optimised) to a particulardegree. Therefore, a new population is formed from the oldone by selecting the most successful individuals, and fillingthe remainder of the population with individuals created byuse of the genetic operators of mutation (solution data israndomly changed within selected parameters) andcrossover (exchange of data between pre-existingindividuals). The algorithm is stoppedwhen it has been running for a predefined amount of time, oran optimisation constraint is met (Vrcan and Lovrin, 2010). Since genetic algorithm is one of the most widely used metahuristic methods (Jurkovic, et al., 2009; Oiso, et al., 2011), it is beter to employ it in the problem of shelf space optimization.

For the shelf space optimization problem to employ the genetic algorithm, the population size is fixed at 100, at each iteration 50 children are generated from randomly selected parents based on their rank. Then each chromosome of each member of the population is subjected to mutation with p = 0.02. After the mutation, 50 worst solutions are removed from the population (fitness based survival). This process is repeated 300 times. Genetic algorithm solution was implemented using the pseudo code below.

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```
//initialization
initialize counters
set best solution to 0
for 100 members
   generate random solution
//iterations
for 300 iterations
   //generate new members
   for 50 children
      chose random parent1
      chose random parent2
      crossover and produce children
   //mutate
   for 150 solutions
      for each chromosome
         chose random number
         if random number < mutation probability
            mutate
      calculate objective value
   //cull the weak
   remove 50 worst solutions
   //update best solution if better than previous best
   if highest(objective value) > best solution
      update best solution
//finalization
return best solution and runtime
```

4. COMPARISON OF RESULTS

Both methods were used 20 times to evaluate their efficiency and the findings are summarized on Table 1. It was observed that on average both methods outperform the greedy solution reported by Ayhan et al. (2007).

	Min z	Mean z	Max z	Average runtime
Tabu Search	106.35	155.31	193.90	200.81
Genetic Algorithm	145.95	162.38	176.25	253.13
Greedy (Yang, 2001)	135.9	135.9	135.9	
Greedy with improvements (Ayhan et al., 2007)	146.1	146.1	146.1	

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Table 1: Comparison of metaheuristics and greedy algorithm

Although Tabu Search did worse than the greedy algorithm on some occasions, it did outperform greedy algorithm on average. These findings contrast with findings of Lim et al. (2004), where Tabu Search failed to outperform the greedy algorithm.

On average Genetic Algorithm yielded better results, although it took more time to obtain the solution. Tabu search algorithm demonstrated faster convergence, but also higher variability. This suggests that TS is more prone to getting stuck at a local maximum.

It's noteworthy that Tabu Search algorithm did not only yield the worst solution, but also the best one. This high degree of variability suggests the sensitivity of TS algorithm to initial solution.

Fine tuning parameters of the algorithms and/or introducing other techniques such as swaps for mutations, random survival, different aspiration criteria, exploration of a random subset of the neighborhood may yield better results.

5. CONCLUSION &FUTURE WORK

Shelf space allocation problem is an interesting problem with significant potential to improve retailers' profitability. Although it is a kind of knapsack problem, it is hard to find the optimal results. This is because of the problem type and characteristic varies due to different occasions and there are many constraints to be taken into account. Therefore, this study aims to develop a model to solve SSAP, regarding some of the most important constraints. Furthermore, the developed model is enhanced by metaheuristic algorithms to find better results (in many cases the optimal ones) in shorter computing times. Genetic algorithm and Tabu Search methods are employed to solve SSAP. According to results of the test cases compared with the greedy algorithms explained in the literature review part, Genetic Algorithm resulted better solutions in terms of maximizing the profit and minimizing average runtime. In the absence of other heuristics, metaheuristic algorithms such as Genetic Algorithm are the most viable options to solve the SSAP.

In the future, the solution algorithms may be used on larger problems to measure their performance on real life sized problems. Test cases with different parameters can be solved to evaluate the performance of the algorithms under different circumstances. Moreover, other metaheuristic algorithms such as simulated annealing can be adapted to this problem to compare with the current solutions.

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Impact of Capital Structure on Firm Financial Performance: A Case Of The Pakistani Engineering Firms Listed On KSE

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Abstract

The purpose of this study is to empirically investigate the relationship between capital structure and profitability of engineering firms listed on Karachi stock exchange of Pakistan. The study uses four years data i.e. 2006-2009 for these firms. The study uses regression analysis as a research methodology. Capital structure is measured by three financial ratios i.e. short-term debt to total assets ratio, long-term debt to total assets ratio, and total debt to total assets ratio. Profitability in this study is measured by return on investment (ROI) and return on equity (ROE). Findings indicate that short-term debt, long-term debt, and total debt are significantly and negatively related to profitability measured by ROI. However, the relationship of short-term debt and total debt with profitability measured by ROE is insignificantly negative and the relationship of long-term debt with ROE is positive but not significant. This is the first

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study which investigates the relationship between capital structure and profitability of the engineering sector of Pakistan.

Keywords: Capital structure, Short-term debt, Long-term debt, Total debt, Profitability, Return on investment, Return on equity, Engineering firms.

1. Introduction

Capital structure (CS) is the mixture of equity and debt used by a firm to finance its assets. It is also called financial structure. Capital structure is a very important concept in corporate finance because returns to different stakeholders need to be maximized (Modigliani & Miller, 1958). Capital structure play an important role in determining cost of capital which ultimately effect the firm profitability. Due to the importance of cost of capital (interest plus dividends) in capital budgeting decisions, it is required to establish an optimal capital structure that maximize returns and minimize cost of capital. The shareholders wealth maximization goal of financial management state the firm should maintain an optimal capital structure that maximize the firm value and minimize the cost of capital (Weston & Brigham, 1990). The capital structure theory (Harris & Raviv, 1991) indicates that a firm establish a target debt ratio based on the trade-offs between benefits and costs of equity versus debt. Considerable research (Modigliani & Miller, 1963; Myers & Majluf, 1984; Kinsman & Newman, 1999; Jensen & Meckling, 1976; Berger & Patti, 2002; Abor, 2005; Ebaid, 2009; Salehi & Biglar, 2009; Harris & Raviv, 1991; Shoib & Gohar, 2010) have been done on capital structure but there is no agreement on what exactly is an optimal capital structure.

The funds generated through capital structure are invested by the firm in assets which are used to

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generate revenues. If these assets are efficiently used then the firm will earn profit which is the basic purpose of any business. Kinsman and Newman (1999) (as reported by Ebaid, 2009) mention that examining the relationship between capital structure and firm profitability is important for several reasons. First, average debt level for firms is showing an increasing trend, requiring an explanation of the effect of CS on profitability. Second and most important reason is to study the relation between CS and stockholders wealth, since stockholders wealth maximization is the basic purpose of financial management.

The purpose of this paper is to empirically test the relationship between CS and profitability of engineering firms listed on Karachi stock exchange (KSE) of Pakistan. Almazan and Molina (2005) and Bradley, Larrel and kim (1984) (as reported by Amjed, 2007), examined that firms in a particular industry establish similar capital structures. Certain variables force firms to behave in a similar fashion in an industry which leads to industry specific capital structure. This study is very important for engineering firms of Pakistan as it will help these firms to make effective capital structure decisions and determine a level of capital structure that maximize their profitability and shareholders wealth. The study will also help the creditors and shareholders of engineering firms of Pakistan to know how effectively their money is being utilized.

The rest of the paper is structured as: second section gives the literature review, third section state the data, sample and methodology, fourth section contains the empirical results, fifth section discussion, and sixth section conclusion and recommendations.

2. Literature Review

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Since Modigliani and Miller (1958) pioneer work, the relationship between CS and performance is an important issue in finance. Modigliani and Miller (1958) argued that in the absence of market imperfections and no taxes, no bankruptcy costs, the total value of the firm and the cost of capital (COC) are independent of its CS i.e. no matter what is the mix of financing the firm value and the COC remains the same. Modigliani and Miller (1963) review their previous paper and include taxes in their model. They argued that the interest payments on debt is tax-deductible expense which reduce the amount of tax to pay, so the optimal capital structure of the firm is 100% i.e. there is no equity in the firm CS. This means that the firm's value increases as debts increases.

However, the assumptions of Modigliani and Miller does not hold in the real world situation but it motivate many researchers to study the relationship between CS and profitability. For example, Jensen and Meckling (1976) presented agency costs theory. They have developed the well known agency costs hypothesis i.e. high leverage decreases the agency costs of outside equity and increases firm value by motivating managers to act in the best interest of stockholders. The researchers further state that ownership and control separation in firms may result in manager's inefficiency and they may fail to maximize the firm value. Jensen and Meckling (1976) define agency costs as the costs incurred by shareholders and creditors in order to monitor the behavior of the management. They argued that high leverage reduces agency costs because managers have the threat of liquidation from creditors and they work efficiently which ultimately results in the firm value maximization.

Similarly, the other two dominant theories, the pecking order theory and the trade-off theory were developed. The "pecking order" theory presented by Myers and Majluf (1984) suggest that firms will first

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rely on an internal source of fund such as retained earnings, in case of no information asymmetry, then they will go for debt and lastly they will issue shares for further funding requirements. Thus, according to the packing order theory, profitable firms that retained most of their earnings are expected to have less debt in their CS. Consequently, negative association could be expected between debt level and profitability. The trade-off theory which combine tax concept given by Modigliani and Miller (1963), bankruptcy costs concept given by Baxter (1976) and agency costs concept given by Jensen and Meckling (1976) can be used to determine the optimal CS. When the debt level increases, the bankruptcy and agency costs eventually become significant. The point at which the marginal bankruptcy/agency costs equal the marginal tax-shield benefits, the share value is maximized and cost of capital is minimized. At this point there is an optimal CS. Thus, according to the trade-off theory (as reported by Ebaid, 2009), firms with larger profits have larger income to shield and thus should borrow more to save tax. Consequently, a positive relationship between CS and profitability could be expected. Trade-off hypothesis proposed that firm should have an optimal CS based on balancing between the costs and benefits of debt.

Only few studies are carried out regarding the said topic in the developing countries and the results of these studies are mixed i.e. some show positive relationship while some shows negative relationship. For example, Abor (2005) found significant positive association between short term debt and profitability measured by return on equity (ROE), significant negative relationship between long-term debt and profitability, and significant positive relationship between total debt and profitability of Ghanaian firms. Ebaid (2009) studied the relationship between CS and performance of Egyptian firms.

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Findings indicate a significant negative relationship between short-term debt and performance measured by return on investment (ROI) of Egyptian firms, no relationship between long-term debt and performance, and a significant negative relationship between total debt and performance. Amjed (2007) argued that short term debt has significant positive relationship with the profitability (ROE) while long term debt has negative relationship with the profitability in the textile sector of Pakistan. However, no significant association between total debt and profitability in the textile sector of Pakistan was found. It is because of the fact that short term debt have positive relationship and long term debt have negative relationship with profitability and they combine result is no association with profitability. Abor (2007) examined the relationship between debt level and profitability of small and medium-sized enterprises (SMEs) in South Africa and Ghana. Findings indicate that short-term debt and total debt is negatively related to gross profit for both SMEs of South Africa and Ghana. The researcher further reported that long term debt has a significant positive relationship with gross profit.

Similarly, Salehi and Biglar (2009) observed direct relationship between debt to assets ratio and profitability of Iranian firms. Profitability is measured by ROE and ROI. They reported that profitable Iranian firms have less debt in their CS. Berger and Patti (2002) tested the agency cost hypothesis and conclude that high leverage ratio or low equity to capital ratio was associated with higher profit efficiency in the banking industry.

Research indicate that the size of the firm also impacts profitability. For instance, Eljelly and Abuzar (2004) studied a sample of Saudi Arabian companies and a strong direct relationship was observed between firm size and profitability. Abor (2005) mentioned that the firm size is positively

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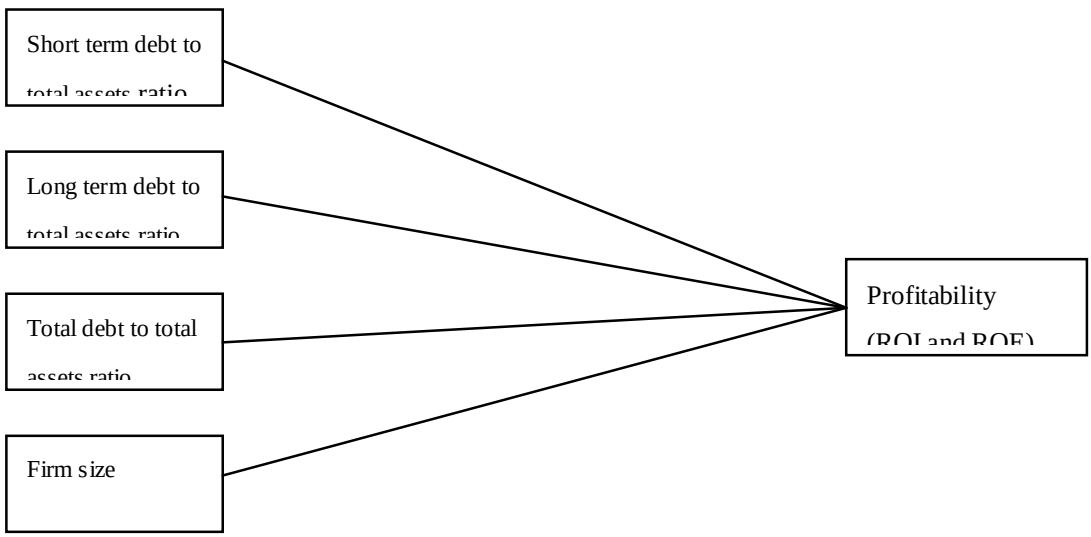
related to profitability. Similarly, Zubairi and Baig (2010) reported that profitability of the automobile firms in Pakistan is significantly and positively related to the size of the firm.

The above literature indicates that few studies have studied the relationship between CS and its impact on financial performance in developing countries. In a Pakistani context, Shoib and Gohar (2010) examine the relationship between an optimal CS and its impact on bank performance. However, their study is based on the financial sector of Pakistan specially banks. Therefore, the current study empirically study the relationship between CS and financial performance in the non-financial sector with focus on engineering firms of Pakistan listed on KSE. Based on the related literature, the following research framework has been proposed.

Schematic Diagram



3. Methodology

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3.1. Sample and Data

The sample for this study consists of 33 listed firms on Karachi stock exchange of the engineering sector of Pakistan. There are 38 listed engineering firms on Karachi stock exchange but five firms were not considered for this study because of incomplete data and negative equities in capital structure of these firms. The data is obtained from the publication of SBP i.e. Balance sheet analysis of joint stock companies listed on KSE for the period 2006-2009.

3.2. Variables Defined

The study uses profitability as dependent variable and individual component of capital structure as independent variables. Profitability is operationalized by two commonly used accounting based measures i.e. return on investment (ROI) and return on equity (ROE). ROI in this study is computed as net profit before tax divided by total assets. ROE is computed as net profit before tax divided by total stockholders equity.

Capital structure is measured by the following three financial ratios:

a) Short-term debt divided by total assets

b) Long-term debt divided by total assets

c) Total debt divided by total assets

Short term debt is defined as all debt that have a maturity period of one year or less i.e. which is to be paid within one year. Long-term debt include those debts whose maturity period is more than one year. Total debt equals short-term debt plus long-term debt. Assets are defined as all assets at their book values.

Another independent variable firm size is used as a control variable. Firm size is measured by

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logarithm of total assets. This measure as a proxy for firm size is most commonly used by researchers (Eljelly & Abuzar, 2004; Abor, 2005 & 2007; Ebaid, 2009).

3.3. Hypotheses

Various hypotheses are developed to study the impact of CS on firms profitability in the engineering sector of Pakistan.

First hypothesis is;

Ho: There is positive relationship between short term debt and ROI

H1: There is negative relationship between short term debt and ROI

Second hypothesis;

Ho: There is positive relationship between long term debt and ROI

H1: There is negative relationship between long term debt and ROI

Third hypothesis;

Ho: There is positive relationship between total debt and ROI

H1: There is negative relationship between total debt and ROI

Fourth hypothesis;

Ho: There is negative relationship between short term debt and ROE

H1: There is positive relationship between short term debt and ROE

Fifth hypothesis;

Ho: There is positive relationship between long term debt and ROE

H1: There is negative relationship between long term debt and ROE

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Sixth hypothesis;

Ho: There is negative relationship between total debt and ROE

H1: There is positive relationship between total debt and ROE

Seventh hypothesis;

Ho: There is negative relationship between size of the firm and ROI

H1: There is positive relationship between size of the firm and ROI

Eight hypothesis;

Ho: There is negative relationship between size of the firm and ROE

H1: There is positive relationship between size of the firm and ROE

3.4. Regression Equations

The regression equations used in the study are given here;

1. $ROI_{i;t} = \alpha + \beta 1\ STD_{i,t} + \beta 2\ SIZE_{i,t} + e$
2. $ROI_{i;t} = \alpha + \beta 1\ LTD_{i,t} + \beta 2\ SIZE_{i,t} + e$
3. $ROI_{i;t} = \alpha + \beta 1\ TD_{i,t} + \beta 2\ SIZE_{i,t} + e$
4. $ROE_{i;t} = \alpha + \beta 1\ STD_{i,t} + \beta 2\ SIZE_{i,t} + e$
5. $ROE_{i;t} = \alpha + \beta 1\ LTD_{i,t} + \beta 2\ SIZE_{i,t} + e$
6. $ROE_{i;t} = \alpha + \beta 1\ TD_{i,t} + \beta 2\ SIZE_{i,t} + e$

Where:

$ROI_{i;t}$ = Net profit before tax divided by total assets of firm i in time t;

$ROE_{i;t}$ = Net profit before tax divided by total equity of firm i in time t;

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STDi,t = Short term debt divided by total assets of firm i in time t;

LTDi,t = Long term debt divided by total assets of firm i in time t;

TDi,t = Total debt divided by total assets of firm i in time t;

SIZEi,t = log of total assets for firm i in time t; and

e = Error term

4. Empirical Results

4.1 Descriptive Statistics

The descriptive statistics in order to look at the nature of the data are given in table 1. A total of 132 observations for 33 firms of engineering sector are recorded during the study period of 2006-2009. The mean (median) short term debt to total assets ratio is 0.4790(0.5100) which shows that a significant amount of assets of engineering firms of Pakistan is financed by short term debt. This may be due to the easy availability of short term financing or limited long term sources of financing. The minimum value of STD recorded during the study period 2006-2009 is 0.0800 and maximum is 0.8900. The average (median) of long term debt to total assets is 0.0672(0.0300) which is very low. This may be due to the underdeveloped nature of long term debt Pakistani market. The average (median) total debt to assets is 0.5436(0.5600) which depicts that the engineering industry is moderately leveraged. The average firm size measured by log of total assets is 3.3330 with minimum 1.9500 and maximum 4.3900. The mean (median) return on investment (ROI) is 8.7697 %(6.5000%) for four years period and it shows a reasonable performance of the firms. The average (median) value of second profitability measure return on equity (ROE) is 19.7053 %(17.9000%) that shows a good performance of using owner's funds to

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generate profits. Large variations are observed for both ROI and ROE during the study period of 2006-2009.

Table 1. Descriptive statistics of the variables

Variables	Mean	Standard deviation	Median	Range	Observations
STD	0.4790	0.1664	0.5100	0.0800-0.8900	132
LTD	0.0672	0.1197	0.0300	0.0000-0.7400	132
TD	0.5436	0.1691	0.5600	0.1100-0.9000	132
Firm size	3.3330	0.5564	3.2950	1.9500-4.3900	132
ROI %	8.7697	10.9528	6.5000	-26.9000-44.8000	132
ROE %	19.7053	22.6804	17.9000	-73.0000-70.6000	132

Note. STD = Short term debt to assets ratio. LTD = Long term debt to assets ratio
TD = Total debt to assets ratio. ROI = Return on investment. ROE = Return on equity.

4.2. Regression Analysis

Regression results are presented for each equation separately in order to compare the different financing options.

4.2.1. Equation 1. Table 1 contains the results of the first regression equation. The first equation contains the relationship between short-term debt and profitability measured by ROI by keeping firm size as a control variable. Empirical results indicate that there is significant negative relationship between short-term debt and ROI. The beta coefficient for short term debt is (-13.5135) is negative and significant at the 95% confidence level indicating that one percent increase in short term debt decrease ROI by 13.5135 percent. The possible reason may be the probability that the firms will be unable to meet their

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short term obligations and will become technically insolvent that contribute negatively to profitability measured by ROI. These findings are in line with the pecking order theory i.e. profitable firms initially rely on an internal source of fund such as retained earnings, then they will turn to debt if additional finances are needed and finally they will issue equity (Myers & Majluf, 1984). These results are also consistent with the Ebaid (2009) findings. The first null hypothesis is rejected at the 5% significance level as the p-value is 0.0160<0.05. The beta coefficient for firm size is 4.9112 which are positive and significant at the 5% significance level indicating that large firms of engineering sector of Pakistan are more profitable. The null hypothesis is also rejected in this case as the p-value is 0.0036<0.05. The R square and adjusted R square measure the percent variation in the dependent variable explained by the independent variables. The values of both R square (0.0949) and adjusted R square (0.0809) are very low indicating that there are other factors that contribute to the profitability of firms.

$$ROI_{i;t} = -1.1263 - 13.5135(STD_{i,t}) + 4.9112(SIZE_{i,t}) + e$$

Table 2. Short term debt to assets ratio and ROI

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	-1.1263	5.9688	-0.1887	0.8506
STD	-13.5135	5.5383	-2.44	*0.016
Firm size	4.9112	1.6559	2.9659	0.0036
R square =	0.0949			
Adjusted R square =	0.0809			

Note. STD = Short-term debt to assets ratio.
*P<0.05.

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4.2.2. Equation 2. The empirical results in table 3 indicate a significant negative relationship between long-term debt and profitability measured by ROI. The beta coefficient for long-term debt is (-15.5225) negative and significant at the 5% level indicating that one percent increase in long-term debt will reduce ROI by 15.5225%. The reason for such relationship may the more expensive nature of long-term debt. Long-term debt adds certain financial distress costs that impact profitability negatively. These findings are in line with the pecking order theory. The second null hypothesis is rejected because the p-value is less than the significance level i.e. 0.0465<0.05. Again there is significant positive relationship between the firm size and ROI. It shows that as firm size increases, profitability also increases. Again the values of R square (0.0819) and adjusted R square (0.0677) are very low indicating that there are other factors that influence the profitability of engineering firms in Pakistan.

$ROI_{i;t} = -5.2650 -15.5225(LTD_{i,t}) + 4.5236(SIZE_{i,t}) + e$

Table 3. Long term debt to assets ratio and ROI

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	-5.2650	5.6370	-0.9340	0.3520
LTD	-15.5225	7.7222	-2.0101	*0.0465
Firm size	4.5236	1.6606	2.7240	0.0073
R square =	0.0819			
Adjusted R square =	0.0677			

Note. LTD = Long-term debt to assets ratio.
*P<0.05.

4.2.3. Equation 3. The regression results are shown in table 4. The results show a significant negative

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relationship between total debt of engineering firms and their profitability (ROI). The coefficient beta for total debt is (-21.3103) significantly negative at the 5% level state that one percent increase in total debt will reduce ROI by 21.3103 percent. The negative relationship may be due to the costly nature of total debt. Certain costs are associated with total debt that contributes negatively to the firm's profitability. These results are in line with the pecking order theory and findings of Ebaid (2009). The third null hypothesis is rejected as the p-value is less than the significance level of 5% and the data support the alternative hypothesis. The beta coefficient of firm size is (5.2472) positive showing a significant positive relationship between firm size and ROI. The values of R square (0.1601) and adjusted R square (0.1471) are reasonable indicating the variation in the dependent variable ROI caused by the independent variables total debt and firm size.

$ROI_{i;t} = 2.8648 - 21.3103(TD_{i,t}) + 5.2472(SIZE_{i,t}) + e$

Table 4. Total debt to assets ratio and ROI

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	2.8648	5.8289	0.4915	0.6239
TD	-21.3103	5.2581	-4.0528	*0.0001
Firm size	5.2472	1.5980	3.2837	0.0013
R square =	0.1601			
Adjusted R square =	0.1471			

Note. TD = Total debt to assets ratio.
*P<0.05.

4.2.4. Equation 4. The results of the fourth regression equation are given in table 5. The empirical results

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indicates a negative relationship between short-term debt and profitability measured by ROE as the beta coefficient for short-term debt is (-0.7021) negative but the relationship is not significant at the significance level of 5%. The forth null hypothesis is do not rejected as the p-value is greater than the significance level i.e. 0.9522>0.05. Up to some extent these results are in line with Ebaid (2009) findings. The control variable firm size in this case is again positively related to the profitability (ROE) as the beta coefficient for firm size is (10.0093) positive. The value of R square (0.0601) and adjusted R square (0.0455) are very low showing the influence of factors other than short-term debt and firm size on ROE.

ROEi;t = -13.3197-0.7021(STDi,t)+ 10.0093(SIZEi,t) + e

Table 5. Short term debt to assets ratio and ROE

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	-13.3197	12.5953	-1.0575	0.2923
STD	-0.7021	11.6869	-0.0601	*0.9522
Firm size	10.0093	3.4943	2.8645	0.0049
R square =	0.0601			
Adjusted R square =	0.0455			

Note. STD = Short term debt to assets ratio.
*P>0.05.

4.2.5. Equation 5. Table 6 contains the results of the regression equation 5. The results indicate a positive relationship between long-term debt and ROE as the beta coefficient for long-term debt is (6.0073) but the relationship is not significant at the 5% significance level. These results are in line up to some extent

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with the trade-off theory. The fifth null hypothesis is do not rejected as the p-value is greater than the significance level i.e. 0.7109>0.05. The firm size is again positively related to profitability (ROE). The value of R square (0.0611) and adjusted R square (0.0465) is again very low showing the variation in the dependent variable ROE by the independent variables long-term debt and firm size.

ROEi;t = -14.0128+ 6.0073(LTDi,t) + 9.9953(SIZEi,t) + e

Table 6. Long term debt to assets ratio and ROE

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	-14.0128	11.8045	-1.1871	0.2374
LTD		16.1710	0.3715	*0.7109
	6.0073			
Firm size			2.8743	
	9.9953	3.4775		0.0047
R square =	0.0611			
Adjusted R square =	0.0465			

Note. LTD = Long term debt to assets ratio.
*P>0.05.

4.2.6. Equation 6. The empirical results presented in table 7 shows an insignificant negative relationship between total debt and profitability (ROE) of engineering firms listed on KSE. The beta coefficient for total debt in table 7 is (-1.3757) negative indicating the negative relationship between total debt and ROE. The sixth null hypothesis is do not rejected as the p-value is greater than the significance level i.e. 0.9051>0.05. Again these results are in line with the pecking order theory. Firm size is again positively related to ROE as its beta coefficient is (10.0357) positive. Values of R square (0.0602) and adjusted R

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square (0.0456) is again very low.

ROEi;t = -12.9962 -1.3757(TDi,t + 10.0357(SIZEi,t) + e

Table 7. Total debt to assets ratio and ROE

Variables	Coefficients	Standard error	t statistic	P-value
Intercept	-12.9962	12.7678	-1.0179	0.3106
TD	-1.3757	11.5176	-0.1194	*0.9051
Firm size	10.0357	3.5002	2.8671	0.0048
R square =	0.0602			
Adjusted R square =	0.0456			

Note. TD = Total debt to assets ratio.
*P>0.05.

In summary, the overall capital structure has negative relationship with the profitability of engineering firms listed on Karachi stock exchange meaning that an increase in the debt in the capital structure decreases the profitability of these firms. This may be due to the fact that that profitable firm's use retained earnings as their first source of financing, then they use debt and equity as their second and third source of financing. This overall result is consistent with the pecking order theory , findings of Abor (2007), findings of Ebaid (2009).

5. Discussion

As already stated by the results and the support for the first alternative hypothesis, there is significant negative relationship between short-term debt and profitability measured by ROI of

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engineering listed firms on Karachi stock exchange. The stated relationship in the alternative hypothesis is proven by the regression results and the main reason behind such relationship is that firms with more short-term debt carries a negative image as they may not be able to meet their short-term debt and become technically insolvent which contributes negatively to their profitability. The negative relationship between long-term debt and ROI is also proven in the second alternative hypothesis. The possible reason for such relationship is the more costly nature of long-term debt that negatively affect profitability of firms.

The third alternative hypothesis is also supported which describe that there is negative relationship between total debt and ROI. The reason for this is simple i.e. both short-term and long-term debt has negative relationship with ROI, total debt has also negative relationship with ROI.

The data do not provide sufficient evidence to conclude that there is significant positive relationship between short-term debt and profitability measured by ROE which is the fourth alternative hypothesis of this study. The reason may be the short maturity period of short-term debt which impacts profitability negatively. The fifth alternative hypothesis is also not supported and the relationship between long term debt and ROE is positive but not significant. This provides partial support for the trade-off theory which state that profitable firms use more long-term debt to shield their profit and take tax advantage. There is negative but insignificant relationship between total debt and ROE and the sixth alternative hypothesis is also not supported. The reason is that debt carries certain costs with it which negatively affect profitability.

The seventh and eight alternative hypotheses are supported indicating that firm size is positively related to profitability measured by both ROI and ROE. The reasons for more profitability of large firms

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of engineering sector of Pakistan are the use of more productive resources, well known, more experienced and professional management.

6. Conclusion and Recommendations

This paper examine the relationship between CS and profitability of the firms of engineering sector of Pakistan listed on KSE for the period 2006-2009. The empirical results indicate that short term debt, long term debt, and total debt has significant negative relationship with firm profitability measured by ROI. This provides support for the pecking order theory. However, short term debt, long term debt, and total debt has no significant relationship with profitability measured by ROE of engineering firms. The relationship of short term debt and long-term debt with ROE is negative but insignificant provide support for the pecking order theory. The relationship of long term debt and ROE is positive but not significant and provide partial support for the trade-off theory. The firm size of engineering firms listed on Karachi stock exchange is positively and significantly related to profitability indicating that large firms of engineering sector of Pakistan are more profitable.

Based on the findings of this study, it is recommended that the KSE listed engineering firms of Pakistan should use more equity in their capital structure in order to enhance their profitability. It is further recommended that the study should be conducted over a longer period of time with large sample size.

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Issues of Solar Home Systems in Bangladesh

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Abstarct

This paper discusses the success of Solar Home Systems (SHS) which is becoming a basic tenet of renewable energy sector in Bangladesh. The study focused on operational activities and outcomes of private firms such as Infrastructure Development Company Ltd (IDCOL). This is based on case studies and it is constructed with primary and secondary information. Evident shows that SHS has a bright prospect in Bangladesh.

Key words: Solar Home System, Infrastructure Development Company Ltd, Bangladesh.

Introduction:

The most used form of energy in modern world is electricity. Bangladesh is an energy hungry nation. The per capita consumption of energy is very low because the country is still largely an agricultural country instead of being industrial one. Yet power plants of Bangladesh can not supply the meager demand of only about 3500 Mega watt (MW) lag behind by over 500 MW. Most of our power plants are thermal that use mostly natural gas supply of which is still in abundance in the country. Bangladesh is very young land area most of which was formed in the last geological era named the Cenozoic (Bangladesh Observer, 2000). For this the coal depositions are still not matured for extraction. The expansion of gas fuelled

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power plant cannot be an ever ending process as the ever increasing demand is. The other significant source of electricity of Bangladesh is the hydro electric power plant at Kaptai. However this plant can produce only about 200 MW of electricity in the peak period of the monsoon. Since the country is largely a deltaic plain instead of being a hilly /mountainous one there is no chance of increasing power generation by this means. It has been called by the FAO to the governments of developing countries for helping rural areas to leapfrog directly from primitive energy sources to renewable and sustainable energy technologies without relying on fossil fuels. Notes that most rural residents still depend on burning wood, dung and crop residues for cooking and heating homes. But this practice requires many man-hours for collecting fuel materials and it causes indoor air pollution. So more must be done to provide alternative sources of fuel such as wind, solar and bio mass energy. It was also reported the high cost of installing and operating such power plants and thus, it is called by the donor countries to the government to help rural people to do this. Indeed, Bangladesh is located in the tropical region of the earth and this country gets enough sun light round the year. So the country has ample opportunity to use solar energy unlimited and sustainable energy. The government has declared its vision to provide electricity to all by the year 2020 (ERB, 2007). Since the actual demand could not be met due to shortage of available generation capacity and this is more acute in the remote areas where power can not be distributed in a conventional way, a number of reforms and restructuring of electricity has been undertaken accordingly by associating the private sectors with public sectors in order to supply solar energy to the rural areas. For example, Rural Electrification Board has taken two renewable energy projects with a target to provide 22000 domestic connections through Solar Home Systems (ERB, 2007). With the efforts of the government as well as private firms

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and NGOs, the trend of solar energy plant installation has been increasingly constantly.

Study about renewable energy of Singh et al, (2002) is recognized. His study was a perspective of bio gas technology in the hilly regions of Nepal. He concluded that bio gas technology can prevent the energy poverty vicious circle in the rural areas. However, some important points such as the possibility of employment creation in the rural areas through the introduction of renewable energy are unclear from the study. A similar study in Bangladesh is scant. It is perhaps, the renewable energy is still growing up here. Interestingly, the word renewable energy is used here is mainly to indicate the power supply in order to reduce the demand–supply gap of the electricity. More specifically, it has another aspect which is the creation of the employment opportunity in the rural areas. Considering the significance of solar home systems in Bangladesh, the study objectives are to explore the solar energy activities of some private firms and outcomes of their activities. This study will be helpful for the policymakers and planners of the country with a view to remove the shortage of electricity and increase the human resource employment and development either in Bangladesh or elsewhere.

This paper uses primary and secondary information which are obtained from published articles leading newspapers and discussion on related issues. The objectives of the paper are accomplished through theoretical and logical expressions. The formation of analysis is based on case study which is found in Qiang Xu et al., (2002).

Discussion:

The Case of the Infrastructure Development Company Ltd. (IDCOL).

Operational activities:

This is a non banking financial institution. It has revised its target to set up solar home systems (SHS)

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across Bangladesh. It has revised its plan because it had planned to install 10 lakh SHSs by December 2012 but it has already achieved its target by June 2011. This firm has now set a new target to install a total of 25 lakh SHSs by 2014 in areas where electricity is not available. The company invested around Tk.1440 crore-Tk.1200 crore in loans and Tk.240 crore in grants for the installations until June, 2012. IDCOL also plans to invest another TK 2867 in soft loans and TK.338 crore in grants for the same purpose. It expects to reach the target by mid 2012 with the current pace of operations.

The average fifty percent growth of SHS installations came on the back of availability of financial and technical support and quality equipments. Easy credit facilities and subsidies helped IDCOL achieve the goal ahead of time. Most of the solar home systems installed under financing from IDCOL have capacity of 50 watt-peaks. The original cost of the 50 watt peak system is Tk.30800, of which IDCOL grants Tk. 2800. A household has to pay a down payment of Tk.4200. An IDCOL loan of Tk.19040 is distributed through partner non governmental organizations that actually install the systems. These partners ultimately give loans worth Tk.4760 to customers for the 50 watt peak systems. It installs 50 watt peak system because it is popular one among rural customers and most of the SHSs were installed on off grid areas.

Outcomes:

According to IDCOL statistics (Table-1), it installed 60,142 SHSs in Sunamganj—the highest coverage by the company in a district. Patuakhali and Satkhira come in second and third, with each installing 58,836 and 39,483 SHSs till June, 2011. Of the partner organizations that implemented the IDCOL solar projects, Grameen Shakti alone installed over 6 lakh out of 10 lakh SHSs. Rural Service Foundation has

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set up over 1.5 lakh SHSs in different parts of the country.

Table:1 Number of Solar Home Systems District-Wise Coverage until June, 2011by IDCOL

Districts	**Number of Solar Home Systems**
Shariatpur	33706
Barguna	38406
Satkhira	39483
Patuakhali	58836
Sunamganj	60142

Source: IDCOL, quoted in The Business Star, June 29, 2011.

Socio Economic benefits of Solar Home Systems (SHSs):

SHS have helped save 80,000 tonnes of kerosene worth around Tk.580 crore and Tk 2821 crore in the electricity connection costs. The major benefit of SHSs is to create job opportunities. The prospects of the renewable sector in the country are huge as the future adaptation and mitigation measures will generate hundreds and thousands of jobs (Business Star, 2011). The renewable sector generally needs to hire a large number of field level employees, such as technicians, field assistants, sub assistant engineers and unit managers to reach out to the remote areas. A solar company generally recruits secondary or higher secondary pass candidates as technicians. They normally get Tk. 4500-Tk. 6000 based on their experience. The IDCOL has created 15000 direct and 30000 indirect jobs. Similarly Rural Service Foundation a partner organization of the IDCOL has recruited 4000 people with a view to run SHSs works.

The case of a Rural Household

Before using Solar Power:

Samad lives in a village. He is illiterate. There was no electricity connection of his house. He has 3

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children. His attitude was not charming. His room fills with darkness and dampness. Using kerosene, the surface of his room and other utensils had a layer of ash. Every night Samad sleeping without wash his leg. Because of high cost of kerosene, Samad was unable to give chance to study his children at night. Otherwise he had not any communication media like, TV, radio etc. It is therefore, he was out of many things of the country. His life was covered with cloud.

After using Solar Power:

Samad's wife feels interest to install solar power after watching it from a house of her relative. Samad had a little interest for the use of solar power. He said his wife that solar power only for literate peoples. Very soon, Samad was encouraged by his wife. After installing solar power, the family of Samad feels very happy. After install solar power, the first day when they turned on the light, they found their house is covered with garbage. They also saw that their feet were very dirty. Now they wash their feet and go to sleep at night daily. They can clean their house easily. This solar power lightens the mind of Samad. He does not need to pay any electricity bill and there is also no chance of load shedding. He buys a TV. He knows about the current world and also modern cultivation systems. Also he withdraws the restriction from his children to study at night. The successes of Samad rise day by day.

The case of a Recruited Person

"Even five years ago, Jamal Uddin had little hopes of getting a dignified job as he could not study beyond secondary level. But he is now employed by a solar home system producing company. Nonetheless, he got a job as a technician at a solar panel distribution and installation company in his home district" Business Star. (2011).

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Conclusion:

Only half of Bangladesh's population has access to electricity from the national grid. People on non grid areas who have no access to maintain electricity rely on heavily on costly kerosene lamps for lighting. This makes SHSs more attractive to them.

Career prospects in the renewable sector is a decent job that helps reduce consumption of energy and raw materials, de-carbonize the economy, protect and restore ecosystem service like clean water, flood protection and biodiversity and minimize the production of waste and pollution which can also prevent the vicious circle of energy. By getting job in the renewable sector such as SHS, people can get a new source of earning which may assist them to increase saving, capital accumulation and additional investment in order to remove vicious circle of energy. Policymakers of the country should take steps so that SHS can be continued in order to create job opportunities in Bangladesh and other developing countries.

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Organization Structural Dimensions Effects on Knowledge Management: A Review

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Abstract

This study focuses on reviewing suggested relationships between structural dimensions of an organization and knowledge management. Structural dimensions included of complexity, centralization and formalization. Reviewing studies in this area represented a clear contradiction about formalization and also complexity influence on knowledge management.

Keywords: Knowledge Management (KM), Organization structure, complexity, centralization, formalization

Introduction

Nowadays organizations are working in an environment that has five bold features: globalization and the increasing intensity of competition, organizational changes, new features and workers set of preferences and desires, advances in information and communication technologies and the emergence of knowledge management (Handzic, 2006). Therefore knowledge management is an essential area to be considered in successful performance for decade ahead. Also Drucker (2008) claimed that during the last two decades, organizations have experienced an environment of continuous, often rapid and discontinuous change. Indeed, many organizations in the developing world have moved from almost agrarian and feudal modes of operations to complex electronic manufacturing in the space of a few decades, So organizations must reserve traditional organization structures and adapting new situations with applying fresh organizational forms supporting emergence needs.

As the production of tangible goods is increasingly displaced by the production of identity products and opportunities to access social networks, organizations have begun to thrive on the development, retention and dissemination of organizational knowledge (Hamilton, 2003). The rapid accumulation of knowledge about customers, products, interactions, transactions, and human resources has necessitated the increasing growth of knowledge management systems that can capture, store and disseminate knowledge (Frappaolo, 2006).

Maier (2010) noted the harmony and balance between Knowledge Management Systems (KMS) and organizational structure. It is the existing human and social structure of an organization that remains the critical determinant of the successful integration of knowledge management systems within an organization.

This paper presents a review on studies around how organizational structure affects on knowledge management.

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Knowledge Concept

Today, knowledge is a key resource for sustainable earnings and creating organizational excellence (Sveiby, 1996). Nonaka et al (2000) defined knowledge as a dynamic concept caused by people and organization interactions and can be explained in a specific framework as it related to specific time and place. Unique experiences and organizational learning are sources of knowledge and frequently found in written documents in ordinary activities, process and organizational values (Behgat et al, 2002). Czapla (2004) noticed that knowledge is a a kind of an institution created in the process of divisible assets and social interaction.

In another definition knowledge is information processed by thinking and converted to something permanent in the memory that could be used by an individual to improve his/her way of living by harnessing the world that surrounds him/ her (Sheryl and Apostolos, 2011).

In IT context knowledge described as stored models or information used by person or machine to interpret, predict and appropriately respond to the outside world (Fischler & Firschein, 1987)

Knowledge Importance

Knowledge importance have been noticed as a new issue in organizations by many management practitioners. Toffler (1981) Believes that knowledge is the most important source of power.

Leading to decision and actions that increase capacity for effective performance in organizations are other aspects of knowledge importance (Davenport & Prusak, 1998).

In Taghavi and shafizade (2010) studies knowledge importance highlighted as an critical component of organization ability to learn and environmental adaptability.

Knowledge Management

It is evident that the word knowledge management (KM) has been used for diverse activities intended to administer, produce, improve and raise the merit and worthiness of intellectual resources within an organization, and unsurprisingly there exists no unanimity on the meaning and explanation of knowledge management (Haggie and Kingston, 2003).

Terra (2001) believes that KM implies, necessarily, to develop abilities interrelated in the strategic, to organize and individual plans; to accelerate competitive value new knowledge generation; to find out intellectual capital and knowledge already existing in the company; to generalize new revenues based on reusing existing intellectual knowledge capital in the company; to protect the existing intellectual capital in the company; to improve the decision making process at managerial, production and front line levels of the company; to reduce costs and redoing the job.

From Costa and Gouvinhas (2004) approach KM is process of generation, storage and sharing valuable information and views within and among societies and organizations with similar interests and needs.

Knowledge management has emerged as one of the new approaches and investigates how to acquire knowledge for the future profitability of the organization, dissemination and application of new knowledge for the production (Barratt-Pugh et al, 2011).

Organizational Structure

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According to Purcidonio et al (2007) the current context is characterized by accelerated changes, in markets, in technologies and in organizational structures, and the capacity to generate and to absorb innovations is considered crucial, in order to become organizations competitive.

In recent situation the strict bureaucratic model of organization is becoming more and more inadequate to face the current challenges imposed to companies (Terra, 2000). Although bureaucratic structure models existence in current business environment can't be ignored, regard to dynamic environment and intensive knowledge bureaucracy paradigm seems to be fail (Monavvarian and Asgari, 2009).

Since organizational structure forms the framework of organizational decisions and processes, itself is the primary driver of the mentioned change (Wang and Ahmed, 2003).

Organizational structure determines the communications between various organization levels to develop discipline in corporations and people implement the commands and decisions based on appointed communications. In other words organizational structure specifies tasks allocation, reporting reference, formal coordination mechanisms and interaction practices in an organization (Saraf, 1999).

According to Daft (1991) organizational structure is a an indication of the stable configuration of tasks and activities. Alvani and Danaie Fard (1998) defined organizational structure as one shows the division of labor and coordination among individuals and organizations reed units for organizational affairs. Making decision about allocation of responsibilities to departments, and provides a set of coordination mechanisms described as organizational structure by Anada & Giutena (1998). Power, authority, responsibility and work procedures division is organizational structure (Nahm et al, 2003).

Types of Organizational Structures

Generally organizational structures included of two main categories: Theoretical and Practical. Theoretical structures divided to organic and mechanistic models. Organic structures featured with some characteristics like flexibility, horizontal communication, low degree of formalization, knowledge based authority and various control modes. On the other hand, mechanistic structures have some specifications such as lack of flexibility, vertical communication, high degree of influence, authority and power based on organizational power and centralized control (Arabi, 2000).

Structural Dimensions

Former studies in organizational structure context concentrated on three dimensional frameworks for describing different organizational forms. For instance, Robins (1990) applied formalization, centralization and complexity as factors explaining organizational structure. Structure dimensions are formalization, centralization and integration in Chen and Hwang point of view (2007).

7.1. Complexity

Complexity is the extent of flexibility or rigidity of the organization structure. It defines the extent of differentiation, including the degree of specialization or division of labor, the number of levels in the organizations hierarchy as well as the extent to which the organizations units are dispersed geographically (Robins, 1990; Stephen, 1996; Sycamnias, 2008).

7.2. Centralizaton

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Centralization locates the focus of decision making authority in the organization (Robins, 1990).

7.3. Formalization

It is the degree to which instruction and procedures are written down (Pugh, 1973). Formalization connotes rules and procedures intended to direct behavior (Sycamnias, 2008).

In a general view structural changing trends tend to more organic ones which flat, team based and functional structures extended and the degree of formalization and centralization decreased (Milne, 2007).

Organizational structure and Knowledge Management

Most management process models introduced before KM emergence are top to down models that are inappropriate in necessary reactions for dynamic interactions about organizational knowledge creation (Takeuchi & Nonaka, 1997). Top to down management model is an organizational classic hierarchical model based on Max Weber and Fredrick Taylor theories. While in bottom-up management hierarchy and the division of work give place to autonomy, with knowledge being to a large extent controlled in the base (Linke, 2001).

For successful performance in current paced changing business context in order to effective KM application strengthen some elements of the organizational structure such as such as team work, more flexibility and job enrichment for more organizational agility and adaptation of organization plan with new characteristics of the market are important (Purcidonio et al, 2007).

Organizational structure may encourage KM or can be an obstacle in front. Degree of centralization, formalization, information flow among organization sectors are key structural factors affect on knowledge creation, transfer, storage and application directly (Monavvarian and Kasaie, 2007). Both formal and informal structural aspects influence on KM. As formal structure determines guidelines for KM activities, informal structure provides required communication channels for knowledge exchange (Monavvarian and Asgari, 2009).

Organizational Structure as an important factor related to KM

It is widely mentioned that organizational structure and plan is an effective factor in KM implementation.

Regard to knowledge importance in current organizations, in order to achieve a suitable method for organize knowledge and transfer degree determination inside and outside of organization, applying organizational structure with high capability of knowledge creation and transfer is a necessity. A point should be remembered is knowledge may not provide considered advantage regard to applied organizational model (Claver-Corte's et al, 2007).

Application of structures which eradicate despondency and facilitate knowledge flow in organization for certain access to organizational success advised (Claver-Corte's et al, 2007).

Organizational structure as a critical success factor for KM

Organizational structures with more flexibility are more suitable for knowledge management application. Bureaucratic organizational model are inadequate for knowledge sharing because they prevent the free flow of knowledge in organizations (Milovanovic, 2011).

Some studies considered organizational structure as one of KM critical success factors mentioned in Table.1

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Table.1: Studies considered organizational structure as one of KM critical success factors

Scholar	Suggested CSFs
Anderson and O'Dell (1996)	• Corporate Compliance Procedures • those involved in knowledge management • Organizational Support of Knowledge Management • Use information technology to manage knowledge
Bannett and Gabreil (1999)	• Organizational Structure • Organizational Culture • Size of organization • The environment • Knowledge management methods
Hasanali (2002)	• Leadership • Culture • structure, roles and responsibilities • IT infrastructure • Assessment
Lindsey (2002)	• Technology • Structure • Organizational Culture
Wang (2005)	• Leadership and Management Support • Organizational Culture • Goals and Strategies • Information Technology • Evaluate • Organizational Infrastructure • Process and Activities • Motivational factors • Resources • Training and Development • Human Resource Management
Jafari and	• Public Awareness

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Akhavan (2006)	• Government support • Strategic Planning • Information and Communication Technology • The public and private sectors • Common Reference Model • Publication on Knowledge Management • Benchmarking • Research on Knowledge Management • Leadership • Change Management • Human resources Attention • Organizational Learning • Horizontal organizational structure (flexible and dynamic) • Investment in Knowledge Management • Seminars on Knowledge Management • Communities of practice • Training • Culture • Pilot Implementation
Lin (2007)	• Incentive based strategies • Organizational Structure • Evaluation of knowledge management • Define clear goals and rules • mutual trust • Senior management support • ability to produce knowledge • innovative ideas • the desire to share Knowledge Transfer • System of friendly exchange and reuse of knowledge • Authentication mechanisms

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	Activities
Claver-Corte's et al (2007)	• Horizontal organizational structure, flexible organization with minimal hierarchy. • Organizational Culture • Corporate Communications
Heisig (2009)	• Human Factors: culture - Human Resources - Leadership • Organizational: Processes - Organizational Structure • Technology: Infrastructure - Applications • Process Management: Strategies - Goals and Assessment
Akhavan and Hosnavi (2009)	•Human Resource Management •Flexible organizational structure •Knowledge Management Architecture • Organizational preparation • Knowledge storage • Benchmarking •Knowledge Manager determination
Valmohammadi (2010)	• Leadership and Management Support • Organizational Culture • Information Technology • Knowledge Management Strategy • Performance Evaluation • Infrastructure Sazmans • processes and activities • Motivation and Reward • eliminate resource constraints • Development and Training • Human Resource Management

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	• Benchmarking
Zheng et al (2010)	• Culture • Organizational Structure • Strategy
Ling (2011)	• Organizational Culture • Leadership • employee participation • Information and Communication Technology • Organizational Structure
Hassan and Al-Hakim (2011)	• Human Resource Management • Leadership • Information Technology • Organizational Structure • Organizational Learning • Corporate Strategy • Organizational Culture
Emami and Hamidi Pour (2011)	• Enterprise Technology • Corporate Strategy • Organizational Culture • Organizational Structure • Organizational Process
Milovanovic (2011)	- Social: • Tacit Knowledge • Organizational Structure • Organizational Culture • Individual and organizational learning - Technical: • groupware • Workflow • Document Management • Enterprise Portal • Human Resources Smart • Data Storage and Data Mining • Use of other organizational intelligence

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Yi and Jayasingam (2012)	• Human Capital •Information and Communication Technology • Limiting organizational structure •The culture of knowledge sharing

Relationship between Structural Dimensions and KM

Formalization and centralization in decision making authority reduce creative solutions greatly. While the distribution of power in the organization cause self-expression and freedom of empiricism. These are factors that make up the foundation of knowledge creation and transfer (Bannett & Gabriel, 1999; Malhotra et al, 2002). Excessive centralization and formalization reduces autonomy and therefore lead to lower staff satisfaction and motivation. Decentralized organizational structure provides an environment in which employees voluntarily participate in the process of creating and sharing knowledge. Collaborative environment by encouraging collaboration among organization members will facilitate the creation, sharing, storage and application of knowledge (Starbuck, 1992).

Also some Iranian scholars in this field shared their views. Takabi Studies (2007) about the structural aspects of knowledge management in Zamyad automotive companies indicated the relationship between complexity, formalization, centralization, and knowledge management. Considered Parameters in studies on knowledge management implementation in 2009, proven that organizational structure had a significant role in the implementation and application of knowledge management in the organization (Adli, 2009). Also, Based on Fathollahi (2010), organizational structures and processes have played an important role in implementing knowledge management.

Ghorbani et al (2011) in a research on Educational institutions in Khorasan Razavi claimed that there is a significant negative relationship between centralization and knowledge management. Also no significant relationship between the complexity of the organization and knowledge management reported.

However, in another study by Fazli and Alishahi (2012), in which number of Saderat bank branches in Tehran investigated, different results obtained. Organizational structure divided to three variables of centralization, formalization and control. They concluded that, organizational structure, Unlike strategy and organizational culture does not have much impact on the implementation of knowledge management and performance.

Whereas according to Allameh et al research (2011), there is a significant positive relationship between organizational structure and knowledge management processes. There is a negative significant relationship among Formalization and centralization and knowledge management (Asgari, 2005).

Lee and Choi (2003) studied knowledge management enablers. Technology, structure and culture of the organization are considered as enablers. Results illustrated that there is a significant relation between centralization and KM but no relation between formalization and KM recognized.

Based on Rastegari et al research (2012) about sport institutes, significant negative correlation between Formalization and knowledge transfer in sports organizations exist.

Some other studies examined the relation between organization structural dimensions and knowledge management collected in Table.2

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Table.2: structural dimensions and knowledge management Relationship

scholars	Relationship with KM		
	Complexity	Formalization	Centralization
Davenport and Prusak (2005)	Pos	Not mentioned	Not mentioned
Abutorabi et al (2007)	No relation	Not mentioned	Neg
Catherine et al (2008)	Not mentioned	Not mentioned	Neg
Goudarzi and Abutorabi (2008)	Neg	Not mentioned	Not mentioned
Boz Bora (2009)	Neg	Not mentioned	Neg
Willem & Buelens (2009)	Not mentioned	No relation	No relation
Rastegari and Njafi (2010)	No relation	Not mentioned	Not mentioned
Pertusa-Ortega et al (2010)	Pos	No Relation	Neg
Jafari et al (2012)	Not mentioned	Neg	Neg
Jokar et al (2012)	Not mentioned	Pos	Not mentioned
Enayati and Sayyadi (2012)	No Relation	Pos	Neg

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Results and Discussion

As seen in Table.2 there are some contradictions in research results especially about complexity and formalization relationships with KM. Part of this contradictions caused due to differences in the instruments used and the circumstances of time, place, and limitations of research. While most studies of the effects of informal structure on knowledge management features reviews have found similar results.

Results of studies conducted to examine the relationship between organization structural dimensions and knowledge management can be summarized in Table.3

Table.3: Summary of relationship between organization structural dimensions and knowledge management

	Structural Dimensions of Organization		
	Complexity	Formalization	Centralization
Relationship with KM	No Exact Comment	No Exact Comment	Negative Relation

Conclusion and future research

An investigation for exact relationship determination between complexity and formalization with KM needed. For a future research concentrating on two mentioned factor and their effects a KM and KM effectiveness advised. Proposing a model that represents exact correlation between organizational structure factors and KM could help to understand issue more appropriately.

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A Review On Knowledge Management Process Models In Former Two Decades

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Department of Industrial Engineering, Iran University of science and Technology**Abstract**

This study concentrates on reviewing knowledge management process models provided between 1991 and 2012 which have been grounded in the KM literature. From process approach knowledge management defined as an issue dealt with some processes such as development, storage, retrieval, and dissemination of information and expertise within an organization to support and improve its business performance. KM processes generally applied to advance the operation efficiency and competitive advantage of an organization. Results obtained from this review confirmed a consensus around identified and classified KM processes but also some different models recognized.

Keywords: Knowledge Management, Knowledge Management Process, KM Process Model Trends

Introduction

In the current climate of increasing global competition, there is no doubt about the value of knowledge and learning in improving organization competence (Preto and Revilla, 2004). Knowledge is recognized as an important weapon for sustaining competitive advantage and improving performance (Chang and Chuang, 2011). In today's competitive environment needs for considering adaptive and intelligent strategies of knowledge management processes for succeed clearly palpable (Kangas, 2005).

According to De Long and Fahey (2000) and Desouza (2003) KM defined as a set of processes providing knowledge creation, organization and sharing with the adoption of various technologies and supporting creation and dissemination of knowledge culture.

From Davenport et al point of view (1998) KM concerned with knowledge assets exploitation and development of an organization with furthering objectives orientation.

Knowledge management processes such as knowledge creation, sharing, storage, application and etc which mentioned by many scholars in KM context are key elements for developing a successful KM system.

This paper presents a review on studies around knowledge management process models provided in two former decades.

Knowledge Management

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Knowledge management has emerged as one of the new approaches and investigates how to acquire knowledge for the future profitability of the organization, dissemination and application of new knowledge for the production (Barratt-Pugh et al, 2011). Terra (2001) believes that KM implies, necessarily, to develop abilities interrelated in the strategic plans, to organize and individual plans; to accelerate competitive value new knowledge generation; to understand intellectual capital and knowledge already existing in the company; to generalize new revenues based on reusing existing intellectual knowledge capital in the company; to protect the existing intellectual capital in the company; to improve the decision making process at managerial, production and front line levels of the company; to reduce costs and redoing the job.

Knowledge Management Process Approach

Many researchers studied about KM processes and proposed different processes in KM context. Suggested models represented three to eight processes for KM (Ramachandran et al, 2009). Generally knowledge generation, use and application recognized as main KM processes by Ramachandran et al (2009).

Gottschalk (2002) defined KM from process view as a process of implementing, sharing, distributing, creating, and comprehending the knowledge of an organization.

Process of knowledge creation, acquisition, incorporation, allocation, and application to advance the operation efficiency and competitive advantage of an organization is Albers and Brewer (2003) definition of KM.

Development, storage, retrieval, and dissemination of information and expertise within an organization mentioned as KM processes in Gupta et al researches (2000). Creation, sharing, distribution and use the knowledge in the organization considered as KM process approach by Daruch (2003). Spender (1996) spotted KM processes as knowledge creation, transfer and application. Capturing, transferring and application of knowledge considered as KM processes in Delung (1997) studies. Probest et al (2000) stated that KM processes include knowledge Identification, capture, development, sharing, dissemination, application and storage. Alavi and Lidner (2001) examined different characteristics of provided models for KM processes and introduced four processes of creation, storage/retrieval, transfer and application. Knowledge acquisition, knowledge protection, knowledge conversation and knowledge application are four dimensions identified as KM processes in some studies (Gold et al, 2001; Park, 2006). Lawson (2003) presented a model which consisted of six KM processes such as knowledge creation, capture

, organization, storage, dissemination and application. Supyuenyong et al (2009) identified four main KM processes included of knowledge acquisition and creation, knowledge organization and retention, knowledge dissemination, knowledge utilization. Other studies about KM processes collected in Tabel.1 which shows KM processes introduced in studies in recent twenty years.

Scholar	Introduced KM Processes
Huber (1991)	Acquisition, Distribution, Interpretation, Organizational memory development
Walsh and Ungson (1991)	Acquisition, Storage, Retrieve
Dixon (1992)	Acquisition, Distribution,

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	Interpretation, Meaning-making, Organizational memory development, Retrieve
Leonard-Barton (1995)	Problem solving, Implementation and Integration, Examination, Internalization
Nevis et al (1995)	Acquisition, Sharing, Utilization
Stein and Zwass (1995)	Acquisition Learning, Retention, Maintenance, Retrieval
Wiig (1995)	Creation, Capture Transformation, Use
Pentland (1995)	Construction, organize, Distribution
Nonaka and Takeuchi (1995)	Sharing tacit knowledge, Creating concepts, Justifying concepts, Building prototypes, Knowledge clearing
Andersen and APQC (1996)	Application, Sharing, Creating, Identifying, Collecting, Adaptation, Organizing
Szulanski (1996)	Initiation, Implementation Ramp-up, Integration
Meyer and Zack (1996)	Acquisition, Refinement, Storage /retrieval, Distribution and Presentation
Demarest (1997)	Construction, Visualization, Dissemination, Use
Spek and Spijkervet (1997)	Development, Distribution, Combination, Storage
Bartezzaghi et al (1997)	Abstraction and Generalization, Embodiment, Dissemination, Application
Ruggles (1997)	Generation, Codification, Transfer
Alle (1997)	Collect, Identify, Create, Share, Apply, Organize, Adapt
D.Little	Acquisition and Creation,

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(1998)	Retention, Dissemination, Use
Delphi (1998)	Capture, Sharing, Manipulation, Feeding
Ernst and Young (1998)	Planning, Acquisition, Use, Evaluation
Jang and Lee(1998)	Acquire knowledge, Develop schema, Knowledge development, Knowledge retrieval, Embedded knowledge, Problem analysis, Problem solving, Knowledge shaping
Pan and Scarbrough (1998)	Production, Processing, Storage, Distribution, Use / Reuse
Scapel et al (1998)	Use and Proliferation, Development and acquisition, Transfer, Institutionalization
KMPG (1998)	Creation, Use, Exploitation, Sharing and Dissemination, Protection, Sourcing, Learning
Probst (1998)	The knowledge purpose, Identification, Acquisition, development, Distribution, Maintenance, Use, Evaluation
Veenhoven (1998)	Acquisition, Preservation, Search, Storage, Distribution
Despres & Chauvel (1999)	Mapping, Capture and Creation, Packaging, Storage, Application Sharing, Innovation and Evolution, Re-exploitation
Argote (1999)	Collect, Identify, Create, Share Apply, Organize, Adapt
Mc Elroy (1999)	Acquisition, Learning, Validation and Integration
Ahmed et al (1999)	Create, Share, Measure, Learning and Improvement
Burk (1999)	Create, Organize, Share and Use
Lai and Cho (2000)	Commissioning, Producing, Modeling, Warehousing,

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	Distribution and transferring, Use, Retrospect
Martensson (2000)	Information collection, Information storage, Information availability, Information usage
Alavi and Leidner (2001)	Creation, Storage, Transfer, Application
Gold et al (2001)	Acquisition, Conversion, Support, Application
Lee and Kim (2001)	Accumulation (Acquisition and Creation), Integration, Reconfiguration
Bouthillier & Shearer (2002)	Discover, Learn, Create, Store, and Organize, Share, Use
Albers and Blewer (2003)	Creation, Acquisition, Participation, Allocation and Use
Stolberg et al (2004)	Identification, Acquisition, Preparation, Allocation, Distribution, Use, Maintenance
Booth (2004)	Creating, Capturing, Refining, Storage, Distribution, Management
Wang and Aspinwall (2004)	Creation, Acquisition, Organization, Storage, Transfer, Sharing, Utilization and Application
Chen and Chen (2005)	Create, Convert, Rotate and Distribute, Complete
Lee et al (2005)	Creation, Accumulation, Sharing, Utilization
Cui et al (2005)	Acquisition, Conversion, Application
Deng and Yu (2006)	Identify, Capture, Select, Store, Service
Dafous and Kah (2006)	Production, Codification, Storage/Retrieval, Sharing and Use
Lee and Lee (2007)	Generation, access, Achieve, Facilitating, Presentation, Insertion, Use, Transfer and

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	Measurement
Ramachandran et al (2009)	Creation, Capture, Organization, Storage, Dissemination and Application
Fong and Choi (2009)	Acquisition, Creation, Storage, Distribution, Use and Maintenance
Supyuenyong et al (2009)	Acquisition and knowledge Creation, Organization and Maintenance of knowledge, Dissemination and Use of knowledge
Liao et al (2010)	Creating, Sharing and Exploiting
Aujirapongpan et al (2010)	Acquisition, Creation, Storage and Application
Shafie Nik Abadi (2012)	Acquisition, Creation and Generation of knowledge / Organization, Storage / Transfer, Sharing, and Distribution / Use, Application and Exploitation

As seen in represented Table most of studies refered to creation, acquisition, storage, sharing and knowledge application as KM processes. Thrfore in next section of this review definition of mentioned processes will be presented.

KM Most Mentioned Processes Definition

4.1. Knowledge Creation/Generation

According to Zaim (2006) all healthy organizations generate knowledge. Whereas organizations interact with environmental factors, they capture information, combine it with their experiences, values and internal rules, convert it to knowledge, and take action based on it.

Knowledge creation is a complex, dynamic and multi dimensional process. Organizational knowledge creation is an institutional capability in creating and flowing knowledge in organizations, products, services and systems (Nonaka and Takeuchi, 1995). Nonaka (1995) believes that knowledge creation must be as the organizational strategies main orientation.

Knowledge creation and generation refer to knowledge assets development in an organization in functional and operational boundaries and need to power for developing new applications of existing knowledge and new untapped talents exploitation (Liao et al, 2010). Ramachandran et al (2009) argued that knowledge creation occurs through discovery based on internal or external sources.

From Bouthillier & Shearer (2002) point of view, knowledge creation deals with new knowledge generating from various sources through information analysis and organization internal knowledge.

Factors influencing knowledge creation classified into four categories by Ang & Massingham (2007) that included of cultural,

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organizational, knowledge resources and knowledge processes ones.

4.2. Knowledge Acquisition /Capturing

In KM, first issue is knowledge capturing in order to Manage and control stakeholder interests and their impact on knowledge management (Lee & Suh, 2003).

Organizational knowledge capturing is a process of new knowledge content generation and replace it with organization's tacit and explicit knowledge base content (Pentland, 1995).

Ramachandran et al (2009) mentioned to knowledge capturing happening situation as new knowledge identification as relevant and valuable to current and future needs. Parikh (2001) claimed that knowledge acquisition is process of exploring and accessing to knowledge in knowledge bases. Knowledge capturing sources divided to internal and external ones. attending conferences, reading newspapers and magazines, watching news programs, getting electronic information, watching television, pursuing economic, social and technical procedures, collecting manufacturers and customers' information are some represented external sources in literature (Markwart, 2002).

4.3. Knowledge Storage

Creating new knowledge is not enough and mechanisms are needed to store acquired knowledge and to retrieve it when needed (Alavi, 2000).

Knowledge storage is a process where knowledge is codified and stored in a reasonable format (Ramachandran et al, 2009).

Databases, directories of expertise, procedural handbooks, and email messages are examples of knowledge codifying (Ramachandran et al, 2009).

An appropriate structure for quick and correct information presentation, information classification based on learning needs, precise and clear representation ability of information and an on time, precise and available content are four factors for a knowledge storage system (Markwart, 2002).

4.4. Knowledge Sharing/Dissemination

Knowledge dissemination involves personalising knowledge and distributing it in a useful format to meet the special needs of the academics (Ramachandran et al, 2009). knowledge dissemination is the process of transfer knowledge through out the organization. (Alavi and Leider, 2001). Knowledge sharing is a set of behaviors that involve the exchange of information or assistance to other (Connelly and Kelloway, 2003). Gupta and Govindarjan (2000) equating knowledge sharing to knowledge flows theorize the knowledge flows. The less the voluntary or planned knowledge exchange is, the more loss in the potential knowledge would be (Allameh et al, 2011).

There are some factors that influence knowledge sharing behaviors of individuals. Tools and technologies as hard issues and organizational culture, personal values and self-identities, national culture and trust (Chennamaneni, 2006) are some of suggested factors affect knowledge sharing.

4.5. Knowledge Utilization/Application

To make sure that the presented knowledge in an organization is applied productively to benefit the organization is the key

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point in knowledge management (Probst, Rub and Rumhardt, 2000).

The effective application of knowledge helps companies increase their efficiency and reduce costs (Davenport and Klahr, 1998).

Application and use of knowledge in an enterprise's value-adding process is definition presented about knowledge Utilization (Alavi and Leidner, 2001; Currie, 2003).

Knowledge application happens when knowledge is applied to new situations where academics can learn and generate new knowledge (Ramachandran et al, 2009).

Direct knowledge application examples included of Decision making at the organizational level, innovation, and customer relationship management (Ramachandran et al, 2009).

Discussion about KM Process Models Trend

Trend in developed KM processes in past two decades indicates that most of models mentioned approximately similar processes. Some models like Lawsen (2003) combined number of former presented models. A few models introduced some different processes such as manipulation, feeding in Delphi model (1998). Generally, number of processes provided between mid 1990s and 2000 enhanced but in recently proposed ones main processes such as knowledge creation, storage, sharing and application considered more.

Conclusion

KM processes are important parts for an effective implementation of knowledge management systems.

Three basic processes mentioned in literature included of knowledge creation, sharing and application which seems to be urgent for each KM implementation program. Added processes to mentioned ones have complementary role in KM program and based on organization and systems features may differ. It should be said that any organization have its own characteristics and applied KM process models must adapt to those.

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Challenges of videoconferencing distance education - a student perspective

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Abstract. Videoconferencing is considered one of the most relevant and proven distance learning technologies to stimulate collaboration between the various sites, to support and enhance student and/or staff communication, to enable flexible quality learning and accessibility, as well as to rationalize various costs. The purpose of this study is to evaluate the potentials of videoconferencing distance education compared to the traditional classroom environment as well as students' perceptions and satisfaction in both settings. The results show that if appropriate methodology is adopted by the teacher, considering the specifics and limitations of videoconferencing setting then students in both the standard classroom setting and distance setting can perform well and have a high overall perception of the course.

Keywords: distance learning; interactive videoconferencing; technology-based learning; digital learning environments; pedagogy

Introduction

Until the 90's, higher education studies in Republic of Macedonia, were provided by two state universities (Ss. Cyril and Methodious and St. Kliment Ohridski – located respectively in the cities of Skopje and Bitola). Additionally, in the next few years, other private and public universities (mainly located in Skopje and north-west part of the country) were established. The location of these institutions did, however, raise a question about ease of access for people living in other parts of the country, notably the east. Additionally, social and economic circumstances prevented people from moving freely from rural areas to cities for studying, therefore limiting their access to academic institutions.

In the last two decades there have been significant changes in policies, organizations, staffing and funding of universities. One consequence of these changes is that students who now attend university are no longer drawn from an elite or privileged group but become representative of the general population.

Morgan (1996) analyzed the report by the Joint Funding Councils' Libraries Review Group, and states that it: "Identifies long-term changes in the make-up of the student population, with more part-time and mature students; modularization of courses; changes in teaching and learning methods; and a great stress on student-centered learning…". Additionally, due to the increasing demand for information and communication technologies (ICT), faculties of computer science are increasing class size in an attempt to meet this demand.

In order to offer the equal possibilities for high education studies, some universities open dispersed campuses and units at geographically remote locations in the same country or internationally. Macedonian "Goce Delcev" University perfectly fits these global trends. The university, located in Stip, has four campuses, and integrating 13 faculties - covering almost all disciplines, 10 university centers and three institutes. The studies at this university are performed in 12 units, dispersed in 12 different cities (Figure 1). The institution has also established agreements with various universities and experts worldwide to enable and support a growing number of students and staff exchanges between campuses.

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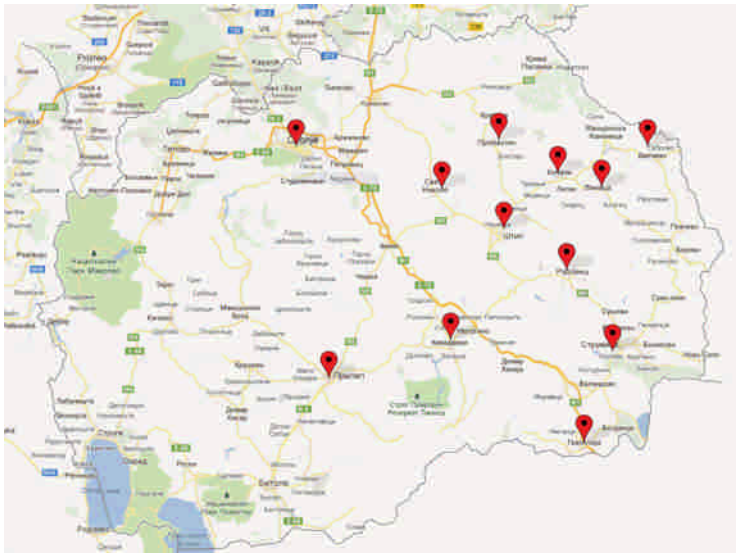

Figure 3. Locations of the "Goce Delcev" University dispersed units.

The current structure and growing trends of the university challenges the "Goce Delcev" University to organize and support its education with attention for communication and collaboration between the various campuses. Today this is mainly realized through physical mobility of staff and/or students between different locations. But, the university is progressively supporting initiatives that replace or enhance physical with virtual mobility. Considering the new challenges in higher education and understanding the importance of innovation in education through new educational technologies, the University "Goce Delcev" – Stip is doing permanent efforts to integrate various forms of distance learning with the traditional education.

Distance education has been defined as "a separation in time and/or space between the learner and the instructor. More than a geographic separation of learners and teachers, it is a distance of understanding and perceptions that must be overcome by teachers and learners" (Hunter et al., 2003). There are many types of distance-education models including online courses, interactive videoconferencing, videotaped lectures, and audio-taped lectures.

According to our preliminary evaluation, among other distance learning methodologies, videoconferencing is considered the most relevant and proven to stimulate collaboration between the various sites, to support and enhance student and/or staff communication, to enable flexible quality learning and accessibility, as well as to rationalize various costs.

The purpose of this study is to evaluate the potentials of videoconferencing distance education compared to the traditional classroom environment as well as students' perceptions and satisfaction in both settings.

Theory about videoconferencing

Video conferencing is defined as interactive and synchronous voice, video and data transfer conducted between two or more points via communication lines (Gough, 2006). This system reduces the cost of education by connecting students and teachers who are in different locations. In addition, it offers a connected environment where students can relate their experiences to each another; and a feeling of togetherness is created, along with the benefit of expert instruction.

As discussed by Hackman and Walker (1990), rapid comprehension in this environment, where students are able to express themselves comfortably, enables better teacher-student communication. Video conferencing is more developed compared to other methods of distance education, in terms of real-time interaction, relationship, motivation and collaborative learning (Brown & Liedholm, 2002; Wheeler & Amiotte, 2004; Bates, 2005; Wheeler, 2005). The quality of video conferencing systems varies according to the technology used, and the bandwidth, and it impacts the quality of education and student-teacher interaction level (Martin, 2005). Besides, fostering active student participation in the process is very important for ensuring an effective education and training environment. However, these studies determined that the students were not sufficiently encouraged in regard to learning during the video conference practices (Motamedi, 2001; Watkins, 2002; Newman, 2008).

A frequent error in assessing video conferencing practices is to equate the environment visually with the face-to-face traditional class environment and use it in this way (Hearnshaw, 1998; Anastasiades, et al., 2010). While video conferencing practices do provide opportunities for synchronous watching, listening and communication with other participants, the human interaction is not as effective as in the traditional education process (Bonk, et al., 1998; Schweizer, et al., 2003). Studies that have been conducted in order to evaluate the efficiency of video conferencing in education indicate that the expectations of the

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participants still cannot be met adequately (Motamedi, 2001; Knipe & Lee, 2002; Delaney, et al., 2004). This situation affects student perceptions and their learning depending on the perceptions. The perceptions are accepted as one of the determinants for the development of knowledge (Şimşek, 2008). Students stated that the applied technologies, the locations of the devices, technical problems such as sound, image and connection problems, the interaction inside and outside the class, the teachers' use of body language and the durations of the courses were the factors that affected their viewpoints about distance education (Martin, 2005; Koppelman & Vranken, 2008; Gillies, 2008; Marsh, et al., 2010).

In the study, "The Quality of Teaching and Learning via Videoconferencing", Knipe and Lee (2002) examined the quality of teaching and learning activities performed via video conferencing. The study was conducted with 66 students. 45 students participated in traditional, face-to-face courses and 21 students participated in distance education. After the study, the students participating in the course via distance education felt alone and as if they were not a part of class when they could not make eye contact with other students and the teacher. This situation impaired the concentration of these students and made a negative impact on their learning.

A study carried out by Marsh et al. (2010) and titled "Interactive Video Technology: Enhancing Professional Learning in Initial Teacher Education" investigated the benefits of taking the live implementation of learned theoretical information via video conference. The research took place between 2005-2007 with the cooperation of Sussex University and 6 schools. The video conference technologies provided a way to overcome the limitations of the learning center's physical site. Teacher trainees could access various class applications and practice with the instructor. Course records aided the trainees by refreshing their memories about subjects they forgot.

Martin's article "Seeing is Believing: The Role of Videoconferencing in Distance Learning" (2005) examined Northern Irish students' study of the Constitution of the United States of America as explained by an American congress member. The students from Northern Ireland stated that the opportunity to interact with famous American politicians and to see them without traveling long distances from the places they lived enabled them to evaluate distance education via video conference in a positive way.

Gillies published a paper in 2008 titled "Student Perspectives on Videoconferencing in Teacher Education at a Distance". It was focused on the experiences of students who took courses via video conference for one year within the scope of initial teacher training. After the interviews, the students stated that the technical problems that occurred in the sound, the image and the connection caused them to feel as if they were not real students. Moreover, interviewing with the teacher during a certain time period is regarded as a deficiency. Live interaction with the teacher, creation of a feeling of affinity and receiving simultaneous answers to questions were situations frequently mentioned by the students.

In the study titled "Experiences with a Synchronous Virtual Classroom in Distance Education", Koppelman and Vranken (2008) aimed to determine the viewpoints of the teachers and 10 students in synchronous computer technologies education. The students stated that they liked the courses given in short and frequent intervals and they had no problems with concentration. In addition, they noted that the applied technologies prevented the waste of time it would be to travel for lessons with a distant technician. While the students evaluated the sound quality quite good, some students stated that they did not like the delays.

Research methodology

To evaluate the potentials of videoconferencing education as well as to understand students' perceptions and satisfaction with this kind of distance education compared to the traditional classroom environment, but also to understand the main challenges in this kind of setting, an experimental research was conducted. This research was conducted for a 6-credit hour visual programming course delivered during the winter semester of 2010. One course was taught in a traditional classroom setting to 90 students at Faculty of Computer Science, University "Goce Delcev" in Stip, and the same course was taught in asynchronous sessions via interactive videoconferencing to 48 students at one of the dispersed campuses of the Faculty of Computer Science, University "Goce Delcev". In the latter course, the instructor was physically located in the city of Stip, and the students were approximately 70 kilometers away in the city of Strumica.

Both courses covered the same topics and were given by the same instructor except for 2 lecture hours presented in the classroom to Strumica campus (distance-education) students by external experts.

The distance-education lectures were delivered from a classroom equipped with Polycom HDX 8000 end-point, 36 computers, document camera, interactive whiteboard, two LCD projectors and monitor. The lecturer had the ability to combine and to switch among 3 views delivered to the distant classroom: video image (e.g., the lecturer); computer screen (e.g., PowerPoint presentations); and the document camera (e.g., used to show hardcopies of figures and demonstrate working out calculations by hand). One LCD projector projected the image being transmitted to the distant classroom, and at the monitor the image of the students in the distant classroom was presented. The distant classroom was equipped with Polycom HDX 7000 end-point, document camera, two LCD projectors and whiteboard. They were projecting picture big enough to be

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perceived clearly by all students. During transmission, the distant site also had a faculty facilitator present at least for the beginning of each class, and 2 technicians monitored the entire transmission.

The videoconferencing system used, allows setting up the camera in a number of different positions (e.g., wide shot of an entire class, close up shot of students in on the lower right quadrant) and store them as 'camera presets'. The presets are usually assigned to a button on the remote control. This allows the lecturer to easily focus in on a group of participants during the interactive portion of a session or just get a good overview of the level of engagement of varying groups at the remote site.

The traditional classroom lectures were delivered in a classroom equipped with a computer, a document camera, two video projectors and one interactive whiteboard. The synchronous distance education environment is summarized in Figure 2.

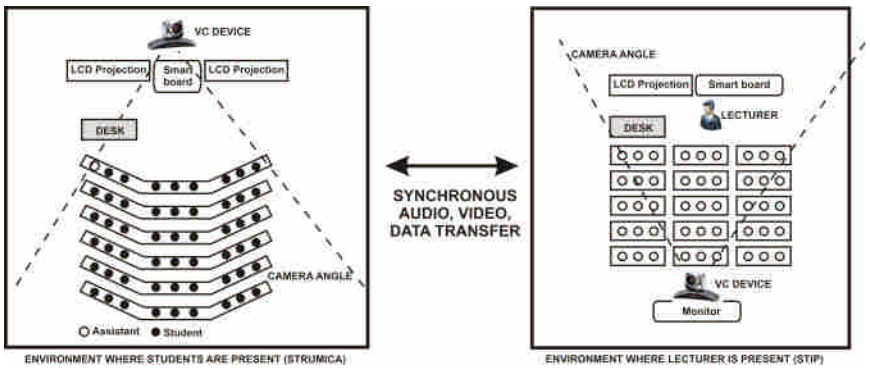

Figure 2. Synchronous distance education environment.

In this setting the instructor may incorporate an alternative video source (e.g., a document camera, a VCR) for sending to remote locations, or may receive video from an alternative video source at the remote site. New feature “people on content” for example uses chroma key technology to allow lecturer(s) in a video call to become one with their content. So, the potential for combining video inputs and outputs can seem endless.

However, with the introduction of more technologically advanced resources during classes, there is the increased danger of losing focus on the most important aspect of teaching - learning. Planning curricular objectives and concentrating on students as the major stakeholders, leads to a continuum in the life cycle of a technology based course. Evaluation at a personal level throughout the course but also at a curricular level can lead to improvements to better suit the needs of the students.

Course and instructor evaluations were administered to each group at the conclusion of the courses. The questions rated students' perceptions of the course and instructor using a 5-point Likert scale anchored at 5 = strongly agree and 1 = strongly disagree. The variances of the results were first analyzed using Levene's test for equality of variances. The evaluations were then analyzed using independent sample t tests based on the assumption of the equal variances or unequal variances where appropriate in SPSS v19.0. The final course grades were analyzed by the same method. This study was approved by Human Subjects Review Board.

Researchers and participants existed in the same environment for a term. Researchers were able to observe all of the courses by being with the participants from the beginning of the term. As a result of this engagement, a warm relationship was established between the researchers and participants.

A “Participant Permit”, indicating the objective of the research, was prepared after the research objective was determined. Participants were given details of the research to be conducted. Participation was on a volunteer basis. Participants were given a guarantee of confidentiality and anonymity, and a guarantee that this data will not be used for any purpose other than the stated purpose. In addition, the researcher maintained objectivity during the collection and evaluation of the data.

Validity and reliability indicators are used for quantitative research. In qualitative research, indicators are credibility, transferability, consistence and verifiability. Credibility is crucial in qualitative studies. In this study, credibility was ensured through continuous participation, source triangulation and participant control. The researchers’ constant presence in the environment and the inclusion of participants with different characteristics is also important in order to determine multiple realities by revealing different perceptions and experiences. In addition, the researcher’s presence enabled opportunities to engage with the subjects outside of the interviews, and to discuss and examine the subject matters in question. In this way, the researcher was able to examine, in more depth, the participants’ view of the process and subject matter. The data obtained from interviews was given to the participants after the interviews, in order to confirm and verify their responses.

First, data was cleared of bias as much as possible to ensure consistency, and deductions were supported with both quotations and raw data. Moreover, data in the study were coded from beginning to end by two different researchers and the consistency of these two data sets was examined. To ensure consistency, triangulation was used, with the addition of a third

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researcher examining the data. During the data analysis, raw data, findings, conclusions and suggestions were recorded and checked several times in order to ensure verifiability criterion of other researchers.

Results

Students' demographic data are presented in Table1. The traditional classroom students had a higher computer science grade point average (GPA) ($P = 0.013$) at the onset of the 2 courses, and the distance-education students had a higher mean grade in the prerequisite Programming Basics and Object-Oriented programming courses ($P = 0.221$ and $P = 0.303$ respectively) that preceded the visual programming course. No other significant differences were found.

Students who completed the course in the traditional classroom setting had an average final course grade of 8.80 compared to an average final course grade of 8.67 among students in the interactive videoconferencing group ($P = 0.034$).

The response rate for the course and instructor evaluation was 97.92% (47 out of 48 students) for the distance-education students and 97.78% (88 out of 90 students) for the traditional classroom students. The mean evaluation score (Table 2) for the distance-education students was higher than for the live students (4.7 ± 0.6 and 4.4 ± 0.7, respectively; $P < 0.001$).

Table 1. Student demographics.

	Traditional classroom settings [Mean(SD)]	Videoconferencing distance education settings [Mean(SD)]	Significance (P value)
Age(years)	14.0640	18.5620	22.0817
Overall CS GPA (on the scale 5-10)	61.6728	44.7844	44.5884
Grade in Programming basics	88.1380	118.1564	101.2240
Grade in Object-Oriented Programming	246.7889	255.9483	284.6633

Table 2. Domain Analysis of Student Responses.

	Traditional classroom settings [Mean(SD)]	Videoconferencing distance education settings [Mean(SD)]	Significance (P value)
General	4.4 (0.7)	4.7 (0.6)	< 0.001
Lecture content	4.4 (0.5)	4.6 (0.8)	0.452
Presentation/style	4.6 (0.5)	4.8 (0.4)	0.204
Student contact	4.3 (0.8)	4.7 (0.6)	0.412

During the videoconferencing lecture the number of interactions between students, as well as between students and teacher were counted. The number of interactions is presented in Figure 3. As it may be observed from the figure the number of interactions is growing, which means improved synchronous communication.

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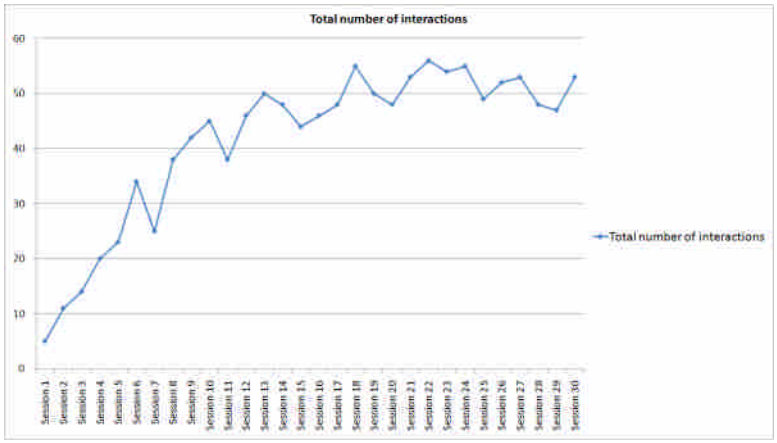

Figure 3. Total number of interactions during the synchronous videoconferencing lectures.

Discussion and conclusions

In videoconferencing distance education it is often common for the distance students to feel a sense of alienation. In our case, students completing a Visual programming course in a traditional classroom setting or by videoconferencing performed well and had a high overall perception of the instructor and courses. The distance-education course was rated higher by students than the same course delivered in a standard classroom. Several techniques were used by the instructor to facilitate the instruction via videoconferencing that may have influenced the distant students' perceptions of the course. Based on the results of the interview with the distance students the use of recitations was highly valued by the distant students. Therefore, the incorporation of regularly scheduled recitation-type sessions should be considered when developing a distance-education course. Moreover, encouraging interactivity with discussions between sites and group works were also highly appreciated.

So, we can say as a general finding from this research is the need for instructors to understand and acknowledge that using videoconferencing as a delivery mode will have an impact on teaching styles and methods. Even though the term "interactive video-conferencing" is often used when discussing this type of technology-based teaching, successful interaction does not take place unless lecturers plan and understand how the medium will alter their teaching approaches. Other findings also indicate that whether the course delivery mode is a traditional one or a technology-based mode, effective lecturers establish and maintain a highly interactive classroom community. Therefore, for efficient delivery of educational content through distance videoconferencing mainly depends on how much teachers are knowledgeable about their subject, about their learners, and about pedagogy.

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