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About The Journal

The European Journal of Contemporary Economics and Management is a peer - reviewed international journal which accepts high quality research articles. It is a biannual journal published each May and December and is available to all researchers who are interested in publishing their scientific achievements. We welcome submissions focusing on theories, methods and applications in economics and management sciences, both articles and book reviews.

Authors can publish their articles after a review by our editorial board. Our mission is to provide greater and faster flow of the newest scientific thought. EJE's role is to be a kind of a bridge between the researchers around the world. "EJE" is opened to any researchers, regardless of their geographical origin, race, nationality, religion or gender as long as they have an adequate scientific paper in the economics sciences field.

Sincerely,

EJE, Team

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DESIGN, KNOWLEDGE EXCHANGE AND INTELLECTUAL PROPERTY.

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Abstract

The paper looks at the relationship between Design, Designers and IP (Intellectual Property). There is almost no use of IP within the design community. The preferred business model has always been first to market. This paper explores aspects of IP in relation to Design:

- Is creating IP collaboratively with design as a core element, an effective model for Knowledge Exchange in business?
- Is this a better strategy for design driven IP than first to market?
- Can this deliver economic benefit and sustained development in Scottish businesses?
- Should we adopt the Californian model of university research IP transfer to business?

In addition there is a scale issue with design businesses, usually below 10 employees, and many function as micro-businesses or lone traders. Even where there are huge corporates (such as Apple and Dyson) defending their IP through the courts has proven to be both expensive and something of a pyric victory. Where judgments are in support of the legal claim they have seldom in reality resulted in any behavioral change. This raises a whole series of issues:

- How does a business engage with design to build IP?
- Do small companies have the resources and knowledge to successfully challenge IP breaches?
- How does a research project unpack these issues?
- Can applying research build new models of engagement with design that gives value to IP at the start of a product journey?

These questions are being posed, and answers sought, by *Design in Action* an Arts and Humanities Knowledge Exchange hub for the creative industries. This issue has been little explored with literature reviews revealing a dearth of papers in the area. The knowledge exchange hub looking specifically at IP for the creative industries has also found a lack of literature in the field. What little information is available in the public domain are reports of litigation; yet even these fail to indicate how and if these challenges can be resolved.

Is creating IP collaboratively with design as a core element, an effective model for Knowledge Exchange in business? Is this a better strategy for design driven IP than first to market? Can this deliver economic benefit and sustained development in Scottish businesses? Should we adopt the Californian model of university research IP transfer to business?
How does a business engage with design to build IP? Do small companies have the resources and knowledge to successfully challenge IP breaches? How does a research project unpack these issues? Can applying research build new models of engagement with design that gives value to IP at the start of a product journey? These questions are being posed and answers sought by *Design in Action* an Arts and Humanities Knowledge Exchange hub for the creative industries.

Key Words: Design, IP, Knowledge Exchange, SMEs

Academic papers on ‘Design and IP” are not evident, the authors have struggled to find any papers from which to draw citations. Given the dearth of literature within the field, the only evidence that is available is contemporaneous, in that it is based upon court cases reported in the press and on-line.

Design in Action, hub is composed of 27 individuals operating across Scotland, comprising 6 groups located at Robert Gordon University - Grays School of Art, St Andrews University - Institute for Capitalising on Creativity, Edinburgh University - Edinburgh College of Art, The Glasgow School of Art, Abertay University and the University of Dundee - Duncan of Jordanstone College of Art and Design, the lead institution. All HEIs operate under the same guidelines.

Design in Action (DiA) seeks to understand how ‘Design as a Strategy’ operates in practice to provide economic benefit. DiA infrastructure imbeds design at the heart of its processes, including: a co-creation innovation process called chiasma; “ideas at the point of creation”.

Every chiasma team has a designer as a member, (funded by Creative Scotland)

Each funded team for prototype development includes a designer

All IP generated through the innovation process is owned by DiA and licensed back to participants to ensure all co-creators have a stake in the projects' successful commercialization.

Chiasma teams are invited to bid for a license agreement and prototype funding. Funding and support are conditional upon enabling DiA's research process, consisting of an evaluation of the entire chain from innovation to commercialization, to identify how design functions strategically; what skills are key to the co-creation innovation process. This will enable the articulation of the value of design as a strategy to communicate the value of design to new businesses.

Design and the market

Design and Designers have always relied on their ability to generate a multitude of ideas and to use these to be the first to market. Design's heritage is built upon this model of generating a market, by developing new concept products, which will hold primacy for a period by creating consumer desirability, through advertising and quality visuals. This market is typified by mid to high range goods, (not the designer elite market) whose products rely heavily upon using a market saturation technique with a quick turnover. The savvy designer also has "serial" products in the background already developed for manufacture. Once the market shows any signs of a downturn, these planned developments of either, an upgraded version or slightly different visual form are produced to enable the designer to extract maximum market value from every iteration. Keeping ahead of the competition, where novelty and uniqueness forms the designer's palette allows them to hold market domination for a period.
http://time.com/jonathan-ive-apple-interview/

This product market significantly weakened when "fake", "replicas" or "near copies" were produced in previously unseen timeframes, and at a quality that made them desirable to the consumer, who then shied away from the high cost of the designer led market. This production based on the "almost" factor and has continued to grow interrupting the products market. A "look-a-like" product was bought to market in effect it could not be construed as a direct copy and therefore a breach of IP. These products were produced at a reduced cost usually achieved through cheaper materials or poorer construction or manufacture. Thereby enabling a third party to mass-produce and optimise the value generated through the design process, whilst effectively and simultaneously destroying the market, as saturation was achieved. This also directed the mass production sector to use the copy as a

product innovator rather than sourcing their own product identity, they relied on the design process but at a secondary level.

Ref: Dyson 2011. Apple Samsung 2011

http://www.theverge.com/apple/2011/11/2/2533472/apple-vs-samsung

Realising value from the market

This business model of the 1960's – 2000 was able to be sustained as production methods remained on the whole traditional, the rise of the digital economy means that manufacturing has become a less people intensive process; technology can now be used to produce items that traditionally were the subject of skilled labour. The pound shop culture has thrived in the recent recession, and exemplifies contemporary consumer habits, (TKMaxx, Aldi, Lidl increased market share) where mass produced goods at relatively high cost have now been remade and sold with minimal margins. With no innovation or research and development costs to consider, this method is being used to maintain market growth and sustain economies. The world has become a single trading environment.

Conran 2012, identified issues with the management of IP within a company base, and the resource intensive process of protecting and challenging IP breaches, "I would rather have 3% of gross revenue than 15% of a net royalty stream - protection of IP is hideously expensive and 15% of a royalty stream sounds meager".

Dyson 2011, has had similar experience in challenging this copycat behavior but took the expensive corporate route to resolution, "We had to put a private detective in their factory and take photos of them making the fans. Then we won the case and they were fined $7,500 but they didn't pay the fine and they just carried on". Dyson is pursuing 20 design or patent cases around the world, many of them related to the distribution and sale of products made in China. The inventor did not put a figure on the amount of lost revenue but said the total was "quite a lot". The business has spent $3m (£1.9m) on legal fees."

Nokia and Apple 2011, have been in a billion dollar IP tussle, as have other major technology players such as Microsoft. All of these cases have evolved around the effective merging of design and technology. Design is the common element in making a distinctive contribution to the products functionality and desirability. Wright 2008 states, 'There's too much stuff in the world'. Indeed, for leading global brands design is as much the product on sale as it is the development process and is the real source of value. Apple's Jony Ive: "We're keenly aware that when we develop and make something and bring it to market that it really does speak to a set of values. And what preoccupies us is that sense of care, and what our products will not

speak to is a schedule, what our products will not speak to is trying to respond to some corporate or competitive agenda". Ive (2013)

So Apple is pursuing values over value. When pursuit of revenue via recourse to legal action has become almost redundant market share is protected by capture of consumer demand. Values become not just integral to the brand but are critical. We see that the attitudes to IP are influenced by brand strength and market security. So as a research project concerned with the broader application of design as a strategy for market success and how the application of these principles creates economic value efficiently, DiA has needed to understand how both our businesses and we work with IP.

Conran visiting California on a UK government trade mission (with David Willetts MP) to look at IP exploitation was convinced that UK universities still have a long way to go to get that IP engine firing on all cylinders. The new universities and science minister Greg Clark MP has retained responsibility for cities and regional growth, which has been interpreted as further evidence of the government's conviction that university research can be an engine of economic growth. It is undisputed that UK research is world leading, yet Silicon Valley is generally more successful at commercialising the ideas and inventions created in Californian universities into world-class enterprises. Why?

There is a consistent approach in California to the handling of intellectual property, copyrights and patents created or invented by students and researchers in academic institutions, and although Californian universities hold onto IP rights, they are obliged to make efforts to commercialise and protect them and, importantly, share 35% of the revenues with their inventor. It is not just about the IP rights, the team that created the technology are also expected to be instrumental in forming the company, so the people and the expertise are maintained in the enterprise. These companies can be very successful; start-ups from the University of California Berkeley alone raised more than $1.3billion in private capital in the five years up to 2011.

The leading enterprises visited during the mission were started by teams who first connected in academic institutions like Stanford, Berkley or San Diego, and there were many references in their surprisingly open presentations to the lessons learned and inspiration received during their early years – as well as to information gleaned more recently from the academy. It was clear that they still had plenty of learning to be done after their formal education ended, but there does seem to be a very healthy on-going relationship between entrepreneurs and their alma mater in California that does not seem to be mirrored in the UK.

Many of these university spinoffs seem to thrive on cross-licensing their IP to each other, sharing and building off each other's ideas and

research. There is a culture of getting ideas commercialised quickly by using design thinking right from the market-scoping stage of the development process or value chain.
http://www.ucop.edu/research-policy-analysis-coordination/policies-guidance/intellectual-property-ex/index.html

There are no overall agreed protocols in the UK University sector for how they operate and implement their IP policies; the basis for the UK Universities IP agreements is the Lambert toolkit originally established in 2005. The guidelines were reviewed in _June 2014 with the aim of providing the best advice on how to operate across sectors and ensure productive working relationships. The overall aims are to:

- Facilitate negotiations between potential collaborators
- Reduce the time and effort required to secure agreement
- Provide examples of best practice

The key elements of the Lambert agreements are:

- Ownership and rights to use the results of the project
- Financial and other contributions made by the commercial sponsor
- University's use of the results for academic purpose

The Auril handbook of intellectual property management is another guide for academic staff to help promote best practice in the management of IP including patents, trademarks design and copyright. These guides establish the basis principles for an IP policy but they are very much geared to STEM (science, technology, engineering and mathematics) subjects. They are predicated on working in partnership with large corporations, where knowledge transfer is the prevalent model for undertaking collaborative business development. These models have considerable deficits when working with Arts and Humanities businesses, particularly those operating as small SMEs/micro and lone traders, whose ability to strike deals based on a financial model up front is non-existent. These businesses require support in monetising and commercialising their IP, and the model of innovation further complicates DiA's own co-production model, entitled Chiasma.

Given the fluid nature of working with Arts and Humanities businesses DiA has had to build its business model and operational structures, (supported by the Arts and Humanities Research Council, Martin Brassell Inngot, University of Dundee's Research and Innovation team - John McKenzie, Ron Jenkins and Diane Taylor and the core DiA team). The construction of an IP policy and model is complex and evolving as the project itself evolves and matures. There is an inherent complexity in using IP as commercial value, as value is only accrued once the market place has

been entered. The UK University systems for working with the SME/micro/sole trader are under developed requiring a considerable shift in order to provide a realistic and viable set of processes.

Creating a model of balanced incentives

Divergent attitudes to IP can be significant barriers to participation in collaborative innovation processes, especially in models such as Chiasma where applications for places are sought publically and participants are meeting for the first time. Trust is a key component in long-term collaboration. Chiamsa is a two and half day innovation process, there is minimal opportunity to build a depth of trust allowing barriers to be lowered, bringing a free exchange of knowledge and expertise. A well-balanced IP structure is needed as a substitute for familiarity and trust. DiA has developed an 'IP shelter'[1] where IP emerging from Chiasma in the form of business ideas are legally owned by DiA (in legal terms, the University of Dundee) but with an explicit commitment to offer licensing to participants who developed the idea. There are several benefits to this approach:

- There is clarity on the approach to background and foreground IP coming into Chiasma. Everyone is on a level playing field and understands their rights.
- Participants can have confidence that an institution with financial and legal clout (the University) will protect their interests in the event of other participants pursuing the idea themselves.
- DiA explicitly judges licensing applications on commercial viability. If the originators of the idea are best placed to commercialise the idea then they will be supported in doing so. This gives a necessary commercial discipline to the Chiasma process.
- There is a conflict resolution mechanism in the event that originating teams are dysfunctional or realize at the outset that they cannot work together long term. Competing applications can then be made and are evaluated on commercial grounds.
- There is also an incentive for DiA with a small claim of, typically, 5% of future revenue or profits or equity being negotiated as a means of replenishing the revenue costs of running the process.

Our own IP

To date the only IP registered formally on the part of DiA is a trademark name on the Chiasma innovation process. The vast majority of IP retained within DiA's business model, developed to facilitate the research and developed as its methodology, remains un-attributable and is not able to

be registered. The only way forward for the project team is to publish frequently on the project, to ensure that the IP developed is associated with the researchers of DiA team.

Chiasma evolved using a method of disruptive thinking and rapid ideation suitable for business engagement. DiA currently has three models and is continuing to develop the process, to fit a variety of circumstances, clients, calls and contexts. DiA's rationale is to build a cross cutting model of innovation positioning designer and the design process at its heart. DiA requires a business model that functions on all levels, practically for business, for the project, the university and for the longevity of the work.

Based on a royalty model, IP generated from Chiasma are logged in an IP bank, so that the copyright and know-how in them can be the subject of a licensing agreement. The aim is to enable participants from Chiasma the opportunity to develop the IP into a commercial venture, supported by seed-corn funding.

http://designinaction.com/

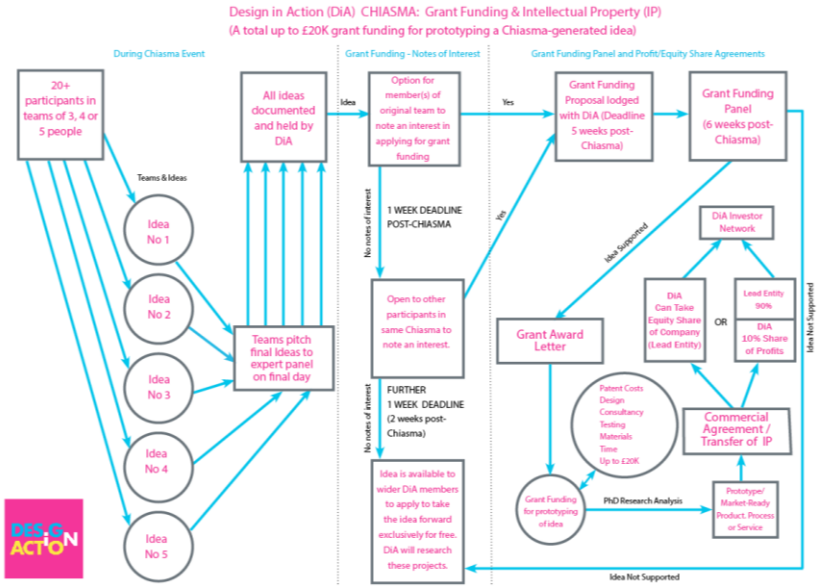

Figure 1: Design in Action (DiA CHIASMA: Grant Funding & Intellectual Property (IP)

The model has been developed to serve a number of purposes, including:

- Effective and open management of the IP resource
- Ensuring maximum exploitation potential
- Evaluating the role of design as a strategy
- Protection of IP
- Building a legacy model, post research funding

Whilst no element within itself is a unique approach, it is the combination of these elements into a form that allows their purpose and its articulation to function in delivering the outcomes needed for DiA's effective operation, longevity and research.

The business model has thrown up interesting opportunities and challenges that have to be resolved; however these issues do not deflect from the fact that participants in the process have had a successful outcome, delivered by DiA's team.

The silent process underpinning the whole theoretical proposition is about the power of design to trigger and build innovation into company thinking, this appears to have been accepted within the model without any objection. Chiasma did not overplay this requirement, DiA simply colour coded the design participants and informed all parties that each team had to include someone with this distinctive colour in their team. This ensured that design was strategically embedded in each team, this method exposed designers to unfamiliar issues and ways of working, as well as inducting all participants into the value of IP as a business tool, and building a knowledge exchange culture.

This positive start, and the requirement for all participants to sign both a confidentially and IP agreement prior to engaging in the Chiasma process should have delivered the model. However at the panel presentation stage an idea was revealed on twitter and following Chiasma a blog was created revealing the IP. These incidents will require DiA to be more explicit about the nature of IP and confidentially. The question arises is it a lack of understanding generally or somehow does using the virtual world as a tool not count in individuals thinking as a mechanism that can breach confidentiality?

The uptake of places amongst businesses, experts, and wild cards all external to the academic process has exceeded DiA's expectations. At June 2013, the second anniversary of the project, some 500 businesses had worked with the project.

DiA believes that its success with the SME community (over 3000 clients are registered with DiA) is the direct result of three elements:

- Firstly, the "scoping" process, where prior to any Chiasma call being launched a Co Investigator and a Post Doctoral Research Fellow have explored potential aspects of each sector. Mapping the sector through a close examination of the contemporaneous experience of business allowed the scoping team to establish territory for a focused business opportunity. The call for Chiasma was pitched to ensure that engagement would provide an outcome capable of meeting market need.

- Secondly, multidisciplinary working is now a proven method within academia, but for small and micro businesses this opportunity is rare if not outwith its abilities to construct. Chiasma is this opportunity for them to engage with the co-creation process, be exposed to world-class experts in the field and to engage with a disruptive thinking-model.
- Thirdly, the use of simple, non-academic language that businesses find accessible and helps to breakdown barriers with the university realm, allowing them access to the research and knowledge that otherwise would be inaccessible.

The academic community has not responded so positively to the chiasma process, although it has to the events programme, usually as the dominant interest. This suggests that it may be because there is currently little internal reward or recognition for academics to engage directly with the business community, and that KE between the two communities holds no academic currency. This behavior also indicates that IP that does not play a significant role within the Arts and Humanities academic community, (generally regarded as a tool of the sciences,) in that they do not explore the development of knowledge into the economy as a focus. Academics who have been asked to undertake a particular role have done so with willingness and enthusiasm. This is a conundrum that will take the project a further period of time to understand and resolve.

The intention is to follow the process of progress, from idea to prototype, and to understand how design functions as a strategy, using IP as the business value model.

Our first business was launched into the economy after a three-month period of development, and did so with extraordinary success. It used a monthly subscription model, and launched itself into the market place using Groupon vouchers (www.groupon.com). These sold out within 45 minutes, a second enlarged Groupon platform formed the core subscribers and enabled the business to build from a regular income base. From this the business went on to use crowd funding to raise capital for expansion, this again was successful, and within the period of 18months the business has an annual turnover of £2million. The business chose to own all of the IP and has used an equity model.

The project has a pipeline of businesses that will enter the economy over the next two-year period, no other business as yet has launched in a three-month period. The length of time from articulating the idea to the market ready stage is taking roughly 18months per business. The aspect that is the most problematic is the business model. Given that the ideas are the result of a co-created process, and many seem to have a community aspect,

or be in the digital product domain, the business models are as yet to fully evolve within the marketplace.

The preferred route for design and designers, indeed the small SME/Micro/lone practitioner is to use the tried and tested model where first to market is the most expedient route to the customer, IP with the exception of the first company to launch, has not played a predominant force within the business thinking.

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"FACTORS AFFECTING THE PRODUCTIVITY OF AREA WORKSHOP ON A HONDA DEALERSHIP IN QUINTANA ROO, MEXICO: EMPIRICAL ANALYSIS"

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Abstract

This study seeks to establish perceptions of factors affecting the productivity of the workshop in a Honda automobile dealership in Playa del Carmen. The research is exploratory type, using a mixed method, previously validated, with open questions and Likert scale for all staff questionnaire service area; and a semi structured interview with the branch manager. In the interpretation of the data SPSS version 18 was used, the Pearson correlation coefficient for hypothesis testing was used, selecting the highest correlations of 1.00 and a lower estimated error to 0.05 and significance level of 0.95, based on the method of analysis of internal factors. Derived from the results, highlights the correlation between the independent variables and work against Capital Productivity was 0,248 and 0.25 respectively, which is considered low. In contrast, the administrative management had an association of 0.76 which means a high ratio. Productivity in the Honda dealership in Playa del Carmen study, may explain most of the time the data in terms of dissimilarities by factors and analyzed on an individual basis: Administrative Management, capital and technology and to a lesser extent differences in quantity and quality of manpower. Globally the mode that includes the analysis of all the responses of the 4 factors optimizes the analysis and validates the model developed for obtaining answers.

Keywords: Dealership, productivity, work, capital, management

Introduction

At the global level, the importance of the automotive industry in national economies and its role as a booster for the development cannot be overemphasized. Other high-value-added sectors, have caused various countries have as one of its main objectives the development and/or strengthening of this industry. Mexico is no exception, as the automotive industry has represented a strategic sector for its development. Its participation in exports places it as the most important industry, surpassing even the oil sector. In 2011, the automotive industry exported 22.5 % of the value of total exports Secretariat of Economy (2012).

The production of light vehicles continues to exceed historical levels, both for the month of September as the cumulative figure for the first eight months of the year. In August 2014 271.406 units were manufactured, realizing a growth of 4.7 % compared to the eighth month of 2013. In both the accumulated record 2,128.634 vehicles were manufactured in our country, 7.2 % higher than what occurred in the eight months of last year. Of the total produced, 83% corresponds to units designed for the external market, and the remaining 17% corresponds to units for the domestic market.

Based on the publication of Organization Internationale des Constructeurs d'Automobiles (OICA) in 2013, Mexico was placed as the eighth largest producer of vehicles at the global level and Brazil as the seventh. The production in Brazil ranged from 300 thousand units produced per month, while in Mexico ranged from 250 thousand units manufactured. However, during the first eight months of 2014, Mexico produced 8.7 % more light vehicles than those produced in Brazil. In August this year, the production of light vehicles in Brazil fell to 17.9 % over the same period of 2013, in Argentina the decrease was 25 %, while Mexico grew by 7.2 %, passing the seventh place as a manufacturer of light vehicles in the world between January to August 2014. It should be noted that recently announced three new auto plants in Mexico, could represent an additional production capacity of around 600 thousand units by Mexican Association of the Automotive Industry (2014).

In 2014, the Mexican automotive industry ranked number 7 in the production of light vehicles, making it be among the main global producers. The January-August 2014 accumulated record level was achieved compared to the exports of 1,732,262 units and a growth of 9.6 % over the same period of 2013.

According to the report of Ward's Automotive, in the U.S., 11, 132.209 light vehicles were marketed in the first eight months of 2014, 5% higher than what was marketed the previous year same period. In the accumulated, the Mexican vehicles accounted for 11.1 % of the total light

vehicles sold in the United States, that is 1, 232.457 light vehicles. Keeping our country as the second vehicle supplier, after Canada, the countries that provide to the United States showed positive growth rates, with Mexico showing the highest rate, of 17.6 %, compared to the cumulative January-August 2013 by Mexican Association of the Automotive Industry (2014).

In this context, the objective of this work is to evaluate the perception of the factors in the organizations that influence the productivity such as; research, development, capacity, government, equipment, costs, ethics, workers, union, motivation, labor, capital, management, among others. Of which the last three were with greater weight with (9, 14 and 14) votes in favor of a total of 21 authors who have studied the productivity in the companies. If these are properly identified, there is a greater chance of success when you diagnose the condition of the productivity of a recognized automotive concessionaire and on all the actions and techniques that should be applied for the improvement of the same.

The rationale in this topic is to ensure the future of a concessionaire, the area of post-sale service (workshop) offers services in matters of maintenance, repairs and diagnostics to the vehicles, which in turn have approximately 15,000 parts. This is divided among seven complex systems that are: engine, train travel, rims-tires-brakes, suspension, steering, electrical system and bodywork and chassis. The information provided by the concessionaire automotive, indicates that 80% of the return of the vehicles to the area of post sale is to make some type of maintenance, to continue the repairs and finally the diagnostics, both are equivalent to the 20% remaining Honda Playa del Carmen (2014). Based on the above circumstances, it has prompted the study to "Perform an empirical analysis of the factors that affect productivity in the workshop area of a concessionaire automotive".

The article chronologically develops the analysis from the theoretical review, to describe the method used in the data collection. Describes the results of the analysis through the application of software and is concretized in the final part the conclusions deriving from the initial hypothesis and the objectives to be achieved in the research.

Review of the literature

The conductor of the word productivity is between a relationship of means of production and the results obtained, (Quesney, 1766). It means the ability to develop more products in the same way Littre, (1883) is conceptualized as the faculty of produce, i.e. the ability of an organization in order to generate more finished products. Early, (1905) says that it is the relationship between the production and the means employed to achieve this, while the Organization for European Economic Cooperation (OEEC, 1950)

mentions that it is the quotient obtained by dividing the production and one of the factors of production, in terms of David, (1955) is the change in the product obtained by resources spent, with regard to Fabricant, (1962) there is always a relationship between the production and the inputs, and same for Kendrich and Creamer, (1965) are functional definitions for the partial productivity factor of total, for Siegel, (1976) is represented by a family of reasons between production and the inputs and finally Sumanth, (1979) says that the total productivity; it is the reason for production inputs between the tangible, the above mentioned it is submitted by the author Sumanth, (1990).

In terms of the variables to measure that are (labor, capital and administration), we can see the following input from a number of renowned authors. Bruce, (2006), and his colleagues came to the conclusion that the increase in productivity due to social factors such as the morality of the employees, the existence of satisfactory interrelationships between members of a working group "sense of belonging" and the effectiveness of the administration, a type of administration capable of understanding human behavior, especially the group behavior, through interpersonal skills such as, motivation, counseling, guidance, and communication. This phenomenon, product on the fact that put attention on individuals, is known as “Effect Hawthorne".

Brown, Lauder and David, (2011) developed a system of rational organization of labor widely exposed in his book Principles of Scientific Management (1911), in an integral approach which was then known as "taylorism". It is based on the application of scientific methods of guidance and positivist mechanistic to the study of the relationship between the worker and the modern techniques of industrial production, in order to maximize the efficiency of labor, machinery and tools, through the systematic division of the tasks, the rational organization of labor in their sequences and processes, and timing of operations, more a system of motivation through the payment of premiums to the performance by eliminating all improvisation in industrial activity.

The general reasons why it is important to measure the productivity according to Pritchard, (1973) are; facilitates communication among the members of the organization, helps to evaluate the progress toward the improvement of productivity, facilitates making changes after a certain period, reveals potential problems and identifies opportunities for improvement, it is a form of feedback, is a source of motivation, and help establish priorities, identifies the problems before they become serious, aid to the decision-making, provides the statistical analysis and mathematical and aid to the long-term planning process. In addition to the measurement of productivity in different periods of time, you can compare the results to

know the behavior of team, performance the staff, and find areas of opportunity to improve.

The model of Craig and Harris, (1973) said that if you increase the productivity of labor; improving the quality of the raw material, does not exceed the savings achieved by reduction of hours and physical inputs are converted into money, paid by the inputs provided.

For its part, (Novit, 1979 ;Torres, 1997), noted that the factors that cause productivity include; assets, working methods, the quality of the raw materials, the availability of transportation and the labor force, while the model for improvement in employee productivity in Japan by industrial enterprises and trade pointed out three factors as the most important: the investment in capital, human resource development and the implementation of the administrative management in organizations (Asomoza, 1985).

According to Adam, and Hershauer, (1981), productivity is a term that describes how the conversion of inputs into outputs. Also, defined as the ratio of the four major resource inputs of an organization.

$$\text{Productivity} = \frac{\text{Products}}{\text{Labor Capital + Materials + Energy.}}$$

For Ghobadian, (1990), the capital is composed of the following components: Reserve of fixed capital (gross or net), working capital, land and labor (hours worked, number of employees, cost of labor, quantity, price, time, direct and indirect labor, materials and supplies. Schroeder, (1991) says that productivity is the relationship between inputs and outputs of a productive system.

Sumanth, (1993) suggests that if the countries have to improve their productivity levels and growth of their tasks, the fight must begin to an enterprise level. With the purpose to be effective, it must be formal and be based on strategies that revolve around a common pattern, which today is known as "the cycle of productivity" that propose the following these steps:

Cycle of productivity. (Measurement of productivity, productivity Assessment, Planning of productivity and improving the productivity).

For its part, Kast, (1993) considers that the administration has a vital role in improving the productivity, given that it acquires resources and investment decisions that affect the level of technology of an organization and individuals are the ones who carry out the tasks assigned to each level, from the hierarchy more high, up to the lowest. The improvement of the productivity requires an administration directly involved in the operational level. The same author, also said that “the productivity is influenced substantially by the motivation and the dedication of the people".

According to Everett, (1994), the worker productivity is the key to the economic viability and the accumulation of wealth, increases with the specialization and the design of the post, it is incremental when the working class works best, progress is through investments in capital. Then, the productivity of the staff is remarkable through the indexes of management, through a director capable and motivating, that make the members a real team, resulting in a productivity ascending.

Productivity according to Bain, (1997) is not only a measure of production or less, the amount of property that has been manufactured. It is a measure of how well that have been combined and used the resources to meet the specific objectives desirable.

The first step in the improvement of the productivity according to Prokopenko, (1987) consists of identifying the problems that arise in these groups of factors and distinguish between the factors that are controllable. The factors for a company that are external and non-controllable, may be internal to another institution, such as for example, the institutions of public administration, which can improve the conditions of the companies through fiscal policy, labor legislation, access to natural resources, social infrastructure, etc.

It is very difficult to measure the productivity of the office work. Prokopenko, (1987) suggests the method of working time, starting from the principle that it is constant to perform certain basic activities, and the sampling method, by means of percentages of time used by each staff member in performing tasks. Continued with the author, proposes to divide the number of hours worked by the number of available hours to reach an effectiveness percentage, in such a manner that an increase in the relationship means self-improvement. By way of conclusion, this researcher suggests that the productivity can also be seen as a synonym for innovation and technological development, due to the technological change being incorporated in different periods to the production processes, enhances productivity with the knowledge of new manufacturing techniques, process automation, invention of new materials of higher quality and lower price, etc.

Productivity for Heizer and Render, (2009) is the result of dividing the outputs (goods and services) between one or more entries (such as labor, capital or management). These three factors are critical to increase the productivity. Represent the major areas in which administrators can act to improve the productivity, below are described in short form:

Labor (Labor). The improvement in the contribution of labor productivity is the result of a labor force healthier, better educated and more motivated.

Capital. Capital investment is often needed, but it is rarely a sufficient ingredient in the battle to increase productivity.

Administration. The administration is a factor in production and an economic resource. The administration is responsible for ensuring that labor and capital are used effectively to increase productivity. The administration is responsible for more than half of the annual increase in productivity. This increase includes the improvements made through the application of technology and the use of knowledge. The education and training required represent important components of high cost are the responsibility of the operations managers when they build organizations and labor forces.

The more effective utilization of capital also contributes to the productivity. The administrator, as a catalyst for productivity, it is also responsible for selecting the best new capital investment, as well as improve the productivity of existing investments.

The American Management Association (Torres, 1997), in a survey carried out among six thousand executives of large corporations in the United States, to identify the factors that influence the productivity, defining the three most important areas; technology was marked by the 35% of managers, the 27% corresponded to the investment of capital and more than 20% indicated that the decisive factor was the administration.

Porter, (2000), suggests that competitiveness raises the productivity so that companies used their factors to produce valuable products and services. It may be inferred from the above-mentioned approach, that the only meaningful concept of competitiveness is the productivity, as the only tool to compete in more advanced sectors.

At present, the strategy and technological innovation are key elements for the competitiveness of the company and represent a significant determinant of the economic growth, innovation makes it possible for the organization to respond to market changes and, in this way, to achieve sustainable competitive advantages over time.

The input-output model of the company Leontief, (1973), based its importance in the relationship of the production function with the inputs, considering the productivity as a result of this relationship, that has to generate income that facilitate the recovery of input costs. When it focuses on the productivity exclusively the labor factor is missed. Therefore the model treats all of the elements or inputs interrelated, which provides a more integrated performance or productivity.

Sustermeister, (1976) presented a model on the productivity of the worker which is based on measurement of the performance of the worker and their impact on productivity. For this brings together all the items into two groups; technological development and human motivation.

The first varies with the type of industry and manufacturing system, and the second is due to personnel policies or not motivating the individual in his personality and ability intrinsic.

The motivational model Lawler, (1968) says that for the improvement of the productivity should be considered the relations existing between the preset psychological perceptions of equity, satisfaction and ability to affect the effort, with the probabilities of the effort for the performance. Constitute a normative model of individual performance.

Methodology

Methodological strategy for perception of productivity factors

Types of research.

Scientific research, in a general way, to the activity that allows us to obtain scientific knowledge, i.e. knowledge that is sought to be objective, systematic, clear, organized and verifiable. The subject of this activity is commonly called researcher, and in charge runs the effort to develop the various tasks required to achieve a new knowledge. The objects of study are the infinite topics and problems that demand the attention of the scientific, often grouped and classified according to the various sciences or existing specialties (Sabino, 1992).

Research helps us to improve the study because it allows us to establish contact with reality so that we have better knowledge of the phenomenon understudy. The purpose of this is to formulate new theories or modify existing ones, to increase the knowledge, this is the way to reach to develop theories. Research activity is effectively leads through a series of elements that make it accessible, the object to the knowledge and whose wise choice and application is going to depend heavily on the success of research work. Scientific research is the activity of search that is characterized by being thoughtful, systematic and methodical and aims to obtain knowledge and solve scientific problems, philosophical or empirical-technicalities, and develops through a process. Scientific research is the method which indicates the path that has to travel in such an inquiry and the techniques require the way to travel (Tamayo, 2003).

From a structural point of view we recognize four elements present in any investigation; subject, object, and middle and end (Tamayo, 2003).

It is understood by subject that develops the activity, the investigator;

By object, which investigates, that is, the subject or the subject;

By means, what is required to carry out the activity, i.e., the set of appropriate methods and techniques?

Finally, the aim, the purposes of the activity of search, which lies in the solution of a problem detected.

It should be noted that in reality, the research cannot be classified exclusively to one of the types that will be brought, but which is generally in any investigation pursues a purpose pointed out, is looking for a certain level of knowledge and is based on a particular strategy or combined (Tamayo, 2003).

For the purpose or purposes persecuted: basic or applied.

Basic Research: Also receives the name of pure research, theoretical or dogmatic. It is characterized because part of a theoretical framework and remains in the; the purpose is to formulate new theories or modify existing ones, to increase the scientific or philosophical knowledge, but without contrasted with no practical aspect (Tamayo, 2003).

Applied Research: This type of research also receives the name of practice or empirical. It is characterized because it looks for the application or use of the knowledge that is acquired. Applied research is closely linked with the basic research, because it depends on the results and progress of the latter; this is clarified if we realize that all applied research requires a theoretical framework. However, in an empirical investigation, what is of interest to the researcher, primarily, are the practical consequences. If a research involves problems both theoretical and practical, receives the name of joint. In reality, a large number of research depends on the nature of basic research and applied (Tamayo, 2003).

For the purposes of this research we can say is mixed because they apply the knowledge acquired from a theoretical framework.

By the class of means used to obtain data: documentary, or experimental field.

Documentary research: This type of research is being performed, as its name indicates, relying on sources of documentary, this is, in documents of any kind. As subtypes of this research work, we found the bibliographic research, the periodical and archives; the first is based on the query of books, the second in articles or essays to magazines and newspapers, and the third in documents that are found in the files, such as letters, offices, circulars, dossiers, etc. (Tamayo, 2003).

Field Research: This type of research was based on information coming from inter, interviews, questionnaires, surveys and observations. As it is compatible develop this type of research along with the documentary research, it is recommended that you first consult the sources of the documentary, in order to avoid a duplication of work (Tamayo, 2003).

Experimental Research: Receives this name that gets its information from the intentional activity carried out by the researcher and is aimed at changing the reality with the purpose of creating the phenomenon itself that investigates, and thus be able to observe it (Tamayo, 2003).

In this research, it was to use both ways documentary since it went to books, journal articles, review in own documents of the company (procedural manuals, control sheets), and field (questionnaire applied to a free and personal interview semi addressed to the service manager and observation).

By the level of knowledge that are acquired: Exploratory, descriptive or explanatory.

Exploratory Research: The research that is performed with the purpose of highlighting the fundamental aspects of a particular problem and find the suitable procedures to develop a subsequent investigation. It is useful to develop this type of research because, in the count with their results, simplifies open lines of research and proceed to its consistent testing (Tamayo, 2003).

Descriptive research: This type of research uses the method of analysis, achieved, characterized an object of study or a specific situation, determine their characteristics and properties. Combined with certain criteria of classification is used for sorting, grouping or systematize the objects involved in investigative work. Like the research that we have described above, can serve as a basis for investigations that require a higher level of depth (Tamayo, 2003).

Explanatory Research: This type of research requires a combination of analytical and synthetic methods, in combination with the deductive and inductive, it seeks to respond or to give an account of the because of the object being investigated (Tamayo, 2003).

In this sense, we can conclude that in this study, the research is explanatory type, since it was the combination of the synthetic and analytical methods, it is a matter of responding to give an account of a phenomenon because the object that is investigated is explanatory and is given by fact that makes use of the other investigations (descriptive and exploratory) since reaching the explanatory, must necessarily have passed by the previous.

When it is going to solve a problem in any scientific way, is very desirable to have a detailed knowledge of the possible types of research that you can follow. This knowledge makes it possible to avoid mistakes in the choice of the appropriate method for a specific procedure. It should be noted that the types of research are hardly pure; they are usually combined and obey systematically to the application of research. Traditionally there are three types of research (Tamayo, 2003).

Historic (describes what it was): This is the past experience; applies not only to history but also on the sciences of nature, the law, medicine or any other scientific discipline. At present, the historical research is presented as a critical search for the truth behind the events of past (Tamayo, 2003).

Descriptive (interprets what is): Includes a description, registration, analysis and interpretation of the current nature, and the composition or processes of the phenomena. The focus is on dominant or conclusions on how a person, group or thing driving or operating in the present. Descriptive research works on realities of facts, and its main feature is the presented us with a correct interpretation (Tamayo, 2003).

Experimental (describes what will): Occurs through the manipulation of an experimental variable not checked under rigorously controlled

conditions, in order to describe in detail how or for what cause occurs a particular situation or event. The experiment is a situation caused by the researcher to enter certain variables manipulated by the study, to control the increase or decrease of these variables and their effect on the observed behaviors. The task of the investigator is to handle deliberately experimental variable and then look at what happens in controlled conditions (Tamayo, 2003).

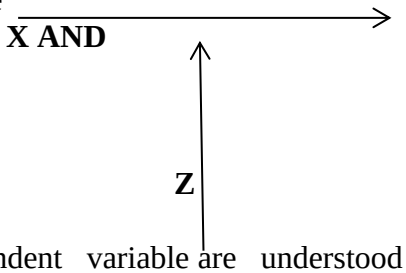
Classification of the variables by their position in a hypothesis (correlation)

Rojas, (2004) says that the variables can be classified into: Independent, dependent and inter-current or responders.

The independent variable should be understood, the element (phenomenon, situation) that explains, condition or determines the presence of another; the dependent variable can be defined as the element (phenomenon, situation) explained or that is a function of another, and the variable or inter-current responder is the element that may be present in a relationship between the independent variable and the dependent, i.e. influences the appearance of another element, but only in an indirect way.

Located in a schema, the three types of variables would be thus:

Independent Variable Dependent Variable



Intercurrent Variable or responder

In the present study by independent variable are understood as the (labor, capital and management), in the same manner the dependent variable is represented by the productivity and finally the variable or intercurrent responder includes both (the organizational culture, geographical position of the concessionaires, organizational climate, etc.), which they will not be the object of investigation, only will be taken into account the variable dependent and independent variables.

Definition operationalization of variables

After you have identified and defined the variables, the next step which is the operationalization of variables for (Sabino, 1992), the operationalization of the variables defined as the process of bringing a variable from an abstract level to a more concrete level, its basic function is to specify the maximum meanings given to a variable in a particular study, we must also understand the process as a way to explain how to measure the variables that have been selected,

Similarly, Hernandez, (2000), defines the operationalization of variables as a process, presented academically in a box designed to such effect, in which are presented and defined the variables that the researcher has determined within the problem that was raised. In this table, relate to the overall objective of the investigation, it defines each of the variables in the context of the research, are also placed the dimensions of each one and their indicators (Hidalgo, Hurtado, and Santos, 2014).

The operationalization of variables

It is a process that starts with the definition of variables as a function of measurable factors strictly to those who are called indicators.

The process forces to perform a conceptual definition of the variables to break the vague concept that it encompasses and give you specific direction within the research, then as a function of this is processed to perform the operational definition of the same to identify the indicators that will allow you to perform your measurement and quantitative empirical form, as well as qualitatively if appropriate (Ferrer, 2010).

Operationalization of variables

Variable Definition and Conceptual	Operational Definition	Dimensions	Indicators	Questions	Techniques
Productivity: For (Heizer and render, 1996) is the result of dividing the outputs (goods and services) between one or more entries (such as labor, capital or management).	Productivity can be achieved through a reduction in the input while the output remains constant, or an increase in the output while the entry remains constant.	1. Entries. 2. Outputs. 3. Labor. 4. Capital. 5. Administration.	Number of diagnoses. Number of repairs performed. Number of maintenance made. Entries of vehicles in the month of April 2014. Outputs of vehicles in the month of April 2014.	Total of entries of car repair, diagnostics, maintenance of 5, 10 and 20 thousand kilometers, in the month of April of the year 2014?	Questionnaire, Likert Scale.

Labor: In the case of this study measures the contribution of labor to the volume of production. Includes: number of technicians, advisors, and other personnel involved in the conduct of the diagnostics, repairs and maintenance.	For (Heizer and render, 1996). The improvement in the contribution of labor productivity is the result of a labor force healthier, better educated and more motivated.	1. Basic education appropriate for an effective work force. 2. Actual work time. 3. Compliance with the training and development plan. 4. Reality in the use of the facilities. 5. Number of technicians. 6. Number of advisers.	Total labor used for the realization of a diagnosis. Total labor used to perform a repair. Total labor used for the realization of a maintenance.	Do you think that the greater the competition of labor improves the productivity of the concessionaire?	Questionnaire, Likert Scale.
Capital: For (Ghobadian, 1990). The capital factor includes machinery, equipment, land, buildings, buildings, facilities, transport and tools. Which with used for the realization of the diagnostics, repairs and maintenance.	They are the resources which the company account. Measures the productivity of the assets of the company.	1. Invested Capital 2. Wages 3. Effectiveness in the use of the facilities. 4. Efficiency in the use of resources. 5. Expansion capability. 6. Number of machinery with that account. 7. Number of ramps.	An approximation of the capital invested in the workshop area. Hourly rate, in issues of diagnostics, repairs and maintenance. Considered an expansion of facilities in the future. How many	Do you consider that in the absence of capital is significantly diminishes the productivity?	Questionnaire, Likert Scale.

		8. Tools used. 9. Use of technology. 10. Application of technology.	machines are currently operating. Common tools used, for the realization of various jobs. Ramps in use. Effective use of capital.		
Administration: For purposes of this study, the administrative process includes the administrative management as are the planning, integration, direction and control headed by a director capable, to make the members a real team, obtaining as a result a productivity ascending. Which work together for the realization of the diagnostics, repairs and maintenance.	Knowledge societies are those in which a large part of the labor force has risen from manual labor to technical tasks and information processing that require education and knowledge. For (Heizer and render, 1996). The administration is a factor in production and an economic resource. The administration is responsible for ensuring that labor and capital are used effectively to	1. Planning. 2. Integration. 3. Address. 4. Control. 5. Manager. 6. Advisers. 7. Technical. 8. Scrubbers. 9. Wizards.	1. Use of the knowledge. 2. Education. 3. Training. 4. Efficiency in administrative management. 5. Standardized work. 6. Briefly describe how it employs administrative process (planning, integration, management, and control) in their daily activities. 7. Briefly describe	Do you think a poor administrative management significantly impact productivity within the concessionaire?	Questionnaire, Likert Scale.

	increase productivity. The administration is responsible for more than half of the annual increase in productivity. This increase includes the improvements made through the application of technology and the use of knowledge.		the functions carried out daily.		

Table 1: Operationalization of variables. Source: own preparation.
Case study, such as methodological strategy

What is a case study?

The General Accounting Office of the USA United States General Accounting Office (USGAO) which has been a forerunner in the use of this methodology in the field of evaluation, presents the following definition: "A case study is a method of learning, that part of a complex example considered as a whole in its context, and is based on the understanding as a whole (holistic) from that sample, from a description and a very detailed analysis".

The case study as a strategy for research in the social sciences is "an empirical investigation of a contemporary phenomenon, taken in its context, especially when the boundaries between the phenomenon and the context are not evident" (Yin, 1994).

Selection of the Research strategy

The method of case study is a valuable tool for research, and its greatest strength lies in the fact that its measures and records the behavior of the people involved in the studied phenomenon, while quantitative methods focus on the verbal information obtained through surveys by questionnaire (Yin, 2003). In addition, the method of case study data are collected from a variety of sources, both qualitative and quantitative (Martínez, 2006).

Table 2: demographic characteristics of the staff Honda of Playa del Carmen July 2014 (Source: Own Preparation).

Since Staff Honda Beach Carmen	Personal Gender Honda Playa del Carmen	Seniority in the post (Months, years)	Seniority in the automotive industry (months, years)
Washer 1	*Man*	1 Year	1 Year
Washer 2	*Man*	4 Years	4 Years
Washer 3	*Man*	8 Months	0 Years
Technician 1	*Man*	8 Years	8 Years
Technical 2	*Man*	2 Years	2 Years
Technical 3	*Man*	6 Years	6 Years
Advisor 1	*Women*	3 Years	3 Years
Advisor 2	*Women*	8 Months	8 Years
Manager	*Women*	1 Year	5 Years

The previous table shows the demographic characteristics (gender, age in the post and seniority in the automotive industry) and the post that plays the service personnel of the concessionaire Honda Playa del Carmen (July, 2014). Resulting in its majority the masculine gender (technical and washers) and to a lesser extent the feminine gender (counselors and manager). The greater seniority in the post is headed by (technical) and the lower by (2 adviser and washer). With regard to seniority in the automotive industry that has more experience (technical and technical 1 3) and to a lesser extent (washer 3).

Conceptualization of the productivity

For Kast, (1993), the administration has a vital role in improving the productivity, given that acquires resources and takes investment decisions that affect the level of technology of an organization and individuals are the ones who carried out the tasks assigned to each level, from the hierarchy more high, until the lowest. According to (Adam, 1994), the productivity of the staff is remarkable through the indexes of management, through a director capable and motivating, that make the members a real team, obtaining as a result a productivity ascending. For Heizer and Render, (1996) productivity depends on three variables: Manpower, which contributes nearly 10% to the annual increase. Capital, which contributes nearly 38% annual increase and Administration, which contributes around 52% of annual increment. These three factors are critical to increase the productivity. Represent the major areas in which administrators can act to improve the productivity

Factors of the productivity and quantification

Productivity for Heizer and Render, (1996) is the result of dividing the outputs (goods and services) between one or more entries.

Productivity of a single factor:

$$\text{Productivity} = \frac{\text{Units Produced}}{\text{Employee Input}}$$

Total factor productivity:

$$\frac{\text{Productivity Output}}{\text{Labor+ Material+ Energy+ Capital+ Other}}$$

In this sense the productivity for the purpose of this research, will be measured by the offered services (maintenance, diagnostics, and repair) between the inputs (labor, capital and administration). These can be obtained through a single factor or a total factor.

According to Adam, Hershauer and Ruch, (1994), productivity is a term that describes how the conversion of inputs into outputs. Also, the defined as the ratio of the four major resource inputs of an organization.

$$\text{Productivity} = \frac{\text{Products}}{\text{Labor+ Capital+ Energy+ materials.}}$$

Picking up what for these authors is productivity, we can say that for the purposes of this study the productivity will be measured by the services (maintenance, diagnostics, and repairs) between the labor, capital and management used to perform the services mentioned above

Working hypothesis

H1: workers believe that the training is sufficient and focused which allows them to improve the productivity.

H2: the consensus of the workers is that the company has a good level of investment that can be used to improve the productivity of the service area.

H3: The workers believe that the management is the most important factor to improve productivity within the concessionaire.

Georeferencing and characteristics of the object of study

This research was conducted in the month of July 2014 in the concessionaire Honda in Playa del Carmen, Q Roo, México. The reason is that the only way for a small business to grow and increase your profitability (or profits) is increasing its productivity. And the main instrument that gives rise to a higher productivity is the use of methods that allow us to assess those factors that add or not value to the operation, in this sense the concessionaire Honda is no exception to be object of study already that accounts with the characteristics of a service provider which offers (maintenance of preventive services, diagnostics, and repair), account with

the staff to which it is provided with facilities and tools for the realization of the services described above. Object was chosen to study the services of 5, 10 and 20 thousand kilometers since 100% of the services offered the 80% represent preventive maintenances and the remaining 20% is divided into issues of diagnostics and repairs Honda Playa del Carmen (2014). The concessionaire Honda Playa del Carmen is located in the city of Playa del Carmen (Federal Highway Batch 39, Mz. 53, Ejido Solidarity, 77712, QR.), the kind of market is widely abroad, taking as clients to a diversity of nationalities.

Description of the method of obtaining information

The research was be confined in the modality of explanatory type, is a case study applied to Honda Playa del Carmen; to carry out the research developed a questionnaire type instrument composed of open-ended questions, and Likert scale; the technique of data collection was through personal interviews. In a first time were applied to test its effectiveness, according to the data obtained were further refined the instrument with the objective of which is accurate and meets the information needs to minimize the potential problems of interpretation.

It was subsequently applied to the total personnel of Honda Playa Del Carmen, Q Roo. To interpret data using the statistical package SPSS version 21, analyzed the results obtained and conclusions were drawn up.

Source of information

As mentioned, the information was collected with the cooperation of the management and employees of the concessionaire Honda Playa Del Carmen where we were provided with information of the company relative to their indicators, operation and functionality. It also interviewed by means of a survey of all employees in the area of service in its different levels. We applied two versions of survey to a total of 9 employees. By way of in-depth interviews this instrument was applied to the managers of the company.

Statistical and graphic Method

Perceptual Mapping is a technique of multidimensional scaling, it is a generalization of the method of principal components, where instead of having an array of observation of variables is a square matrix n x n of distances or dissimilarities between the n elements of a set (penalty, 2002). This matrix can represent the distance between the diversity of views among brands, purchase behaviors or the differences between responses from a survey or questionnaire on a particular topic, in this case the productivity, leadership, organization and employment of technology of a company, such as the example that this research represents. These distances presented here

by perceptual mapping, are the result of a direct estimate asking opinions to employees at all levels of the concessionaire Honda of Playa del Carmen object of study in order to find dissimilarities in the views.

In terms of the multivariate statistics it has as objective or mentioned the attempt to represent this matrix using a set of variables orthogonal, called principal coordinates where p<n, so that the G ting en distances between the coordinates of the elements with respect to these variables are equal to or as close as possible to the distances or dissimilarities main array. That is to say, based on the matrix D is intended to obtain a matrix X, of size n x p, that can be interpreted as the array of p variables in the n individuals and where the Euclidean distance between the elements play, approximately, the distance matrix D initial. When p>2, the variables can be sorted by importance and are typically made graphical representations in two and three dimensions such as those presented in the results of this study to understand the existing structure with the objective to describe and interpret the data.

The array of similarities although small by the number of employees of the concessionaire Honda of Playa del Carmen and therefore of the number "n" of views, made it possible to represent a few variables and the structure in which the elements forming groups, have similar properties or if there are atypical elements, among other observations that are identified in the results and conclusions.

Results

Spearman correlation coefficient

The Pearson correlation coefficient measured the association between qualitative variables, takes values between -1 and +1. The interpretation of their non-standardized values as shown below (penalty, 2002).

Coefficient	Interpretation
0	Null Relationship
0-0.2	Relationship very low
0.2 -0.4	Low Ratio
0.4 -0.6	Moderate Relationship
0.6 -0.8	High Ratio
0.8 -1	Relationship very high
1	Perfect Relationship

Perceptual Mapping

Table 3: Perception by posts and correlation coefficient of the staff of Honda Playa del Carmen (washers, technicians, advisers and manager), July 2014. Source: Own Work.

Perception	Pearson's correlation coefficient
Administrative Management and its benefits on productivity	***0,005***
Years of experience in the post that plays	**0,173**
Adequacy in the training	**0,248**
Contribution of the capital in the productivity	**0,254**
Contribution of the capital invested in the productivity	**0,254**
Use of strategies to improve productivity through efficiency in the use of resources	**0,254**
Capital investment to improve the productivity	**0,254**
Use and application of the technology	**0,380**
Level and frequency of training staff in the	**0,390**
Use of administrative strategies	**0,390**
According to standard performance of the concessionaire Honda	**0,848**
Knowledge of the job profile that plays	

This table shows the Spearman correlation coefficient, on the perception of the four variables under study (productivity, labor, capital and administration) by choosing the higher correlations and age of 1.00 with an error estimate of 0.05 and a significance level of 0.95. It is worth mentioning that there is high correlation (association) when the correlation coefficient is between 0.7 and 1.0, medium if the correlation coefficient is between 0.05 and 0.7 and low if the ratio is between 0,000 and 0.04999.

Quality of global model (all the answers together)

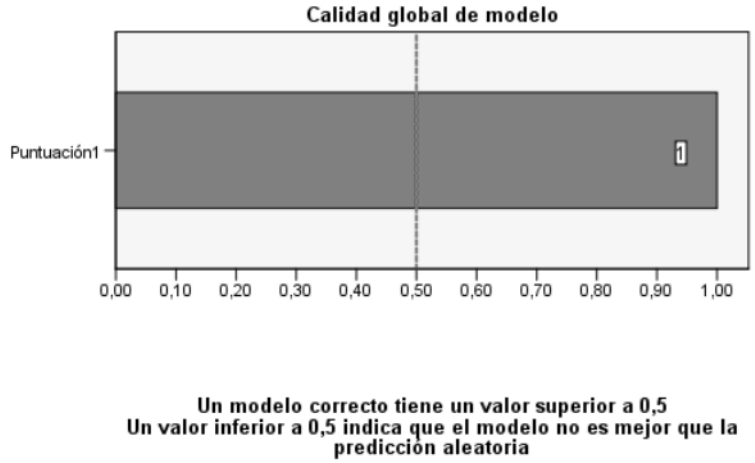
Table 4: Quality of Global Model of the almes Respect July 2014 Source: Own Work.

Overall quality of the Model With respect to	**Value in**	**Significance**
Overall Quality (management, capital, labor)	*Ji2*	1.00
Administration	*Ji2*	*0.76*
Capital	*Ji2*	0.40
Labor	*Ji2*	0.17

This table shows the overall quality of the Model studied (Honda Playa del Carmen) by measuring the relationship between the variable Post (washers, technicians, advisors, assistants and manager) and the quality of the answers given in relation to the objectives of the research in the survey to measure views. Does not represent a measurement of the variables, only sets the quality of the answers, even if the probability of positive responses were not related to the hypothesis.

Quality of contribution model with respect to administrative management responses.

The table above show the quality of the model on the basis of the three variables in research, resulting in greater weight management, capital and labor in the same order of appearance, taking the administration 0.76, within which protrudes the perception on the profile of the post that plays with a correlation coefficient of 0.84, which is located within the paragraph of administration. Showing exactly the opposite in terms of capital and labor, with only a 0.40 and 0.17 of quality in the responses, that is to say it is atypical to that contributed by different authors who share the view that the more capital and labor productivity would be on the rise. Represented graphically would be as follows:



Justira 1: overall quality of the model.*Source: Own Preparation* .

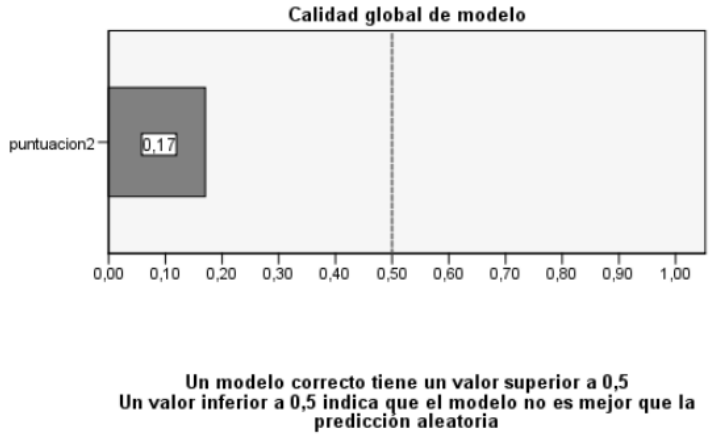


Figure 2: Quality of contribution model responses with regard to labor. *Source: Own Preparation.*

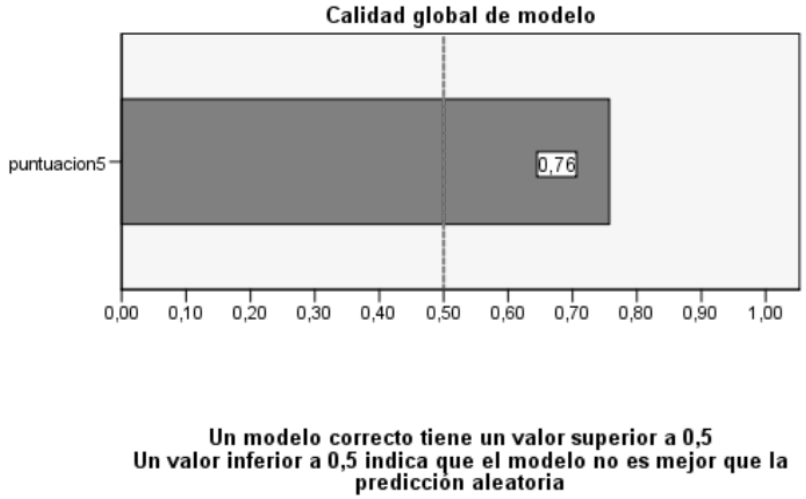


Figure 3: Quality of contribution model with respect to administrative management responses. *Source: Own Preparation.*

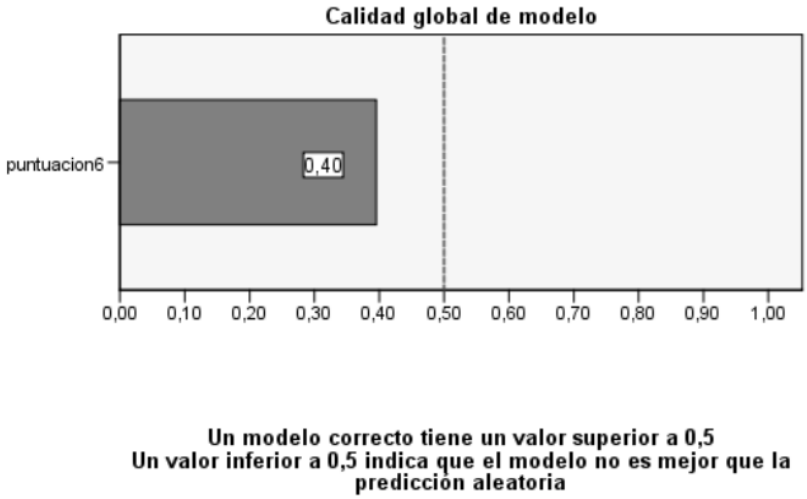


Figure 4: Quality of model with respect to capital contribution responses. Source: Own Preparation.

Findings from the analysis of intervals by Chi-squared

With the above graphic it is clear that to understand the problem of productivity in the concessionaire Honda in study of Playa del Carmen, may explain the higher of the times the data in terms of differences in order of factors and analyzed individually by: Administrative Management, capital, and to a lesser extent by differences in quantity and quality of labor.

In a global manner, the model that includes the overall analysis of the responses of the 4 factors optimizes analysis and validates the model developed for obtaining responses (Figure 1).

Results of the research

Rojas, (2004) explains that the interpretation of results obtained in a work of research attempts to find a meaning detailed information on the ligand the knowledge obtained during the approach to the problem and the theoretical framework with the relationship of the variables belonging to the study. According to information gathered from the concessionaire automotive on the perception of the factors that affect productivity, as well as the special relationship between the labor, capital and management it is possible to carry out the interpretation of the results of the investigation.

Once obtained the results of the questionnaires of the service departments, proceeded to tabular and encode the data obtained using the statistical package SPSS, version 18, to what was used the Pearson correlation coefficient for the testing of hypotheses, by choosing the higher correlations and age of 1.00 with an error estimate of 0.05 and a significance

level of 0.95 . Below are the results of the questionnaire. It is worth mentioning that there is high correlation (association) when the correlation coefficient is between 0.7 and 1.0, medium if the correlation coefficient is between 0.05 and 0.7 and low if the ratio is between 0,000 and 0.04999.

With a Spearman correlation coefficient of 0,254, it can be said that the contribution of the capital in the productivity of the staff Honda, is not significant, i.e. is not presented with the desired frequency. This is because both as technicians, advisers and managers say they lack investment, thus contributing to work better and therefore be more productive.

Within the paragraph of Administration has a Spearman correlation coefficient of 0,848 therefore we can say that the perception of the knowledge of the profile of the concessionaire Honda, is significant, that is to say that the staff Honda knows the profile of the job that plays.

According to the Spearman correlation coefficient of 0,248 (Labor, one can perceive that there is not enough training to the staff Honda, not presented association. That is to say there is not enough training for certain areas.

Discussion of the Results

In regard to Honda Playa Del Carmen.

Leontief, (1973), in its input-output model of the company based its importance in the relationship of the production function with the inputs, considering the productivity as a result of this relationship, that has to generate income that facilitate the recovery of input costs. When it focuses on the productivity exclusively the labor factor is modifying the system. Therefore the model treats all of the elements or inputs interrelated, which provides a more integrated performance or productivity.

With the above data we can see that the capital invested in the concessionaire is not presented in the same proportion and not with the desired frequency, which for Honda Playa Del Carmen would work better, be more productive.

Lawler, (1968), in his motivational model, which considers the relations existing between the preset psychological perceptions of equity, satisfaction and ability to affect the effort, with the probabilities of the effort for the performance. Constitute a normative model of individual performance.

For Honda Playa del Carmen you can perceive that there is not enough training for staff, i.e. there are no sufficient training for certain areas.

The causes of the increase in productivity for (Kast, 1993), the administration has a vital role in improving the productivity, given that acquires resources and investment decisions that affect the level of

technology of an organization and individuals are the ones who carried out the tasks assigned to each level, from the hierarchy more high, up to the lowest. The improvement of the productivity requires an administration directly involved in the operational level. The same author, also said that" the productivity is influenced substantially by the motivation and the dedication of the people".

In the concessionaire Honda Playa Del Carmen, within the section administration we have the question about the knowledge of the profile, and the staff is very familiar with the profile of the post that plays.

In all the three variables of research (labor, capital and administration), according to (Adam, 1994) the productivity of the worker in the first place is the key to the economic viability and the accumulation of wealth, increases with the specialization and the design of the post, it is incremented when the working class works best, progresses by means of capital investment. Then, the productivity of the staff is remarkable through the indexes of management, through a director capable and motivating, that make the members a real team, obtaining as a result productivity ascending. For Heizer and Render, (1996) labor contributes almost 10% to the annual increase, the capital approximately a 38% and the administration around the 52% to the annual increment. These three factors are critical to increase the productivity. Represent the major areas in which administrators can act to improve the productivity. And finally the American Management Association, Torres, (1997) in a survey carried out among six thousand executives of large corporations in the United States, to identify the factors that influence the productivity, defined the three more important: technology was marked by the 35% of managers, the 27% corresponded to the investment of capital and more than 20% indicated that the decisive factor was the administration.

Conclusion discussion of the results

In this sense, we can conclude that for the staff of Honda Playa Del Carmen, the Administration factor, in their points of view, is the one that contributes to a greater extent an increase in the productivity, and same way tied with the contribution of the authors as Adam, (1994) and Heizer and Render, (1996) which they expose the previously mentioned perspective.

Conclusions

This research work was carried out to the concessionaire automotive, Honda Playa Del Carmen, therefore the results, are limited to the concessionaire before mentioned and correspond to the latched on fieldwork undertaken in the month of July 2014. The study focused on the one hand, to assess the perceptions of the factors that affect the productivity in the

workshop area of a concessionaire automotive (Honda Playa Del Carmen), and on the other hand, in the elaboration of the theoretical framework of contextual productivity and automotive industry, as well, to propose a model for measurement of productivity based on the factors (labor, capital and administration) and finally in the design of the methodological strategy to assess the perception of the above factors, in the workshop area of the concessionaire in automotive study.

To perform the research was carried out the questionnaire to open questions mode and Likert scale, which was composed of 40 questions formed in the following manner (10 productivity, 10 capital, 8 labor and 12 administration). Of which there is agreement that the administration is the most weight and participation in the productivity, this according to the service employees, but as discussed above is only the perception of the employees. Therefore this would be one of the limitations as there are many differences in the views, there is no trend. That is why it is suggested to investigate a greater number of dealerships and service personnel, perhaps in this way, we could see a thought more standard.

Let me begin by mentioning the research hypothesis which are the following:

H1: workers believe that the training is sufficient and focused which allows them to improve the productivity.

In this sense it could be said, the answers of the respondents threw diversity of opinions there are those who commented that the training is sufficient and those who commented that for the post that play there is no training. Therefore there is no significant relationship between training and productivity. That is to say with Pearson's correlation coefficient of 0,248 (low ratio), it can be said that the perception of the level of sufficient training for the staff Honda, show no association. That is to say there is not enough training for certain areas. As well as considering a Pearson correlation coefficient of 0,380, we can say that the training of staff Honda Playa Del Carmen, is not significant, i.e. is not presented with the desired frequency. This is because both as technical manager and regularly comment that is sufficient.

H2: the consensus of the workers is that the company has a good level of investment that allows improving the productivity of the service area.

In terms of capital invested the staff of service says that they are not invested significantly in technology issues, capital in general, since the comments with regard to how much has been invested in the last year, the response was the following $25,000.00 mn Honda in Playa del Carmen, at the same time mention was made that the technology with which they have don't give you enough application use and therefore rely on an acceptable capital does not benefit as an increase in productivity.

With a Pearson's correlation coefficient for 0,254 , we can say that the perception of the staff of the service area on the contribution of capital to the productivity of Honda Playa Del Carmen, is not significant, the ratio is low, i.e. does not have the optimal capital.

The opinion of the service staff is represented by Pearson Correlation Coefficient of 0,254, which shows us that the contribution of capital in the productivity of the staff Honda, is not significant (low ratio), i.e. is not presented with the desired frequency. This is because both as technicians, advisers and manager commented that lack investment, thus contributing to work better and therefore be more productive.

Considering the Pearson correlation coefficient of 0,254, the personal Honda Playa Del Carmen tells us that the use and application of technology to improve the productivity of the concessionaire Honda, is not significant, i.e. is not presented with the desired frequency. This is because both as a technician and manager commented that do not use or apply or little used and applied technology.

H3: The workers believe that the management is the most important factor to improve productivity within the concessionaire.

Within the paragraph of Administration is the next Pearson's correlation coefficient for 0,848, in this context, we can say that the perception of the knowledge of the profile of the concessionaire Honda Playa Del Carmen, is significant (very high), that is to say that the staff knows the profile of the job that plays. Which brings benefits to the variable of study (productivity).

Limitations

Within the limitations we must highlight a part, the small number of employees; and; on the other hand, the results may be influenced by the perception of each of the respondents. Future research may evaluate in greater number of employees of the service area in statesmanship concessionaires. This work could be used in combination of the various contributions of the authors treated in the same in order to provide a model to follow to increase productivity in the service area of a concessionaire automotive. Likewise, we hope that the methodology proposed to show the perception of the factors that affect the productivity of the workshop area of a concessionaire automotive is replicated to give validity in terms of consistency of the results of this research.

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INFLATION TARGETING AND ECONOMIC GROWTH IN NIGERIA: A VECTOR AUTO REGRESSIVE (VAR) APPROACH

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Abstract

Various evaluations have attested to the success of inflation targeting (IT) as a potent framework for monetary policy in both developing and developed economies for sustainable economic growth. This study examines the achievement of sustainable economic growth through inflation targeting using the Vector Autoregressive (VAR) Model Approach. The study employs annually time series data spanning from 1981-2010. The variables of interest are consumer price index (CPI), Gross Domestic Product (GDP), Exchange Rate (EXR), US consumer price index (USCPI) as a proxy for foreign price, Money supply (M2) and Interest Rate (INTR). The empirical results show that in the VAR model, exchange rate contributes significantly to inflationary pressure in Nigeria, which is a reflection of the import-dependent nature of the economy. Hence, the need to develop the real sector of the economy through incentives that will induce investment becomes necessary.

Key Words: Inflation Targeting, Economic Growth, Monetary Policy, Vector Auto-regression
Jel Classification: E23, C30, E52

Introduction

Inflation targeting (IT) is the new orthodox theory of mainstream macroeconomic thought. Various evaluations have attested to the success of inflation targeting as a potent framework for monetary policy in both developing and developed economies (Bernanke, Laubach, Mishkin and

Posen, 1999). It is popular because of its ability to set clear standards to evaluate whether or not central banks achieve their inflationary goals, keeps them accountable and guarantees their independence (Petursson, 2005; Kiruhara, 2005). Under inflation targeting, central banks commit to a target level of inflation, usually over one-year horizon.(CBN, 2010). The approach has now been adopted by twenty four central banks, and many more, including those in developing countries, are expressing serious interest in following suit. Initially adopted by New Zealand in 1990, the norms surrounding the IT regime have been so powerful that some Central Banks of both the industrialized and the developing economies alike have declared that maintaining price stability at the lowest possible rate of inflation is their only mandate. It was and to some extent it still is, generally believed that price stability is a pre-condition for sustained economic growth and employment, and that "high" inflation is damaging the economy in the long run.

For its proponents, the appropriate inflation target is typically prescribed as maintaining price stability, though there is less agreement on the meaning of this term and on its precise measurement. Many practitioners simply adopt the widely-cited definition of Alan Greenspan, the former Governor of the U.S. Federal Reserve, as "a rate of inflation that is sufficiently low that households and businesses do not have to take it into account in making every day decisions". For Feldstein (1997), however, price stability meant a long-run inflation rate of zero. On the same line, Bernanke, Laubach, Mishkin and Posen, (1999) defines inflation targeting as a framework for monetary policy characterized by the public announcement of official quantitative targets (or target ranges) for the inflation rate over one or more time horizons, and by explicit acknowledgement that low, stable inflation is monetary policy's primary long-run goal. Among other important features of inflation targeting are vigorous efforts to communicate with the public about the plans and objectives of the monetary authorities, and, in many cases, mechanisms accountability for those objectives." From this definition, the authors take some care to describe inflation targeting as a framework and not as a rule. In other words, inflation targeting fits somewhere between the extremes which feature in the "rules versus discretion" debate which raged in monetary policy circles in earlier years. Inflation targeting is not "automatic" in the sense of a Friedman-like rule by which growth in the money supply is governed in order to achieve the ultimate goal of price stability (Sherwin, 2000). But nor does inflation targeting allow the central bank full discretion to take decisions in any ad hoc or unconstrained fashion. Rather, inflation targeting can be described as a form of "constrained discretion" (Sherwin, 2000). To quote Bernanke, Laubach, Mishkin and Posen, (1999), "By imposing a conceptual structure

and its inherent discipline on the central bank, but without eliminating all flexibility, inflation targeting combines some of the advantages traditionally ascribed to rules with those ascribed to discretion."

In addition, inflation targeting is usually associated with appropriate changes in the central bank law that enhances the independence of the institution (Bernanke, Laubach, Mishkin and Posen, 1999; Mishkin and Schmidt-Hebbel, 2001; Buiter, 2006) for an evaluation. The implementation of inflation targeting then depends, among other things, on the following conditions: (1) the assignment of the target; (2) the interaction of the target with other policy goals; (3) the appropriate definition of the target; (4) the role of inflation forecasts; and (5) the degree of the accountability of the central bank to achieve the target **(**Tutar, 2002). On the assignment of inflation targeting framework, the success of the framework depends on the central bank's instrumental independence and the announcement of the inflation target, which differ across countries. Debelle (1997) observes that to promote the agreement between the central bank and the government and to increase the effectiveness and the credibility of inflation targeting framework in any country, central bank should be responsible for announcing inflation target while government should only endorse it.

Economic theorists share varying views about inflation targeting as a tool for economic development, however one of the consensus views among economists is the importance of a low and stable inflation. Economic theory posits that low and stable inflation is important for market-driven sustainable economic growth, and that monetary policy is the most direct tool for controlling inflation. Furthermore, among the entire government tools for influencing and directing the economy, monetary policy has proven to be the most flexible instrument for achieving medium-term stabilization objectives.

In Nigeria, for some time now, Inflation targeting has been accepted as the principle to guide monetary policy by the government and the CBN. However, the CBN's commitment to the effective implementation of this framework remains to be seen. For instance, the CBN has not specified if targeting refers to core inflation or overall inflation or if the target is a specific level or a range. The central bank also lacked the operational autonomy that is required for effective inflation targeting. Encouragingly, with the enactment of the 2007 Central Bank of Nigeria (CBN) Act, operational autonomy of the CBN was strengthened. The Bank was charged with the responsibility of achieving price stability among other functions and the appointment and removal of the CBN Governor is subject to the confirmation of the Senate as enshrined in the Act. Uchendu (2007) further noted that the launching of the Financial System Strategy (FSS) 2020, added

vigor towards implementation of inflation targeting (IT) framework in the country since it hinges on strategic objective of achieving low single digit inflation. The Bank on its part decomposed its Research and Statistics Department into a department each with a view to strengthen and improve the quality of data and research output carried out in different aspects of monetary policy implementation. Recently, modeling units in the Research department has been charged with the task of developing a robust model for Nigeria. The rest of the paper is organized as follows: Following the introduction is a survey of the literature review which consists of conceptual framework, theoretical review and empirical review. Section three focuses on sustainable economic growth through inflation targeting while section four is the methodology of the research covering issues relating to the sources of data, model specification and techniques of analysis. In section five, the empirical analysis are undertaken and results are discussed. While summary, recommendations and concluding remarks are contained in section six.

Literature review

As is well known, inflation targeting was introduced in New Zealand in 1990. As Murray (2006) points out, when inflation targeting was implemented in New Zealand, it was viewed as a special case, because New Zealand was a small open economy that had just announced a number of audacious reforms. Those reforms were helpful in restraining inflation particularly in the country's significant fiscal consolidation, labour market reforms, and major reductions in barriers to international trade. The Policy Targets Agreement was a creative and reasonable extension of this first wave of reforms. It was designed to lend more discipline and accountability to the conduct of monetary policy.

Conceptual and Theoretical Framework

Inflation Targeting:

At present there is no single most accepted definition of inflation targeting, some kind of generic characterizations of what constitutes inflation targeting are common in the literature. For example, Truman (2003) noted that some writers including Bernanke and Mishkin 1997; Bernanke, Laubach, Mishkin and Posen, 1999; King, 2002; Kuttner and Posen, 2000) refer to inflation targeting as offering a framework of "constrained discretion" in which the constraint is the inflation target which may be a point or a range, and the discretion is the scope and flexibility to take account of economic and other considerations.

Attempt is also made in the literature to distinguish between strict inflation targeting (SIT) and flexible inflation targeting (FIT). SIT is the type

characterized by Uchendu (2009) as that form of IT which disregards entirely the real effects of monetary policy in the short-and medium-term, and focuses exclusively on controlling inflation within the shortest possible time horizon. This kind of inflation targeting is practiced by any central bank as at the present, rather what inflation targeting central bank practice is the FIT which in general terms is that the primary goal of monetary policy is to achieve price stability in the form of an inflation target, while also paying attention to stabilizing the business cycle (Uchendu, 2009).

Essentially, IT may be viewed as a strategy in which the central bank adopts a numerical target for inflation and commits to achieving the target a (Pierre, 1999). Mordi (2008) noted that this means that as long as inflation remains within the stated range, the central bank is free (and indeed expected) to stabilize the economy. However, if at some point inflation threatens to exceed the permissible range, then the central bank must make the inflation target its overriding objective and work towards containing it to within that range. Many authors including (Mishkin 2000; and Truman, 2003) have identified the essential elements of IT to include:

- Institutional commitment to price stability as the primary goal (explicitly or implicit) of monetary policy;
- Numerical target or sequence of targets aimed at making the goal operational;
- Time horizon to reach the inflation target or to return (if missed) to the inflation target;
- Evaluation on-going review of whether target will be or has been met;
- An information inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used to decide the setting of policy instrument and;
- Increased transparency of the monetary policy strategy through communication with the public and the markets about the plans, objectives, and decisions of the monetary authorities.

``According to Tsenkwo (2010), the hallmark of inflation targeting is the announcement by the government, the central bank, or some combination of the two that in the future the central bank will strive to hold inflation at or near some numerically specified level. Inflation targets are more often than not specified as for example 1-3 percent, rather than single number and are typically established for multiple horizons ranging from one to four years. However, Tutar (2002), reported that the centre point of inflation target is referred to as their interpretation of the operational definition of price stability. While in theory, inflation appears to be equal to price stability, in

practice, the concept of price stability is influenced by some issues like price level measurement and nominal rigidity. However, what appeared to be more comprehensive regarding the concept of inflation targeting was the one providing by Eichgreen (2001) where he defined inflation targeting as follows:

"a monetary policy operating strategy with four elements; an institutionalized commitment to price stability as the primary goal of monetary mechanism rendering the central bank accountable for attaining its monetary policy goals; the public announcement of target inflation; and policy of communicating to the public and the markets the rationale for the decision taken by central bank". To state clearly, an inflation targeting arrangement is not just about public pronouncement of an inflation target/range. Important features of an inflation target arrangement include the definition of what type of inflation is being targeted, the inflation target range, the use of exclusion clauses or caveat for example under what circumstances the central bank is able to overshoot its target), and the target horizon. However, Bulir (2008) used three key inflation targeting communication tools-inflation targets, inflation forecasts, and verbal assessments of inflation factors contained in quarterly inflation reports-provided consistent message in five out of six countries: Chile, the Czech Republic, Hungary, Poland, Thailand and Sweden. However, no single central bank, according to him in the sample stands out as an exceptional good forecaster of inflation and communication of its policies.

Conceptually, inflation targeting (IT) decreases monetary policy framework in which central banks accept and announce certain targets of inflation, over a given period of time, as measure of policy anchor and are accountable for deviation of actual from set of targets. Three main forms of inflation targeting have been identified: (i) Full fledge IT (FFIT), that is, when a country is ready to adopt IT as its single nominal anchor upon which macroeconomic stability would be achieved. This s suitable with countries with robust or sound financial environment, and a central bank, which is transparent, accountable and high committed to the attainment of the goal of IT. (ii) Electric IT (EIT), when a country, for instance pursues IT along with other monetary policy objectives in a stable financial environment which, however, is less accountable and transparent. (iii) Inflation targeting lite (ITL), low profile forms of inflation targeting pursues by countries, largely due to lack of strong or credible macroeconomic environment. ITL float their exchange rate and announce an inflation target, but are not able to maintain the inflation target as the foremost policy objective. A number of emerging markets are practitioners of ITL. It is agreed also that FFIT is not possible in ITL countries because of the following: (a) Lack of sufficiently fiscal position and high debt/GDP ratio. (b) Lack of a fully developed monetary

and financial system. (c) Vulnerability of economic shocks (especially supply shocks) owing to their low degree of development. (d) Lack of transparency in the operation and implementation of monetary policy (Englama and Aliyu, 2009).

In practice, all types of monetary policy involve modifying the amount of monetary base (Mo) in circulation. This process of changing the liquidity of base currency through the open sales and purchases of (government-issued) debt and credit instruments is called open market operations. Constant market transactions by the monetary authority modify the supply of currency and this impacts other variables such as short-term interest rates and exchange rate. The distinction between the various types of monetary policy lies primarily with the set of instruments and variables that are used by the monetary authority to achieve their goals (Tsenkwo, 2010).

The New Open Economy Macroeconomics Paradigm

While the central bank can in principle embrace any model for its purpose, in practice inflation targeting regimes (and also the theoretical literature on inflation targeting have adopted the version of what is known as the "New open economy macroeconomics paradigm" (Chang, 2007). In this paradigm, exchange rate news affects forecasts of future inflation through a few specific channels including:

i. Exchange rate shocks affect the prices of some imported goods that are included in the consumer price index.
ii. Exchange rate also affects the cost of imported intermediate inputs to domestic production, which in turn may affect aggregate supply relations between inflation and output gap.
iii. Real exchange rate movement which may be due to nominal ones can affect the relative demand for domestically produced goods vis- a- vis foreign goods, therefore affecting the aggregate demand.
iv. Finally, exchange rate shocks may affect domestic interest parity conditions, and hence investment demand.
v. Hence, one should expect IT central bankers to justify any policy reaction to exchange rate developments (Tsenkwo, 2010).

Empirical Literature

Many developed and emerging economies switched to inflation targeting as their monetary policy regime. Different inflation forecasting models have been developed to forecast inflation especially in developed countries. Adopting the standard general-to-simple approach, Sekine (2001) attempted a structural model-based forecast for Japan with a view to deriving a structural inflation function as an equilibrium correction model. With the primary objective of establishing a long run relationship in the Japanese inflation process, the paper found excess money and output gap as the major

determinant of inflation process in its construction of a one-year-ahead inflation forecast for the economy. Barden, Jansen and Mymoen (2003) constructed an inflation targeting econometric model for Norway at the time the country was transiting from exchange rate targeting to inflation targeting. Their focus was to empirically quantify the importance of the different transmission mechanisms rather than calibrating the values as well as harness the design and estimation of econometric models in the forecasting of inflation to enhance policy analysis. Using a smaller simultaneous model of wage and price setting (core model) along with marginal models of the rest of the economy, they found that inflation can be affected by changing the short term interest rate and that the main channels of transmission are through the output gap and unemployment level, while interest rate can be used to offset shocks to GDP output. In developing and new emerging economy, Lopez (2003) investigated the efficient policy rule for inflation targeting in the Columbian economy. The paper examined the place of well-defined policy rule in inflation targeting using inflation-output variability frontiers in the manner of Taylor's rule (1979). The purpose is to determine the reaction function that would be efficient in the minimization of output gap, inflation and instrument variability. Using stochastic simulations of the macroeconomic model of the Columbian economy, the results showed that output variability in the Taylor's rule was lower than the inflation forecast-based rules while inflation and instrument variability were very high (CBN, 2010). In the study conducted by Ye and Lin (2008) on the effect of inflation targeting in thirteen (13) developing countries, using variety of propensity score matching methods, their results showed that on the average, inflation targeting has large and significant effects of lowering both inflation and inflation variability in these thirteen countries.

Table 1: Key indicators of developing countries that follow inflation targeting.

Country	**Year of IT**	**GDP**		**Inflation rate**	
		Before	**After**	**Before**	**After**
Thailand	2000	0.6	5.1	4.3	2.7
Korea	1998	4.5	5.7	5.5	2.8
Philippines	2002	3.0	5.4	6.0	5.8
Indonesia	2005	4.7	5.5	9.3	13.1
Pakistan	-	7.0	-	6.3	-

Source: SBP Research Bulletin Vol. 5 No.3, 2009

Table 1.0 above shows that all the counties experienced an expansion in GDP and a reduction in inflation rate respectively after an inflation targeting policy.

INFLATION TARGETING AND SUSTAINABLE ECONOMIC GROWTH IN NIGERIA

For the Central Bank of Nigeria (CBN), the primary objective in its conduct of monetary policy is to maintain a stable price level that supports sustainable economic growth and employment. While other central banks adopted numerical inflation or nominal GDP targets as guides for monetary policy since the 1980s and 1990s because financial market innovations and deregulations rendered monetary aggregates less reliable policy guides, the CBN did not deviate from the conventional monetary aggregate as the appropriate intermediate target. An implicit assumption with respect to this choice is that the intermediate target chosen is measurable, controllable, and predictable. In addition, it is assumed that the money demand function is stable in the conduct and implementation of monetary policy. This is very important because the money demand function is used both as a means of identifying medium term growth targets for money supply and as a way of manipulating the interest rate and reserve money for the purpose of controlling the total liquidity in the economy and for controlling inflation rate (Owoye and Onafowora, 2007).

A common argument for conducting monetary policy so as to keep inflation very low (e.g., in the lower single digits) is that inflation is harmful to long-run growth. There are several reasons for this: inflation can raise transactions costs and may contribute to uncertainty about the future. However, there is no consensus in the literature that maintaining rates of inflation at a typical inflation targeting level (e.g., around 5 percent) necessarily leads to faster growth.

One early study of the relationship between inflation and growth across 127 countries found that growth rates declined only when inflation rates moved beyond 20-25 percent and that growth increased as inflation rose up to the 15-20 percent range (Bruno, 1995). Similarly, Bruno and Easterly (1995) reported that the negative relationship clearly manifests itself only when inflation exceeds 40 percent. These early estimates were based on combined data across all countries. However, the threshold at which inflation reduces growth appears to vary between developed and developing countries. Khan and Senhadji (2001) identify the threshold point at which inflation reduces economic growth at 1 to 3 percent for developed economies, but the threshold point for developing countries is between 11 and 12 percent. Pollin and Zhu (2006) find that higher inflation is associated with moderate gains in GDP growth up to 15-18 percent inflation, after which growth begins to decline. The results are more robust in developing countries relative to developed economies. Some researchers have found that the threshold at which inflation reduces growth is in the single-digits (Ghosh & Phillips, 1998). What can we conclude from these studies? There is broad consensus that rapid rates of inflation will have a negative impact on growth, and this turning point will most likely be reached once inflation exceeds 15 to 20

percent. Only a few studies show that reducing inflation down to the level typically adopted in inflation targeting regimes will contribute to stronger growth. Other studies suggest that keeping inflation in this range actually leads to slower growth. At best, the benefits of maintaining inflation in the lower single digits are uncertain and there is a possibility it may slow the process of development.

Methodology

Sources of Data

The study employs Vector Autoregressive (VAR) Model Approach using annually time series data spanning from 1980-2010 obtained for the following variables consumer price index (Headline), money supply, Gross Domestic Product (GDP), exchange rate, minimum rediscount rate/ monetary policy rate, US CPI as a proxy for import price. The data for the study is obtained from Central Bank of Nigeria (CBN) Statistical Bulletin,2010, CBN Annual Reports and Statement of Account (various years), national Bureau of Statistics (NBS) and World Data Bank (World Economic Indicators). E views econometric software is employed to handle the data manipulation.

Model Specification

The study employs a Vector Autoregressive (VAR) models to examine output variability and inflation instrument variability. In the specification of the model, in line with the works of Mordi (2008) and Valle (2002), the VAR models are specified as follows:

$LCPI_t = \alpha_1 + \beta_1 LCPI_{t-1} + \delta_1 LM2_{t-1} + Л_1 LEXR_{t-1} + \lambda_1 LGDP_{t-1} + \rho_1 LUSCPI_{t-1} + \partial_1 LINTR_{t-1} + \varepsilon_1$……1

$LM2_t = \alpha 2 + \beta_2 LCPI_{t-1} + \delta 2 LM2_{t-1} + Л 2 LEXR_{t-1} + \lambda_2 LGDP_{t-1} + \rho_2 LUSCPI_{t-1} + \partial_2 LINTR_{t-1} + \varepsilon_2$……2

$LEXR_t = \alpha_3 + \beta_3 LCPI_{t-1} + \delta_3 LM2_{t-1} + Л_3 LEXR_{t-1} + \lambda_3 LGDP_{t-1} + \rho_3 LUSCPI_{t-1} + \partial_3 LINTR_{t-1} + \varepsilon_3$……3

$LGDP_t = \alpha_4 + \beta_4 LCPI_{t-1} + \delta_4 LM2_{t-1} + Л_4 LEXR_{t-1} = \lambda_4 LGDP_{t-1} + \rho_4 LUSCPI_{t-1} + \partial_4 LINTR_{t-1} + \varepsilon_4$……4

$LUSCPI_t = \alpha_5 + \beta_5 LCPI_{t-1} + \delta_5 LM2_{t-1} + Л_5 LEXR_{t-1} + \lambda_5 LGDP_{t-1}\ \rho_5 LUSCPI_{t-1} + \partial_5 LINTR_{t-1} + \varepsilon_5$ …….5

$LMRR_t = \alpha_6 + \beta_6 LCPI_{t-1} + \delta_6 LM2_{t-1} + Л_6 LEXR_{t-1} + \lambda_6 LGDP_{t-1} + \rho_6 LUSCPI_{t-1} + \partial_6 LINTR_{t-1} + \varepsilon_6$……6

Where LCPI is the log of consumer price index, LM2 is the log of broad money supply, LEXR is the log of exchange rate, LGDP is the log of gross domestic product, LUSCPI is the log of US consumer price index while LINTR is the log of interest rate.

Econometric Tests, Data Analysis and Interpretation of Results

Ordering of Variables

The selection of the variables is done to build multivariate models which can be used to target inflation and as a forecasting instruments.

One of the basic issues to address when using VAR is the ordering of the variables. In ordering our variables, it is assumed that monetary policy variables M_2 and INTR would transmit into price and output through exchange rate while foreign price (USCPI) is the most exogenous variable in the model. For the selection of lag length, a lag length of one is selected based on Schwarz information criteria because it takes into consideration the parsimoniousness of the model and has stringer theoretical backing (Serrato, 2006).

Roots of characteristic Polynomial Test

The result of this test in the appendix when LCPI, LEXR, LGDP, LINTR, LM2 and LUSCPI are endogenous variables while the constant is the exogenous variable shows that no root lies outside the unit circle. The VAR satisfies the stability condition.

Block Exogeneity Test

Block exogeneity tests are to determine how these variables enter the model. It has as its null hypothesis that the lags of a set of variables do not enter the equation of the other variables, and, thus, it is exogenous to the model.

The block exogeneity test result in the appendix indicates that none of the variables at lag one should enter the equation of LCPI as an exogenous variable at 5 percent significant level. The values of their various probabilities are greater than the 5 percent significant level thereby accepting the null hypothesis. There is no indication of LM2 granger cause LCPI. This opposes monetary policy theory.

VAR Lag Order Criteria

To determine the optimum lag length, we begin with a lag of twenty but finally selected an optimum lag of one. We employed the sequential modified LR test, the final prediction error (FPE) test, Akaike information criterion (AIC) test, Schwarz information criterion (SIC) test and Hannan Quinn (HQ) information criterion at 5 percent level of significance to carry out the selection. All the test results in the appendix indicate a lag order of one.

Impulse Response

This section analyses the dynamic property of the model using impulse response functions. Figure 1.1 in the appendix reveals the response of CPI to a one unit shock to USCPI, GDP, CPI itself, EXR, LM2 and INTR. While figure 1.2 reveals the response of GDP to a one unit shock to USCPI, GDP, CPI, EXR, LM2 and INTR. The graphs in the appendix show that a positive shock to CPI itself decreased CPI throughout. While a positive shock to exchange rate increased CPI throughout. This shows that the theory of exchange rate pass through. CPI did not respond to interest rate but a positive shock to GDP led to a decline in CPI. This is in line with economic theory of inflation and output having an inverse relationship. LCPI did not also respond to foreign price proxied by USCPI while a positive shock to LM_2 led to a decline in CPI. This is in consonant with the work of Mordi (2007) where the use of monetary aggregates as intermediate monetary target was questioned.

Variance Decomposition

This section has to do with assessing the relative contribution of the variables to the fluctuation in prices and GDP. This is done by decomposing the forecast variance of the inflation rate and GDP over different horizons. The statistics in table 2.1 and 2.2 in the appendix indicate the percentage contribution of innovations in each of the variables to the variance decomposition of CPI and GDP.

Variance decomposition to CPI shows that shocks to exchange rate are important source of variation in CPI, accounting for 27.17 percent shocks in prices after 10 period, while own shocks explained 59.51 percent. GDP and USCPI accounted for just 4.09 and 3.72 percents respectively. This is in line with the open economy paradigm that exchange rates news affects forecast of future inflation. Not much can be said of LM_2 and INTR which is inconsistent with the use of monetary aggregates as intermediate monetary targets. it is also not in line with the monetary precepts which states that the expansion of bank lending and hence of the money supply leads to an increase in expenditure that in turn puts further pressure on prices in an open-ended process that epitomized the inherent instability of credit.

Variance decomposition of EXR shows that shocks to CPI and GDP are important sources of fluctuation in EXR accounting for 25.30 and 11.44 percents respectively.

Variance decomposition of GDP reveals that apart from itself which accounted for 27.15 percent, EXR and CPI are major sources of fluctuation in EXR accounting for 36.42 and 21.83 percents respectively. This is also in line with the open economy paradigm and economic theory of inflation and growth.

Not much can be attributed to interest rate. In fact the findings is not in line with Keynesian precepts which states that fiscal policy is seen as the primary tool of macroeconomic stabilization, while interest rate is to be set low to encourage investment, and credit controls employ to restrain consumer borrowing.

Conclusion

An inflation target clearly provides a nominal anchor for the path of the price level, and, like a fixed exchange rate anchor, has the important advantage of being easily understood by the public. The resulting transparency increases the potential for promoting low inflation expectations, which helps to produce a desirable inflation outcome. Also, like a fixed exchange rate or a monetary targeting strategy, inflation targeting reduces the pressure on the monetary authorities to pursue short-run output gains that would lead to the time-inconsistency problem. An inflation-targeting strategy also avoids several of the problems arising from monetary targeting or fixed exchange rate strategies. For example, in contrast to a fixed exchange rate system, inflation targeting can preserve a country's independent monetary policy so that the monetary authorities can cope with domestic shocks and help insulate the domestic economy from foreign shocks. In addition, inflation targeting can avoid the problem presented by velocity shocks because it eliminates the need to focus on the link between a monetary aggregate and nominal income; instead, all relevant information may be brought to bear some forecasting inflation and choosing a policy response to achieve a desirable inflation outcome.

Based on the findings and policy implications from this study, the following recommendations are proffered:

(i) making the objective of monetary policy clear and thereby improving planning in the private and public sectors;

(ii) since the impact of shocks to most of the variables on CPI and GDP is immediate, CBN should critically and carefully evaluate policy options before implementing them;

(iii) since the study established a stable relationship between inflation and monetary policy instruments, the plan of the Bank to transit to inflation targeting framework of monetary policy is appropriate. However, other preconditions, such as CBN autonomy, absence of fiscal dominance, non-reliance on seignior age as a means of financing government deficit, Exchange rate targeting, among other should be reconsidered;

(iv) in the VAR model, it is observed that exchange rate contributes significantly to inflationary pressure in Nigeria, which is a reflection of the import-dependent nature of the economy. Hence, the need to

develop the real sector of the economy through incentives that will induce investment becomes necessary. This is necessary as inflation cannot be targeted without a robust real sector.

The study examined the achievement of sustainable growth through inflation targeting using the VAR models. The innovation analysis showed that shocks to exchange rate have a significant effect on prices and GDP. The major conclusion from the VAR analysis is that the basic transmission mechanism runs from exchange rate to prices which is in- line with the open economy paradigm which states that exchange rate news affects forecasts of future inflation.

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APPENDIX

Roots of Characteristic Polynomial
Endogenous variables: LCPI LEXR LGDP LINTR LM2 LUSCPI
Exogenous variables: C
Lag specification: 1 2
Date: 12/03/12 Time: 13:54

Root	Modulus
0.991870	0.991870
0.902903 - 0.025181i	0.903254
0.902903 + 0.025181i	0.903254
0.535307 - 0.556582i	0.772229
0.535307 + 0.556582i	0.772229
0.399383 - 0.543734i	0.674650
0.399383 + 0.543734i	0.674650
-0.296906 - 0.600957i	0.670300
-0.296906 + 0.600957i	0.670300
-0.247198 - 0.195414i	0.315108
-0.247198 + 0.195414i	0.315108
0.293727	0.293727

No root lies outside the unit circle.
VAR satisfies the stability condition.

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VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/03/12 Time: 13:55
Sample: 1981 2010
Included observations: 28

Dependent variable: LCPI

Excluded	Chi-sq	df	Prob.
LEXR	3.333773	2	0.1888
LGDP	1.634639	2	0.4416
LINTR	0.111896	2	0.9456
LM2	4.127249	2	0.1270
LUSCPI	2.491206	2	0.2878
All	13.98498	10	0.1737

Dependent variable: LEXR

Excluded	Chi-sq	df	Prob.
LCPI	3.958352	2	0.1382

LGDP	2.128730	2	0.3449
LINTR	1.006630	2	0.6045
LM2	1.057619	2	0.5893
LUSCPI	4.672536	2	0.0967
All	14.44377	10	0.1537

Dependent variable: LGDP

Excluded	Chi-sq	df	Prob.
LCPI	7.131852	2	0.0283
LEXR	4.693196	2	0.0957
LINTR	1.108403	2	0.5745
LM2	1.073039	2	0.5848
LUSCPI	1.748511	2	0.4172
All	25.93280	10	0.0038

Dependent variable: LINTR

Excluded	Chi-sq	df	Prob.
LCPI	2.066743	2	0.3558
LEXR	5.405964	2	0.0670
LGDP	2.916790	2	0.2326
LM2	2.578568	2	0.2755
LUSCPI	4.212443	2	0.1217
All	16.37803	10	0.0893

Dependent variable: LM2

Excluded	Chi-sq	df	Prob.
LCPI	5.357578	2	0.0686
LEXR	1.253231	2	0.5344
LGDP	2.619396	2	0.2699
LINTR	1.067119	2	0.5865
LUSCPI	2.709479	2	0.2580
All	17.26654	10	0.0687

Dependent variable: LUSCPI

Excluded	Chi-sq	df	Prob.

LCPI	7.896494	2	0.0193
LEXR	6.808634	2	0.0332
LGDP	3.365834	2	0.1858
LINTR	0.501779	2	0.7781
LM2	6.647061	2	0.0360
All	20.74597	10	0.0229

VAR Lag Order Selection Criteria
Endogenous variables: LCPI LEXR LGDP LINTR LM2 LUSCPI
Exogenous variables: C
Date: 12/03/12 Time: 13:47
Sample: 1981 2010
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	5.229846	NA	4.26e-08	0.055011	0.340483	0.142283
1	200.6896	293.1897*	5.14e-13*	-11.33497*	-9.336667*	-10.72407*
2	235.0943	36.86218	8.56e-13	-11.22102	-7.509883	-10.08649

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2.1: **Variance Decomposition**

Variance Decomposition of LCPI:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.120813	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.204794	95.93079	0.078733	0.723502	0.295924	0.328807	2.642244
3	0.243184	88.20678	2.380893	3.402026	0.501050	1.576480	3.932772
4	0.259209	80.57724	9.034666	3.965917	0.928435	1.893638	3.600103
5	0.271079	73.70817	16.01735	3.633286	1.515254	1.731889	3.394053
6	0.280450	68.95594	20.58487	3.570472	1.547651	1.795101	3.545966
7	0.287434	65.64775	23.03100	3.921405	1.498364	2.105879	3.795609
8	0.293244	63.39789	24.39905	4.188042	1.632985	2.527082	3.854952
9	0.298849	61.56827	25.62854	4.177260	1.907442	2.921919	3.796565
10	0.304721	59.51215	27.16616	4.093508	2.175264	3.328746	3.724171

Variance Decomposition of LEXR:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.319617	2.914321	97.08568	0.000000	0.000000	0.000000	0.000000
2	0.394763	15.24355	75.21043	7.330079	0.003090	2.182690	0.030159
3	0.450641	22.25932	61.22222	11.91162	1.203437	2.624913	0.778488
4	0.471073	25.91845	56.55677	12.28420	1.108145	2.407247	1.725192
5	0.477509	25.44685	55.09594	12.43298	1.485983	2.737165	2.801085
6	0.483346	25.78126	53.82974	12.13454	1.909888	3.360660	2.983916
7	0.489838	26.20561	52.87731	12.10655	2.306703	3.580173	2.923648
8	0.495193	25.80643	53.19795	12.01702	2.441823	3.646896	2.889885
9	0.501318	25.30816	53.95977	11.73185	2.406923	3.681221	2.912075
10	0.508873	25.29865	54.17426	11.43622	2.351555	3.707615	3.031709

Variance Decomposition of LGDP:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.140744	9.115005	0.193192	90.69180	0.000000	0.000000	0.000000
2	0.182713	24.47812	9.990683	62.85865	0.228233	0.096247	2.348071
3	0.211265	31.82549	14.19576	48.94064	2.999603	0.237172	1.801345
4	0.228337	27.48196	20.15799	44.54758	3.620489	2.644612	1.547371
5	0.245190	25.41224	26.31219	38.82269	3.674238	3.346391	2.432254
6	0.259707	24.84386	29.71555	34.60391	3.840167	3.015362	3.981153
7	0.270739	24.59105	31.65099	31.87416	3.558622	2.800521	5.524655
8	0.279330	23.72603	33.16374	29.95785	3.418173	2.767165	6.967043
9	0.286522	22.72301	34.70085	28.51911	3.368378	2.827868	7.860785
10	0.294410	21.83094	36.42481	27.15408	3.341427	2.832609	8.416137

Variance Decomposition of LINTR:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.187067	8.310314	9.944620	3.763429	77.98164	0.000000	0.000000
2	0.207228	6.773399	12.49196	14.06315	63.67250	1.796917	1.202068
3	0.221020	12.78912	14.97511	12.64429	56.44243	1.978233	1.170818
4	0.250470	25.93548	14.79945	9.911968	45.36858	1.619613	2.364912
5	0.265280	26.39474	13.76425	12.62782	40.59286	2.783530	3.836803
6	0.267871	26.21963	13.52272	12.95406	40.01607	3.441931	3.845587
7	0.269639	25.92052	13.36855	12.81273	40.52969	3.540077	3.828427
8	0.270586	25.79147	13.27589	12.79606	40.61382	3.707252	3.815507
9	0.270902	25.73171	13.28058	12.77025	40.59341	3.811412	3.812643
10	0.271484	25.80403	13.34388	12.71618	40.49188	3.845264	3.798771

Variance

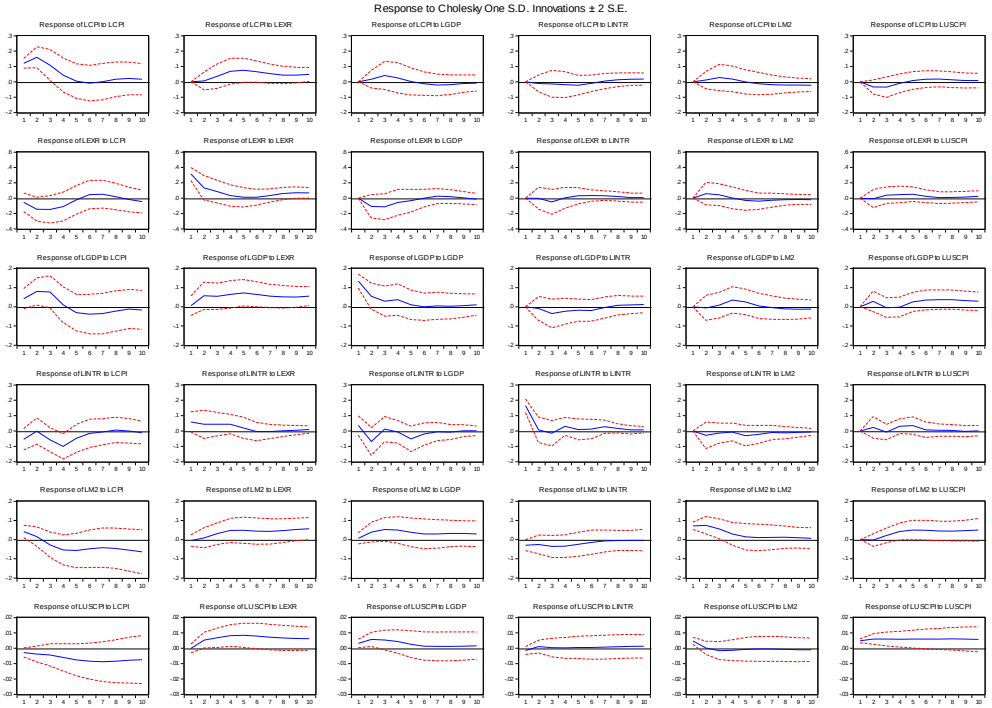
Decomposition of LM2:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.088887	22.69650	0.269166	0.620606	11.01648	65.39725	0.000000
2	0.126442	12.70616	0.594085	9.946148	9.571706	67.14508	0.036822
3	0.159192	10.91909	4.152231	17.42536	11.06270	54.60409	1.836519
4	0.191832	15.36660	8.999392	18.74838	10.86131	39.99091	6.033395
5	0.217157	18.87257	12.01191	17.66065	9.762218	31.65127	10.04138
6	0.234469	20.36622	13.82505	16.75428	8.748626	27.35475	12.95107
7	0.248300	21.05057	15.26362	16.35361	7.886581	24.62184	14.82379
8	0.262719	21.80684	16.76840	16.07571	7.072771	22.21357	16.06272
9	0.279429	23.10721	18.35726	15.52714	6.273963	19.76415	16.97028
10	0.298007	24.93146	19.76122	14.62717	5.531218	17.42265	17.72628

Variance Decomposition of LUSCPI:

Period	S.E.	LCPI	LEXR	LGDP	LINTR	LM2	LUSCPI
1	0.008142	11.50069	0.030481	14.77699	3.203173	34.77099	35.71768
2	0.013352	12.31669	15.74897	23.92599	1.838154	12.94840	33.22179
3	0.017630	13.25770	24.04504	22.89230	1.106862	8.188614	30.50949
4	0.021683	16.41173	30.38279	19.18299	0.741070	5.780965	27.50045
5	0.025341	21.02604	33.31099	15.12974	0.585844	4.314081	25.63330
6	0.028531	25.27872	33.95545	12.17723	0.487760	3.428771	24.67208
7	0.031327	28.73987	33.51176	10.24993	0.452996	2.864740	24.18071
8	0.033751	31.07833	32.84937	8.968847	0.485237	2.508127	24.11009
9	0.035804	32.44162	32.36770	8.122950	0.544558	2.297777	24.22539
10	0.037606	33.29357	32.08149	7.555662	0.612775	2.156386	24.30011

Cholesky Ordering: LCPI LEXR LGDP LINTR LM2 LUSCPI


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of LCPI to LCPI
Response of LCPI to LEXR
Response of LCPI to LGDP
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RISK MANAGEMENT DURING TIME OF FINANCIAL TURBULENCE: THE CASE OF SAUDI ARABIA AND OMAN

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Abstract:

Risk and economic activities cannot be separated. Risk can be viewed from various levels such as investors, firms and country level also it has various types such as market, operational, and credit risk. In general risk is associated with the uncertainty about various events. The global financial crises created various doubts about the effectiveness of traditional risk management approaches. It seems that the relevance of risk management was lost. The global financial system failed to prevent the global crises and to minimize its impact. It becomes more apparent that risk sharing can be more fruitful than risk taking. Every country is trying to deal with financial shocks. The 2014-2015 crude oil prices have raised the risk of gulf countries heavily dependable on crude oil export revenues for development and financing expenditures. Saudi Arabia and Oman economies are greatly dependent on their oil and gas sector returns. In fact, reliance entirely on one industry to build economic development would be a serious risk, in case of falling prices or production capacity due to various reasons. The two countries deal with financial turbulence differently. What they did and are doing is the concern of this paper.

Keywords: Risk management, Saudi Arabia, Oman, Global financial crises

Introduction

The purpose of this paper is to highlights the efforts of two countries- Saudi Arabia and Oman- in managing financial risk during time of

turbulence and financial shocks. Firstly, it explains a general shock which is global Financial Crises and how Saudi Arabia tried to mitigate it and control its impact. The Saudi Arabia Monetary Agency (SAMA) tried through various policies to manage risk and through its high reserves it was very successful. Secondly, a particular financial shock to Arab oil exporters and how Oman is trying to manage risk of decreasing oil prices. In contrast to Saudi Arabia, Oman tried to develop SMEs in order to diversify business sectors and tries to encourage an alternative economy less dependable on crude oil revenues for governmental financials. Due to various reasons, efforts in Oman up till the beginnings of 2015 were not successful- as in the case of Saudi Arabia during Global Financial Crises- in managing risk of decreasing crude oil prices.

The 2014-2015 crude oil prices decline has raised the risk of gulf countries heavily dependable on crude oil export revenues for development and financing expenditures. Systemic risk is the risk of collapse of an entire financial system or entire market, as opposed to risk associated with any one individual entity, group or component of a system, which can be contained without harming the whole system. It has many causes but it represent a shock that produces negative effects for most or all of the domestic economy or system. It could have effect on the entire banking, financial, or economic system, rather than just one or a few institutions. Kaufman (2000, p.14) states:

> For countries, this may occur through direct trade linkages so that if country A experiences problems or a depreciation in its exchange rate that reduce its imports from country B, it causes B's aggregate income to decline, reducing its imports from country C, and so on down the chain. What makes direct causation (chain reaction) systemic risk in financial sectors particularly frightening to many is both the lightning speed with which it is believed to occur and the perception that it can infect innocent as well as guilty parties, so that there is little or no protection against its damaging effects.

A prominent issue in the area of finance is how to measure and manage risk. Expected rate of return rate is not a one solid indivisible brick, in fact it is constructed form several factors that combined forms the interest rate as we know it today. A representative equation for any investor, depositor or even saver when making a decision concerning his money is the Capital Asset Pricing Model. The CAPM can be expressed by the following formula:

$$\boldsymbol{K_e = K_{rf} + (K_m - K_{rf})\beta}$$

$\boldsymbol{K_e}$= expected rate of return on investment

$\boldsymbol{K_{rf}}$= rate of return on risk free
$\boldsymbol{K_m}$= market rate of return
$\boldsymbol{\beta}$= risk factor of specific investment

In this equation we can clearly see that interest (or rate of return) required on any financial product or transaction is actually composed of three main parts: first, the risk-free part - a macro level decided by a government's central bank and over which individuals have no control; second, the market rate of return - a micro level determined by general market expectations of the rate and it is simply a build up over the risk-free for venture capitalists to risk their money in the market; third, the riskiness factor which justifies the high return of one product compared to the other based on the rule that the higher the risk, the higher the return (Mishkin, 2012 and Ingham, 2008). The equation of CAPM can be modified to include country risk as follows according to Numoski, (2012):

$$\mathbf{E(R) = Rf + \beta\ (ERPm) + CRP}$$

E(R)= required or expected rate of return for investing in an emerging market

Rf= is the risk-free rate in a developed market (e.g. the USA)

β= is a firm's beta, or the beta of an equivalent project in a developed country (e.g. the USA)

ERPm= is the equity risk premium in a mature market (e.g. the USA) as the difference between the rate of return on the developed market (e.g. S&P500) and the risk-free rate in a developed market (e.g. the USA), i.e. *ERPm = E(Rm)* – Rf=

CRP= is the country risk premium of an emerging country.
The rate of return in emerging markets is higher than developed markets due to higher risk. Numoski (2012, p.414-18) states:

> The required rate of return is more difficult to assess in the case of emerging markets. Most academics agree that, in the required rate of return, the country risk must be rewarded with a country risk premium (CRP) over an equivalent investment in a developed country …. To multinational companies faced with a range of risks derived from factors closely related to a particular foreign country, broadly classified as financial, economic and political risk factors, it may seem unreasonable to invest abroad. In order to facilitate international trade and to promote their exports, many

> countries have established a state-backed specialized institution usually named a credit export agency. Their primary task is to provide country risk insurance to companies and the second is to assist their exporters through financial support and funding. Here, among the most famous we will mention ECGD (UK), Coface (France), Hermes (Germany), Sace (Italy), EDC (Canada), or Exim Bank (USA).AUMOS NAUMOSKIKI

Therefore the governmental intervention through encouragement of risk sharing according to Islamic finance principles will lead to the mitigation of the overall country risk through diversification of investments in physical assets. As according to Islamic finance guide lines that have been extensively studied by financial and economic scholars worldwide who have concluded that the general principles can be summarized as follows (Gait and Worthington, 2007):
(i) Prohibition of usury or excessive interest - riba;
(ii) Full disclosure of information in any contract or exchange and removal of any asymmetrical information in a contract - gharar;
(iii) Prohibition of financing and/or dealing in sinful/socially-irresponsible activities and commodities regarded as non-permitted (haram) under Islamic, such as gambling and the production of alcohol for consumption;
(iv) Business risk-sharing between capital provider (financier) and capital user (entrepreneur) in profits and losses;
(v) Materiality - a financial transaction needs to have a 'material finality', that is a direct or indirect link to a real economic transaction;
(vi) Prohibition of exploitation of any party to the transaction and promotion of justice and fair trade.

To this list, Rowey et al. (2006) added that capital should have a positive social and ethical impact and investors should not just consider profit. The point of prohibition of taking interest in itself enforces risk-sharing in project financing. Therefore, Islamic financiers can derive their profit either from fees or fixed charges and in partnerships share both profit and loss. Rowey et al. (2006) defined gharar more widely than selling items which you do not own, i.e. not only the full disclosure of contractual terms and conditions or full description of goods but also included maysir(gambling or speculation) which is also prohibited by Islamic jurisprudence.
Governments intervene directly or indirectly through for example the development of SMEs to develop an alternative economy less dependable on crude oil revenues. Accordingly we can use the principle of risk sharing, capital having social impacts and materiality of transaction (physical assets)

to risk mitigation through government's programmers and policies and the nurture and encouragement of SMEs to develop a diverse healthy economy to control and manage risk. The paper proceeds as follows: section two highlights in general difference between Islamic finance and traditional finance, section three and four contrasted the role played by Saudi Arabia and Oman in managing country risk during time of turbulence. Section five is a conclusion to the paper.

Islamic finance versus traditional finance in managing risk.

The last decade of the 20th century and the few years towards the beginnings of the 21st century showed explosion in the financial shocks this magnified due to financial integration. Fundamental economic forces have led to increase competition in financial markets. Greater competition in turn has diminished the cost advantage banks have had in acquiring funds and has undercut their position in loan markets. As a result, traditional banking has lost profitability, and banks have begun to diversify into new activities that bring higher returns. The ability to securitize assets has made nonbank financial institutions even more formidable competitors for banks. Advances in information and data processing technology have enabled nonbank competitors to originate loans, transform these into marketable securities, and sell them to obtain more funding with which to make more loans. Computer technology has eroded the competitive advantage of banks by lowering transactions costs and enabling nonbank financial institutions to evaluate credit risk efficiently through the use of statistical methods. When credit risk can be evaluated using statistical techniques, as in the case of consumer and mortgage lending, banks no longer have an advantage in making loans (Zerban et al., 2012).

Khan and Ahmed (2001) differentiate between different types of risks exposed by financial institutions and pointed to their need to define business strategy in order to be able to control it. It is important to efficiently diversify unsystematic risk and reducing and transferring systematic risk. An effort is being made in the United States to develop a market for securitized small business loans as well. Before 1980, two U.S. banks, Citicorp and Bank America Corporation, were the largest banks in the world. In the 1990s, neither of these banks ranks among the top twenty. The problem is not limited to United States only but it is a worldwide epidemic as stated by (Edward and Mishkin, 1995, p.35)

> French and British banks suffered from the worldwide collapse of real estate prices and from major failures of risky real estate projects funded by banks. Olympia and York’s collapse is a prominent example. The loan-loss provisions of British and French banks, like those of U.S.

> banks, have risen in the l990s. One result has been the massive bailout of Credit Lyonnais by the French government in March 1995. Even in countries with healthy banking systems, such as Switzerland and Germany, some banks have run into trouble. Regional banks in Switzerland failed, and Germany's BfG Bank suffered huge losses (DM 1.1 billion) in l992 and needed a capital infusion from its parent company, Credit Lyonnais. Thus, fundamental forces not limited to the United States have caused a decline in the profitability of traditional banking throughout the world and have created an incentive for banks to expand into new activities and take additional risks.

Much of the controversy surrounding banks efforts to diversify into off-balance-sheet activities has centered on the increasing role of banks in derivatives markets. Large banks, in particular, have moved aggressively to become worldwide dealers in off-exchange or OTC derivatives, such as swaps. Their motivation, clearly, has been to replace some of their lost banking revenue with the attractive returns that can be earned in derivatives markets. Banks have increased their participation in derivatives markets dramatically in the last few years. In l994, U.S. banks held derivatives contracts totaling more than $16 trillion in notional value. Of these contracts, 63 percent were interest rate derivatives, 35 percent were foreign exchange derivatives, and the remainder was equity and commodity derivatives.

Islamic finance is any finance that operates with the principle of Islamic law (Sharia). It is one of the fastest growing segments of today's banking industry. Ahmed (2010, p.1) argued that the world financial system suffered for too long under conventional (Riba) based banking system. The world in searching for an alternative is "hungry to hear the message loud and clear". Islamic finance is an asset based system. Money in itself has no intrinsic value. The prohibition of paying and receiving fixed, predetermined rate of interest is crucial in Islamic finance. The sale of debt and speculation are not allowed. In the conventional financial system risk is transferred and sold while in Islamic finance it is shared like collective insurance scheme. Ethics and social responsibility are pillars to Islamic finance (Alexakis and Tsikouras, 2009).

Alchaar (2010) pointed that we are facing today a dilemma of compounded greed of individuals, institutions and nation states. Many individuals were trying to buy better houses than they can stand for, institutions who are gambling on the benefit of each other through the creation of credit default swaps and nation states with the laxity of regulation. He states (p.1)

> These macroeconomic imbalances prevailed in the last decade or so resulted in a downward impairment of the term structure of interest rates. This in turn stimulated demand for credit based instruments that achieved the desired yield uplift. It was called "financial innovations". We all believed in the fallacy that these sophisticated tools and instruments would create value. Apparently, the value they created was mostly illusory … It was a textbook-style manifestation of regulatory sabotage.

The operations of Islamic finance are based on profit-loss sharing principle and risk division in losses and profits between lender and borrower (Mouawad, 2009). World Bank report (2014), argued that country financial system can protect citizens from negative shocks and allowing them to benefit from opportunities. Saving instruments such as bank deposits and credit instruments such as education and mortgages loans can help people to absorb shocks and benefit from opportunities. Banks should match the duration between assets and short term liabilities to make financial system more stable. If the financial system fails to manage risk, it will create loss and damage to people. By making more domestic savings available, hence reducing the effect of foreign capital, more stability and less risk can be achieved. Effective global coordination is necessary for mitigating financial risk. Crises can have impact on long term growth as governments are forced to cut expenditures. The report pointed (p.30):

> To better manage the potential for systemic financial crises, countries should establish strong macro-prudential regulatory frameworks—frameworks that consider the interconnectedness of financial institutions and markets and that address the financial system as a whole. Making macro-prudential regulators independent, possibly by placing them under the central bank, is the first step in this direction—as in the Czech Republic, which in 2006 gave the central bank explicit responsibility for fostering financial stability. Governments can then pursue proactive macro prudential supervision and intervene with timely and robust policy tools, as the Republic of Korea did in 2011 in the wake of the international financial crisis by imposing a levy on bank noncore financial liabilities to manage speculative capital flows.

Hersh (2011), pointed to the impact of global financial crises and its deep problem in showing the weakness of global financial system. Global systematic failure created a need for more regulation and unless this is implemented, the world will be more vulnerable to financial crises. Islamic

finance could be one of the alternatives which can be used to manage risk. She states (p.61):

> Islamic finance will not provide a "new way forward," but provides a relevant example of the emergence of a different regulatory system in response to risk created by culturally specific practices …. Risk can never be eliminated, but it can be managed, and policymakers must seek to augment the global financial architecture with a new regulatory framework with a wider scope for institutional differentiation.

The following two sections is going to explain the efforts of Saudi Arabia and Oman in managing two crises and the role played by them. The aim is not to suggest which standards should be implemented in managing risk but to explain real practices that implemented in order to manage financial risk and where capital might have social impact.

Saudi Arabia risk management during Global Financial Crises:

Risk and economic activities cannot be separated. Risk can be viewed from various levels such as investors, firms and country level also it has various types such as market, operational, and credit risk. In general risk is associated with the uncertainty about various events. To manage risk is to handle it to minimize its impact. Magnusson et al., (2010, p.1) used Basel II (2004) to define operational risk as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events". The global financial crises created various doubts about the effectiveness of traditional risk management approaches. It seems that the relevance of risk management was lost. The global financial system failed to prevent the crises and to minimize its impact. When financial crises hit the world, resulting from mortgages all financial institutions as they are mostly, depending on the same financial structure, where in the middle of the avalanche. The risk management strategies and implementation "prove ineffective (or introduce other risks) because they are not coordinated among all relevant policy stakeholders" (World Bank, 2014, p.37). It seems that uniformity in dealing with problems and managing of risk created more deep pain instead of healing it. Most fund managers believe their system and risk management practices were strong and their sand house is too big to fall. The collateralized debt obligations were thought to be safe based on their credit rating. This view failed to account for the fact that the ratings were based on assumptions about default risk, house prices, and cross-correlations among the risks of the underlying assets. The believe, before the crises, is that when storm is coming government interventions will be the financial shield to

protect corporations and financial institutions. According to World Economic Forum report (2010, p.14)

> Prior to the financial crisis, many financial institutions were running similar business and risk management strategies at the product-line level. As evidenced by players' relative performance through the crises, only a few institutions were pursuing a more diversified approach. Indeed, many institutions were simultaneously building large positions in structured credit products derived from the same underlying asset classes, utilizing short-term money-market funding, and making risk management decisions with similar assumptions and techniques. Capital requirements were calculated under similar methodologies, with similar underlying models. Reliance on external credit ratings was pervasive. When the U.S. sub-prime housing bubble burst, financial institutions with the same vulnerabilities all went for the same exit door.

SAMA (2009) forty fifth annual report pointed to many reasons behind the crises including; lack of enough supervision of financial institutions, ease of regulations in financial markets, encouraging securitization and many complicated financial products while underestimating risk inherited in subprime mortgages, decreasing interest rates in U.S. before the crises which created more liquidity that caused real estate to be overvalued and the deficit in the balance of trade. The worldwide recession caused oil and petrochemicals prices to fall and exports of Saudi Arabia to be effected. The global financial crises created liquidity problem worldwide. The global financial system required injection of large amount of cash. Liquidity risks emanate from various financial institutions running out of cash. Banks that finance mortgage-backed securities using repos faced turbulence where "the collapse of the repo market was a calamity" Strahan (2012, p.2). Central banks tried to control the severity of the crises. Puntam (2004, p.31) states:

> Liquidity management involves the ability to access capital for emergency purposes in large quantities during difficult and potentially turbulent market conditions … Central banks need their foreign reserves to be liquid exactly when national markets may be facing broad-based liquidity problems. Whether the cause of the lack of liquidity in national financial markets stems from international pressures on the currency, domestic loan losses in banking portfolios, or from some unexpected national disaster, the central bank must be able to serve as the lender of last resort, thereby supporting the security and stability of the nation's financial system.

A Senior Supervisors Group report (2008) assessed which risk management practices was effective and which did not, at a sample of eleven global banking organizations and securities firms that are significant competitors during the recent period of financial crises. Some firms were better than others. Those who share quantitative and qualitative information as well as creating a comprehensive understanding among managers team perform better than others. While some institutions were exposed to risk that is above their capacity to tolerate. It was a big failure in controlling and managing risk. They state (p.2)

> Another risk management challenge concerned firms' understanding and control over their potential balance sheet growth and liquidity needs. For example, some firms failed to price properly the risk that exposures to certain off-balance-sheet vehicles might need to be funded on the balance sheet precisely when it became difficult or expensive to raise such funds externally. Likewise, some firms found that they could not syndicate their holdings of leveraged loans because of reduced investor appetite for those assets and that they could not cancel their commitments to fund those loans.

The Global Financial Crises of 2007-08 and the European Sovereign Debt Crises created worries about global economic downturn and the need to manage liquidity. The financial markets and capital flows experienced high volatility worldwide as a result of globalization of capital markets. Asset prices and capital flows to emerging market economies effected more strongly than those in advanced economies. As a result of the crises, investors began to focus on safer asset classes and capital flow from riskier countries to advanced economies. Liquidity shocks across countries were effected by exposure to the US and the strength of country fundamentals. Those economies with a poor sovereign rating and worse economic and political institutions were more affected by risk and liquidity shocks in both crises (Chudik and Fratzscher, 2012). Naumoski (2012) argued that investment in emerging economics is difficult due to country risk. Return on investment should be higher in emerging economics compared to developed countries. The period of the Global Financial Crises especially before and at the beginnings were characterized by lack of transparency and the fear of financial institutions to collapse. According to World Economic Forum report (2010, p.27)

> Securitization was originally intended to spread risk across the financial system to institutions that were willing and better able to hold the risks. However, when the usage of some structured products "mutated" from their original intent

> (e.g., from risk management to yield enhancement), complexity grew - blurring the boundaries between risk origination and risk ownership and complicating accountability for risk management. Few could understand where the risks truly resided in the system. Packaging complex products as off-balance-sheet, special-purpose vehicles exacerbated the problem, hiding ultimate liabilities from the market. Investors and regulators could no longer discern institutional risk exposure. Moreover, different accounting standards, regional exemptions for capital treatment (e.g., domestic lending portfolios), and a large, less-regulated "shadow banking" sector made it nearly impossible to get a consistent, system-wide view of overall risk.

Chauvin (2010) pointed that Saudi Arabia is the only Middle East Country, the only Arab country among the constituents of the G20. Saudi Arabia is the largest economy of the Gulf Cooperation Council (GCC) including Bahrain, Kuwait, Oman, Qatar, and United Arab Emirates. The Kingdom of Saudi Arabia contributes with 49% of the total GDP and 67% of the total population of GCC. Despite the recent financial crisis, the GCC has very important economic developments in the recent years. The increase in oil prices allows GCC countries although not in the same degree to have surplus for building very strong economic positions. Saudi Arabia increased spending in infrastructure, education and health in order to stimulate economic development. According to an IMF study the Saudi fiscal stimulus, valued in $400 billon for five years, was the largest in terms of GDP among the members of the G20. The meetings of the G20 accused financial regulators for the global financial crises and focused on increasing borrowing by banks, the unstructured increase of hedge funds and a hunting culture for short-term profits as catalyst of global crises. He states (p.56):

> The G20 formalized in Pittsburgh a number of commitments for future regulation of the financial industry, including: increased capital standards; implementing international compensation standards; increasing regulation of the over-the-counter derivatives market; and creating more powerful tools to account for financial risks.

Al-Hamidy (2010) the Vice Governor of Saudi Arabia Monetary Agency (SAMA) pointed that Saudi Arabia did not have to take any measures to support the foreign currency refinancing of banks or corporations. The reason is that Saudi Arabia is a net capital exporter and Saudi banks' asset/liability management is relatively conservative. The SAMA only conducted foreign exchange swaps with domestic banks to

provide dollar liquidity in order to meet the financial system's demand for foreign exchange. There is an ongoing debate regarding the maximum appropriate amount of foreign exchange reserves. Asian central banks built up their foreign reserves as an insurance policy following the Asian financial crisis in the late 1990s. In fact, this approach helped Asian economies to confront the recent dollar liquidity squeeze. In Saudi Arabia, the foreign reserve position is a reflection of oil market developments and the pattern of government spending. The rate of return on average equity for 2008 was 20%. The high returns in a period of financial crises are a very strong sign of the stability of Saudi banking sector. The financial crisis did not have any impact on the local currency debt market due to the policy followed by the government prior to the crisis to payback its outstanding debt. The corporate bond market was still at infancy stage and was therefore not affected in any way. He states (p.1):

> It is important to note that, due to the structure of its economy, its sound economic conditions, prudent and conservative supervisory framework, countercyclical fiscal and banking system policies, and other macroeconomic reasons, Saudi Arabia was not materially affected by the global financial crisis. In fact, while many economies around the globe, especially developed countries, were severely and negatively affected by the crisis in 2008 and 2009, the Saudi economy continued to show resilience and strong economic growth. Consequently, the Saudi Arabian experience of international banking and domestic financial intermediation during this tumultuous period was relatively positive. Although Saudi banks were moderately affected by the deteriorating conditions in the global financial markets, the Saudi domestic financial market continued to function effectively and efficiently without any hiccups.

Ghassan et al., (2013) argued for the mistake of ignoring the interconnectivity in the international financial system which increased the disturbance in financial markets. Saudi Arabia by connecting to U.S. dollar is subject to risk and loss in financial assets. Also most government revenues depend on oil exports which created another risk burden. They use Structural Vector Autoregressive model (SVAR) to assess the impacts of international financial crisis on real economic growth although the impact of financial crises on Saudi Arabia is limited. They state (p.404):

> Considering the asymmetric SVAR, the accumulated response of GDP to a structural one standard deviation shock indicates that the effect of international liquidity shocks on GDP is enough gradual, taking number of years to arrive at its full level. The full effect of positive shock is about

> 1.01%increase in the real economic growth leading to a positive dynamic pass-through elasticity of 0.032,where as the negative shock droves to reduce the economic growth by 1.04% driving to a negative dynamic pass-through elasticity of 0.070.

Williams (2004) highlighted the need of cash management for governments which was not emphasized like credit management. Cash management can be seen as strategy by which governments manage short term cash flows and cash balances. Governments must be able to meet its obligations and finance its expenditure. The success by government to reduce operating, credit and market risk is an objective of efficient cash management. Khamis et al., (2010) pointed to the differences between Gulf countries in their effect and response to the global financial crises. After Lehman's, the financial sector in United Arab Emirates (U.A.E.), Kuwait, and Bahrain were effected more than Saudi Arabia. The increase in government spending in Saudi Arabia was a defense against the crises. Thanks to increase of reserves resulted from increasing oil prices before the financial crises. They state (p.16):

> Banks' capital adequacy ratios remain strong and there are positive indications on profitability. The GCC financial systems entered the global crisis from a position of strength, with high capital adequacy and modest NPLs. Despite the general increase in NPLs in 2009, banks' capital adequacy remains high, supported by injections of public funds in Qatar and the U.A.E., and private capital in Kuwait and Saudi Arabia.

The financial sector management in Saudi Arabia was very successful during the financial crises. Interest rates were cut by a cumulative 350 bps to 2 percent between October 2008 and January 2009 also reserve requirements on demand deposits were cut by a cumulative 600 bps in October and November 2008. The government ensures that deposits in local banks are guaranteed. Also, depositing huge amount of cash in banks on behalf of government organizations. Government credit institutions are provided with SAR 40 billion during 2009. The resources of the Real Estate Development Fund have been enhanced by an amount of SAR 25 billion to be equally distributed over five fiscal years as from fiscal year 2008 to meet the demand for housing loans. The Saudi Credit and Saving Bank has allocated an amount of SAR 10 billion to give loans to low income citizens, including social loans, professional loans and auto loans. The Public Investment Fund has increased the ceiling of lending from 30percent to 40 percent of the cost of investment projects, and maturities from 15 to 20 years

to facilitate the process of financing projects (SAMA, 2009).According to International Monetary Fund (2012, p.5) report:

> In particular, the Saudi Arabian Monetary Agency (SAMA) introduced Basel II, and used Pillar 2 requirements to foster improvements in banks' risk management and capital planning. In supervision, risk-based approaches (RBAs) have been introduced. SAMA has also been active in introducing the new Basel III requirements. The Capital Market Authority (CMA) has developed a strong regulatory program in a short period of time that fully implements most international standards.

The World Economic Forum report (2010, p.31) pointed to the increase complexity in the real world that require more comprehensive and overall view of the system with the interdependence between its subsystems. The models of risk management that "utilize idealized linear, stable equilibrium dynamics" cannot fit financial crises that consists of "a complex web of interacting parts that are fundamentally nonlinear – i.e., non-equilibrium, unstable, and non-stationary – in their dynamic behavior". Regulators need to critically examine and analyze the comprehensive effects of any financial product on society, identifying potential risk and the interactions between products on the markets.

Oman risk management during oil prices shock:

Oman economy is greatly dependent on its oil and gas sector returns. In fact, reliance entirely on one industry to build economic development would be as a serious setback, in case of falling price or production. Devaux (2013) stated that since 1990, hydrocarbons exports marks a notable drop as it has dropped from 90% reached to 65%of the total exports,. In return, Omani private industry has contributed about 70% of non-oil GDP. Notwithstanding that, the revenues of Oil have decreased for the past two decades; the Omani economy is still built on this industry. CBO (2014) indicated in the 2013 annual report that oil and gas industry accounts for around 75% of government revenues. Consequently, private sector in Oman is unable to support economic and feed development. Recently, after the oil price falling down, Oman government has two choices no more that are reduction in expenditures or cut subsidies.

In spite of the global economic growth anticipation for 2014 has been marked down by 0.3% to 3.4%, the World Economic Outlook predicted that the growth will increases up to 5.2% in 2015 from its reduction at 4.6% in 2014in the emerging and developing economies (International Monetary Fund (IMF), 2014) see Table 1.This is likely because of the improvements in accelerated fiscal and support activity, tax relief and more spending in

infrastructure. In response to the robust growth in services sector activities in Oman, the GDP at market prices has rose to 4.6% in the first quarter of 2014, and is expected to grow in 2015.This reflects that whenever economic activities improve, the capability of Oman economy could offer a better standard of living to the community.

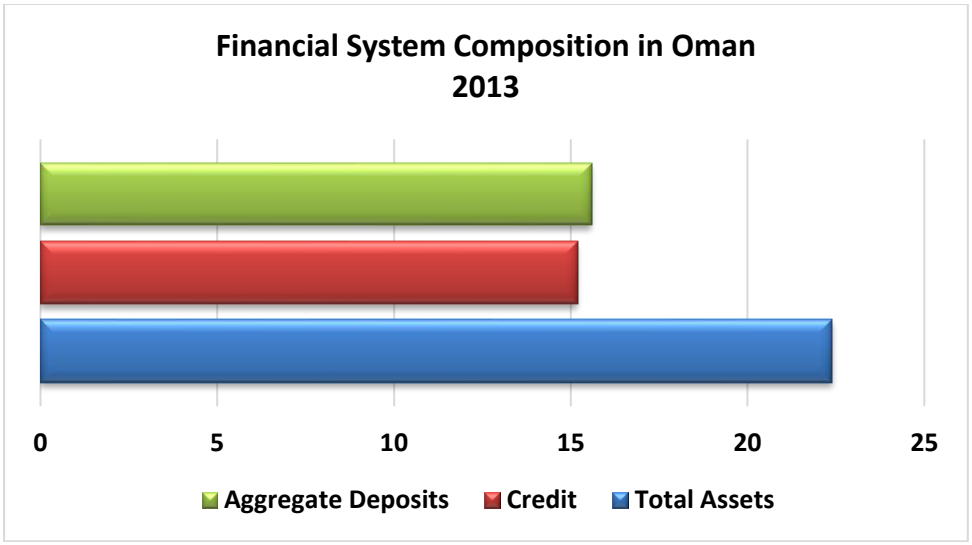
Table 1: Economic growth predictions

Economies	2014	2015	Growth by
World	3.4%	4.0%	0.6%
Advanced	1.8%	2.4%	0.6%
Emerging	4.6%	5.2%	0.6%
Middle East	3.1%	4.8%	1.7%
Oman	4.4%	5%	0.6%

Source: IMF, (2014)

The role of financial industry cannot be ignored in thriving economy, as it is a means and the source of funding to various activities and sectors. The Sultanate's has 20 banks constitute the banking sector, which include two local Islamic banks, seven commercial banks, two specialised banks, and nine foreign banks. Moreover, it has six local commercial banks providing windows that operate Islamic banking services (CBO, 2014).This actually diversify the productivity of these banks with a competition atmosphere and revival the financial sector in Oman. The annual report shows an increase of the aggregate deposits by commercial banks reaching to OMR 15.6 billion in 2013 compared to OMR 14.2 billion for 2012 (CBO, 2014). According to the Moody's Investors Service, the outlook of Oman's financial industry is stable, and in 2014 is expected to grow about10%-12% in constant conditions of macroeconomic (Moody's Investors Service, 2014). Therefore, their strong performance remains stable due to their total assets growth (see Figure 1).

Figure 1: Strength of assets, aggregate deposits, and credit of commercial banks in Oman



Source: The Annual Report 2013 (CBO, 2014).

Unemployment rate is a critical indicator in the economy that could heading into recession whenever raised and then workers will cost industries more. According to the Ministry of Civil Service (MoCS), in 2013 about 89.3% of the total labour force in Omani private sector (1,709,101) are expatriates employees about 1,527,241, where Omanis employees constitute 10.7% only around 181,860 (CBO, 2014).This fact has led to re-examine the functional status in Oman, particularly in the private industry.

Table 2: Employment in Oman by public and private sectors (end of 2013)

	2009	2010	2011	2012	2013
Private Sector Employees1	1,032,560	1,133,346	1,289,031	1,488,248	1,709,101
Omanis	158,315	177,716	174,441	172,066	181,860
Expatriates	874,245	955,630	1,114,590	1,316,182	1,527,241
Public Sector Employees2	126,134	128,415	144,605	151,683	166,707
Omanis	111,845	114,206	129,107	134,417	145,736
Expatriates	14,289	14,209	15,498	17,266	20,971

1. **The Annual Report 2013 (CBO, 2014) – Private Sector Employees.**
2. **The Annual Statistics of Civil Service Employees 2013 (Ministry of Commerce and Industary , 2014)– Public Sector Employees.**

Obviously, that expatriates dominate the labour force in the private sector as it is outlined in Table 2. In Addition, it clarifies that 10.7% of the labour force were not SMEs owners, which implies that their contributing into GDP were not significantly as should. Let alone that the number of Omanis employees in the private industry has increased by 5%, while expatriate employees increased by about 14% in 2013. As a result, the

government believes that creating jobs would be through expanding investment and enhancing and financing SMEs.

Through creating opportunities outside the public sector, SMEs play a developmental role in developing an economy. Where the most successful SMEs would become large private enterprises and thereby its prosperity can benefit the whole of society as well as redound positively on the GDP and employment rate in the country. According to the Public Authority for SME Development (PASMED) (2014), about 132,735 SMEs distributed in Omani governorates involving a variety of trading activities and that represent more than 90% of all corporate; these materialising a vital social position for the private sector. Based on Oxford Business Group Report in 2013, SMEs in Oman constitute about 16% of GDP, which is no small feat compared to others such as firms in OECD and Europe that achieved 51% and 58%, respectively.

The acting CEO of PASMED in Oman, Khalifa Al Abri, has confessed that although SMEs are the significant component in the private industry; however, the active SMEs in Oman did not reach half the number that raised in the private sector and are even less those being operated and managed by Omanis .This means that Oman's SMEs currently are not performing their function properly. This showed in Table 3 below as the ranking of contributions to GDP, Oman's SMEs at the tail end of the rankings associated with Qatar compared to other GCC's SME. Therefore, Khalifa has mentioned that over the next five years SMEs have to increase their GDP contribution to about 20%. Through providing support in marketing, developing business plans, training, design, and products packaging; this aim could be achieved (Muscat Daily, 2013). It is expected that this would create more jobs, and increase productivity and innovation rather than just selling and buying of imported goods and services.

Table 3: in 2013, Oman has low percentage of GDP and employment contributed by SMEs in GCC

Countries	Contributions to GDP	Contributions to Employment
Kuwait	N/A	45%
United Emirates	35%	86%
Saudi Arabia	33%	40%
Bahrain	28%	73%
Oman	16%	20%
Qatar	10%	15%

Sources: CBO: Annual Report 2013; Devaux 2013; and GICWED 2013.

Accordingly, enhancing and developing SMEs were the main priority that made by the government of Oman in order to create more job opportunities and boost innovation. This would reduce the highest official unemployment rate of Oman which reach up to 15% compared to other GCC countries in 2011 (Devaux, 2013).Consequently, government has enacted comprehensive strategies that would prosper the private sector. For example, launching a guarantee programme, in which about 50% of Oman's SMEs loans will be granted (PASMED, 2014). Furthermore, the Sanad programme that in addition to offer soft loan with 2% interest rate, it provides a mentorship and assistance with government services (Oxford Business Group Report, 2013). Adding to this, the Al Rafd Fund is founded to support entrepreneurs in their venture, as a means to stimulate the private sector to thrive. SMEs projects could also be financed through providing about OMR 5.4 million by the Oman Development Bank (ODB) .On the other hand, the Public Authority for Investment Promotion and Export Development (PAIPED) has been established in attempting to assist SMEs extensively to promote their investment abroad. Nonetheless, banking industry remains the official and main source of any investment venture to ensure its needs in cash flow and capital.

Certainly, the growth and development of the banking sector has a vital aspect in the prosperity of the economy where there a great linking between them and thus vulnerable to the effect of the movement of the banking sector. Accordingly, this sector should be regulated with special care with caution to design a competitive atmosphere and an appropriate financial system to achieve a high positive economic performance. For instance, Oman's banks have been directed by the Central Bank of Oman (CBO) to extend loans and credit facilities to SMEs through earmarking at least 5% of their total credit portfolio (CBO, 2013).This demonstrates that both the private and public institutions have made concerted efforts to reinforce the economic growth and thereby provide a secure future for people.

In fact, banking industry is lasting source to enhance the development of various economic industry through grants some financial facilities to the small investors such as an interest-free loan, like that being given by ODB as for an amount of OMR 5,000 (ODB, 2011). Bank Muscat (BM) has also launched a programme called ***"Al Wathbah"***, in which SMEs get financial and advisory services. It also provides up to OMR 400,000 for financing small firms and for the medium firms up to one million, subject to certain requirements that stipulated by the bank (BM, 2014). Recently, Oman has introduced Islamic banking services in order to expand economy due to its vital role in SMEs development. Therefore, it is timely to investigate over banking practices, specifically those enacted in diversifying economy. Particularly, those initiatives provided by the banking sector incorporate

financial operations that actively lead to SMEs development and thereby economic prosperity.

Undoubtedly, that there are obstacles of a similar nature suffered by SMEs around the globe, not to mention the existence of obstacles based on the geographical and cultural aspects of each country. Consequently, this will hinder SMEs from doing its development role to contribute in promoting job creation and GDP. Generally, SMEs, as discussed above, contribute around 60% to GDP and just over that figure to employment. However, SMEs in Oman are contributed less than the above average, with just20% to employment and 16% to GDP (CBO, 2014). Parambi (2014a) attributed this to the; lack of realism in expectations by young entrepreneurs, Lack of professionalism in business administration, Lack of appropriate funding mechanisms, excessive cost of capital and debt, and Low tolerance thresholds. PASMED (2014) also intimated that in addition to that SMEs in Oman lie in the difficulties of; infrastructure weakness, lack of appropriate marketing strategies, linkage development requirement with large industries, and complying with the national strategies and policies.

In spite of incentive support provided to SMEs by the Oman government, however the failure rate of Omani SMEs remains far from the ambition. This could mainly imputed to the efforts that often on providing financing and in some cases trainings rather than investment opportunities. Moreover, this alarming failure of SMEs in Oman attributed to; legal procedures, a perceived lack of entrepreneurial qualities, scarcity of raw materials, and large-scale projects competition (Ayoob and Somasundaram, 2012).This confirmed that funding is not the only obstacle in Oman rather a lack of management and efficiency on entrepreneurial skills as an example. Let alone, the overly bureaucratic regulations that depress the ability to fight and rival the large companies (PASMED, 2014 & Parambi, 2014b).

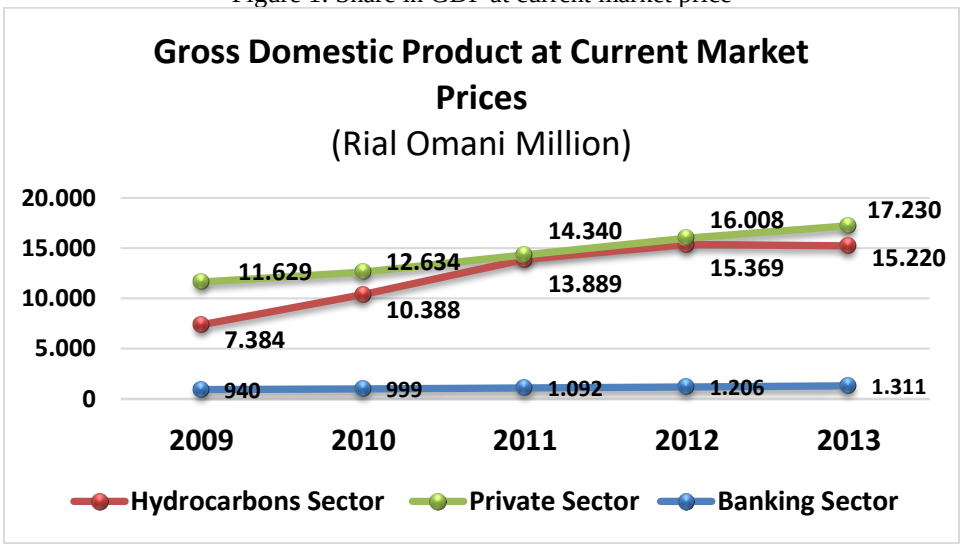
Compared to other GCC countries, Oman has smaller reserves of Oil and still relies heavily on it for its strategies development since the beginning of renaissance in 1970. Controversy and concern among citizens now in the midst of the low price of a barrel of oil, and the absence of another source as an alternative for decades ago. Partly because Oman has focused on its development to the Oil source income solely although it is more vulnerable to influencing of falling oil prices and in 2013 total reserves were estimated at 5.15 billion barrels, meaning that Oman has low rate of oil reserves and not lasting. The IMF pointed out that Oman's "break-even" oil price - the level required to balance its budget - would rise from $62 in 2008 to a projected $120 in 2018.Therefore, the priority is to rationalise the government revenues sources and find alternative sources in order to ensure sustainability and to reform the prevailing fiscal policy. As the continuous

fiscal policy expansion in the presence of certain finite nature of resources may lead to sustainability challenges at the end and for long time.

This warning Oman government over its expansionary spending since 2011, with a significant reliance on oil revenue and small portion on non-oil sector. In this regard, IMF has echoed that Oman need to contain government spending and must increase its revenues through non-oil industry in order to keep its finances sustainable due to the expectation of widening deficit as much as 6.8% of GDP by 2018. Adding that without mainly changing subsidies on fuel, Oman would facing difficulties to place its state finances on a sustainable footing and it should raises its domestic fuel prices gradually.In the absence of alternative sources to support government expenditures, Oman may not be able to encounter the challenges ahead due to fluctuations in the price of oil especially that seen in 2014 from the sharp decline on oil barrel price. According to the CBO (annual report 2013), government participation and other expenses accounting to over 2 billion in 2013 with an increase of 8% from the year 2012,of which 54.6% to support petroleum products. As a result, it can be said that although revenue and income resulting from the oil sector, but it consumes more than 50% of government expenditures for oil extraction project.

Recently, after the falling of oil price down, Oman government announced that the lower price of a barrel of oil would confronted by the ceasing of recruitment and promotions. This was expected after it has proclaimed that the short-term objective for government is to decrease 9% of the oil sector's contribution to overall GDP by 2020 and thus enhances creating more job opportunities in the private rather than public sector (CIA, 2014).This is compatible with the ultimate goal in decreasing pressure on oil revenues, as it constitutes a large burden by the state employment. In this matter, His Majesty Sultan Qaboos has called to the expansion of the significant efforts that would reinforce productivity of SMEs and entrepreneurship.

Figure 1: Share in GDP at current market price



Source: NCSI, (2014).

According to the National Centre for Statistics and Information (NCSI) (2014), in 2013 the petroleum industry activities have witnessed a fall to OMR 15,220 million, compared to OMR 15,678 million in 2012. In contrast, other sectors' activities had grown by 7.6% from OMR 16,008 million in 2012 to OMR 17,229 million by the end of 2013. This suggests that the private sector should fill the income gap created by the oil price oscillation. The International Monetary Fund (IMF) World Economic Outlook forecasts of the global economy were projected to be slightly higher in 2014 witnessing an increase of 0.6% to reach 3.6% from 3% in 2013. Specifically, emerging and developing economies are predicted to witness a gradual rise of 0.2% up to 4.9% from 4.7% in 2013 (IMF, 2014); see Table 1. This is likely due to the improvements in domestic demand, large public expenditure, and more investment spending. In Oman, the GDP growth rate was about 2.8% in 2013, which rose to 4.6% in the first quarter of 2014 (NCSI, 2014), with a position of 77 in the world (CIA, 2014). This reflects that the capacity of Omani society could offer a better standard of living with improved economic activity.

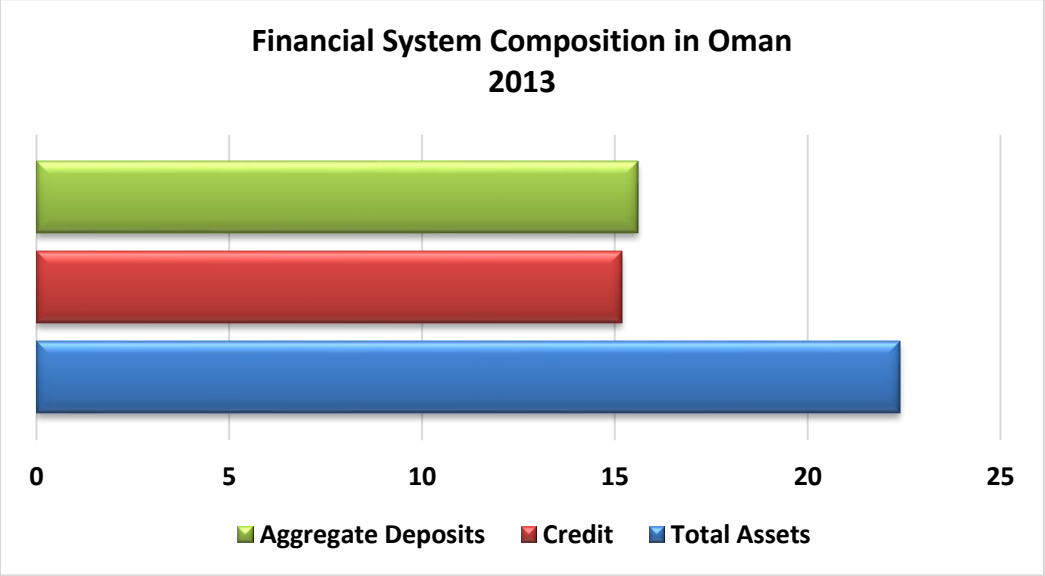
Table 4: Economic growth rate

Economies	2013	2014	Growth by
Global	**3%**	**3.6%**	**0.6%**
Emerging	**4.7%**	**4.9%**	**0.2%**
Oman	**2.8%**	**4.6%**	**1.8%**

Sources: NCSI, 2014; CBO, 2014.

The financial sector in Oman is a very important industry leading the sources of funding and financial transactions for other sectors. According to the 2013 annual report, it comprises 20 banks including seven local commercial banks, nine foreign banks, two specialised banks, and has recently added two fully-fledged Islamic banks together with six local commercial banks operating separate Islamic windows for banking operations (CBO, 2014), creating diversity of products, ability for competition and market resuscitation in Omani banking. Moody's Investors Service (2014) set forth the outlook for Oman's banking system as stable, and with the stability of macroeconomic conditions, the credit is forecast to grow around 10%-12% in nominal terms in 2014. Moreover, the 2013 annual report indicates that commercial banks registered increase in aggregate deposits amounting to OMR 15.6 billion in 2013 from OMR 14.2 billion for the year before (CBO, 2014). Therefore, their performance has continued to remain strong and favourable due to robust growth and increases of their total assets (see Figure 3).

Figure 2: Strength of assets, aggregate deposits, and credit of commercial banks in Oman



Source: The Annual Report 2013 (CBO, 2014).

An increase in the unemployment rate means that economic conditions are heading into recession and industries have to make people redundant. It is an important indicator of the health of an economy and signifies which sectors are creating or losing jobs. According to the annual statistics of civil service employees published by Oman's Ministry of Civil

Service (MOCS), the total number of public sector employees at the end of 2013 was 166,707; of which, 145,736 were Omanis, and 20,971 were expatriates, representing 87.4% and 12.6% respectively. Whereas, the total labour force of the private sector was 1,709,101 in 2013, of which 181,860 were Omanis – representing approximately 10.7% – and 1,527,241 were expatriates – representing about 89.3% (CBO, 2014). These figures have led to calls to re-examine and study the functional status in the Sultanate, especially in the private sector.

Table 5: Employment in Oman by public and private sectors (end of 2013)

	2009	2010	2011	2012	2013
Private Sector Employees[1]	**1,032,560**	**1,133,346**	**1,289,031**	**1,488,248**	**1,709,101**
Omanis	**158,315**	**177,716**	**174,441**	**172,066**	**181,860**
Expatriates	**874,245**	**955,630**	**1,114,590**	**1,316,182**	**1,527,241**
Public Sector Employees[2]	**126,134**	**128,415**	**144,605**	**151,683**	**166,707**
Omanis	**111,845**	**114,206**	**129,107**	**134,417**	**145,736**
Expatriates	**14,289**	**14,209**	**15,498**	**17,266**	**20,971**

1. **The Annual Report 2013 (CBO, 2014) – Private Sector Employees.**
2. **The Annual Statistics of Civil Service Employees 2013 (MOCS) – Public Sector Employees.**

Table 2 outlines that the private sector was dominated by expatriates. This also clarifies that 181,860 Omani employees in 2013 were not owners of the SMEs and were just employees; the implication is that they are not contributing significantly to GDP compared to other emerging economies. In 2013, expatriate employees increased by about 14%, while Omanis employees increased by 5% only. Many now believe that the government needs to show mettle in creating jobs through enhancing and financing SMEs and expanding investment. CIA (2014) proclaimed that Oman is too heavily dependent on dwindling oil resources; the short-term objective is to reduce the oil sector's contribution to overall GDP by up to 9% by 2020 and thereby creating more job opportunities for the younger Omani generations. Accordingly, the His Majesty Sultan Qaboos has made widely reported statements indicating the need for the support of other sectors to be sustainable, and has called for expanded efforts to foster SMEs and entrepreneurship, as state employment is becoming a burden in the light of decreasing oil revenues in the future.

Conclusion:

The global financial crises as a general epidemic created various doubts about the effectiveness of traditional risk management approaches. Also as most Arab countries are relying on crude oil prices to finance their budgets, they are under great risk due to decreasing oil prices. Risk management during time of turbulence must be effective to avoid, control or mitigate risk. Traditional finance and Islamic finance have different approaches in dealing with risk. By giving two examples of Islamic countries-Saudi Arabia and Oman- dealing with financial shocks, this chapter aimed to contribute to the understanding of managing risk in emerging economics in two particular Arab Countries who behave differently during time of turbulence.

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GE/McKINSEY MATRICES REVISITED: A MIXED MODE TOOL FOR MULTI-CRITERIA DECISION ANALYSIS

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Abstract

Multi-criteria decision analysis is an umbrella term describing the collection of formal approaches that take explicit account of multiple criteria in order to explore alternative decisions. Multi-criteria analysis has evolved from its operations research origins to address situations where the criteria are not so easily quantified and where the data is often fuzzy. In this context, GE/McKinsey matrices, a classic tool of the business portfolio analysis, have emerged as a mixed-mode tool to cover modern problems with fuzzy data and simultaneous use of quantitative and qualitative variables. By grouping the variables into a small number of classes, GE/McKinsey matrices provide an effective way to reduce the effect of noise in the data and to identify only major trends thus strengthening the conclusions of the corresponding decision analysis.

Keyords: Multi-criteria decision analysis; Mixed-mode analysis; GE/McKinsey matrices

Introduction

Decision-making is regarded as the cognitive process resulting in the selection of a course of action among several alternative possibilities (Lu et al. 2007). While decision-making involves the analysis of a finite set of alternatives described in terms of evaluative criteria, the final choice is based on the values and preferences of the decision makers (Harris 1998). Real-world problems typically demand multiple perspectives from different stakeholders, and thus a decision is usually understood to be the reduction of multiple individual views into a single collective preference.

Deciding on which alternative to choose amidst conflicting multiple criteria and multiple perspectives of stakeholders is a challenging task. Decision theory coupled with operational research techniques has been

traditionally used in practice to solve complex decision problems by ranking a finite number of decision options based a finite set of evaluation criteria (Lu et al. 2007).

The term multi-criteria decision analysis (MCDA) has been used to describe the analytical tools used to explore complex decision problems characterized by multiple (and possibly conflicting) objectives and criteria. The generally accepted definition of Belton and Stewart (2002) that MCDA is *«an umbrella term to describe a collection of formal approaches which seek to take explicit account of multiple criteria in helping individuals or groups explore decisions that matter»* reflects this use of the term.

Increasingly though MCDA is used as a term to signify the systematic framework employed to support the initial structuring of a decision problem in terms of selecting criteria or attributes and decision options. It is in this sense that the adjectives multi-criteria and multi-attribute analysis are used interchangeably in the literature (DCLG, 2009).

A typical MCDA approach evolves along three stages:

- structuring the decision problem;
- modeling the stakeholder preferences; and
- ranking the alternative choices.

While there are many MCDA methods available for solving a decision problem, there is no single MCDA method that has be proven superior for *all* decision-making problems. In general, different methods lead to different decisions but it has been argued that the ranking of alternative choices is method-independent provided that data are handled "appropriately" (Guitouni and Martel 1998).

Selecting an appropriate MCDA method based on criteria in the literature, problem constraints and the bias of the user is a multi-criteria problem in its own right. There are no clear guidelines on how to choose an appropriate MCDA method but the prevailing view remains that the simpler method should be chosen in any given circumstance (Guitouni and Martel 1998).

There is of course a gap between the theoretical power of MCDA methods and their applicability to real-world problems. This gap is not trivial when the problems are not very well understood and the constraints are ill defined. Traditional MCDA techniques based on operations research principles are often incapable of handling qualitative information and collapse when numerical data is lacking and imprecise.

Mixed Mode Analysis

In real-world situations, decision analysis is usually a *prospective* evaluation tool for the examination of alternative choices for a policy or an intervention. It is used that is to forecast in advance the intended results of a

particular action or series of actions. In *retrospective* evaluations, decision analysis can contribute to the assessment of an implemented policy or intervention through the appraisal of its impact with regard to pre-determined criteria. In both cases, multi-criteria analysis is undertaken to integrate into a coherent framework quantitative and qualitative information, long-time intervention horizons, decision-making uncertainties and heterogeneous criteria.

A characteristic example of such mixed-mode decision analysis is the recent requirement to consider sustainability dimensions of economic, environmental or social interventions. There is a distinct need to develop a framework capable of handling qualitative information and missing or imprecise numerical data. Such an integrative framework should have the potential to provide well-structured, defensible and transparent solutions to complex decision problems.

Traditional MCDA techniques, deeply-rooted in the (mostly) deterministic world of operations research collapse under such circumstances. It is impossible to design interventions in fields such as regional development when the time-span for the collection of reliable data and the cost of sophisticated analysis often exceeds the timescales and budgets set aside for a policy assessment. There are practical difficulties in choosing the interventions to be studied, in determining the relevant criteria, and in addressing the lack of reliable data over a period of time sufficient to validate the methodologies employed. Furthermore, the stakeholders should be skilled in mathematical concepts and data aggregation techniques to appreciate the iterative nature of the processes and the nuisances of the proposed solutions. Often the stakeholders feel that multi-criteria analysis is a subjective tool used to advance pre-determined agendas (Montibeller and Franco 2010).

In such challenging situations, where there is still a need to pass judgment on complex interventions, multi-criteria analysis should use simple methodologies, limited to the comparison of a small set of activities through a set of finite criteria set (or easily understood) by the stakeholders.

In this modern milieu, the International Association for Impact Assessment (2013) defines multi-criteria analysis as follows:

> *«Multi-Criteria Decision Analysis (MCDA) is a general term for systematic and transparent approaches to analyze complex problems involving multiple criteria. We consider the term MCDA to also cover simple structuring methods and tools such as objective hierarchies, strategy tables, consequence tables and (conceptual) influence diagrams. The systematic MCDA framework can contribute the assessments by integrating diverse information*

from scientists, experts and local people, and by incorporating the subjective preferences of stakeholders into the analysis.»

The definition of multi-criteria analysis of IAIA emerged to cover modern problems with fuzzy data and simultaneous use of quantitative and qualitative variables. These problems cannot be addressed by classical methods of operations research that demand quantification and deterministic accuracy (Munasinghe 2007). Mixed-mode multi-criteria analysis methods can effectively support the "*structuring, assessment and decision making on complex policy issues*" as was defined in the EU-funded LIAISE Network of Excellence on impact assessment research for sustainable development (Geneletti, 2013).

The sentiment is echoed in the World Bank (2000) manual on Multi-Criteria Analysis for development:

«Multi-Criteria Analysis techniques aim to provide a rational basis for classifying choice through the aggregation of disparate information onto a common index of utility or value. Multi-criteria techniques encompass a large family of methods of which 40 or more different approaches are distinguishable in the literature, from the highly sophisticated through to simple rating systems.»

and the claimed objective for techniques that have the capacity to simplify complex situations.

GE/McKinsey Matrices

The most basic requirement in modern multi-criteria analysis is to undertake calculations and aggregations that yield performance tables for each intervention, based on carefully weighted criteria that measure their relative importance for each stakeholder. These performance tables should be able to accommodate mixed-mode information and be relatively immune to data noise.

In this context GE/McKinsey matrices, an old stalwart of business portfolio analysis, have received renewed attention and were successfully employed in the MCDA assessment of business cluster policies (Tsakalerou 2014).

The GE/McKinsey Matrices are typically nine-cell (3X3) matrices used to perform portfolio analysis in the strategic planning process of an enterprise. They were invented by General Electric in the 1970s and perfected by McKinsey later on. In essence, GE/McKinsey Matrices are a multi-factorial analysis technique used in product management to help a company decide what product(s) to add to its portfolio.

Typically, one dimension of the matrices comprises three industry attractiveness levels (low, medium and high) while the other comprises three internal business strength measures (low, medium and high). Each product,

brand, service, or potential product is mapped in this industry attractiveness/business strength space (Coyne 2008) with three distinct decisions possible: invest/grow, selectively change and harvest/divest. GE/McKinsey Matrices differ from similar tools, like the Boston Consulting Group Matrix, in that multiple factors are used to define industry attractiveness and business unit strength.

Grouping the variables of a problem and their effect on performance in three classes is the major advantage of the GE/McKinsey matrices in identifying *central trends* in the data. Indeed, GE/McKinsey matrices exploit a fundamental concept in statistics, namely that choosing a small (and preferably odd) number of classes for grouping the data is one effective way to reduce the impact of noise in the data (Newbold, Carlson and Thorne 2009). The situation is akin to low-pass filtering in signals, where the processing of noisy waveforms with low-pass filters is used to improve the signal-to-noise ratio (Smith 2002).

The GE/McKinsey variable-pair analysis can be employed in a totally different context, namely to assess variable performance in multivariable modeling problems complicated by the need to integrate diverse information and imprecise data.

The applicability of GE/McKinsey matrices in organizing and presenting the results of large multi-criteria studies has been demonstrated persuasively (Tsakalerou 2014). In the context of assessing the effect of intellectual capital on firm performance, a modified version of the GE/McKinsey matrices was used to satisfy the quest for appropriate mixed-mode multi-criteria analysis methods. This practical use of the GE/McKinsey matrices exemplified their utility in integrating mixed-mode data (ordinal, categorical and semi-quantitative) in the same decision framework.

Specifically, the following adaptation (mode) of the GE/McKinsey Matrices was proposed for variable-pair analysis:

VARIABLE A2	High	V_{31}	V_{32}	V_{33}
	Medium	V_{21}	V_{22}	V_{23}
	Low	V_{11}	V_{12}	V_{13}
GE/McKINSEY MATRIX MODE		Low	Medium	High
		VARIABLE A1		

Each block (i,j) in the matrix is assigned a weighting V_{ij} appropriate for the situation. In this sense, the entries are calculated as follows:

V_{ij} = SUM [Cases in (i,j) x Quantified Effect] / SUM [Cases in (i,j)]

or

V_{ij} = SUM [Firms in (i,j) x Quantified Effect] / SUM [Firms in (i,j)]

thus enabling comparisons between the pair of variables. The weights V_{ij} are in effect the weighted averages of the effect on performance for all the cases (or firms) in the dataset that satisfy the (i,j) criteria with respect to the variables A_1 and A_2.

If the grouping of the variables in three classes is accompanied by rounding-up the calculations the impact of imprecisions in the data is further diminished. In this sense, only major trends are identified, a fact which strengthens the utility of the conclusions of the analysis. In doing so, the use of an appropriately modified form of GE/McKinsey matrices emerges naturally as an effective mixed-mode tool of choice.

Conclusions

Multi-criteria analysis has evolved from its operations research origins to address situations where the criteria are not so easily quantified and where the data is often fuzzy. In such challenging situations, where there is a need to assess complex interventions, multi-criteria analysis should use simple methodologies, limited to a small set of activities and a well-defined set of finite criteria set.

In this context, GE/McKinsey matrices, a classic tool of the business portfolio analysis, have been demonstrated to be an effective tool to address mixed-mode problems. By grouping decision variables and their effects into a small number of classes, GE/McKinsey matrices provide an effective way to reduce the effect of noise in the data and to allow for major trends to emerge. Thus GE/McKinsey matrices rightly belong to the arsenal of modern MCDA techniques.

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