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A Study on Establishing Competitive Advantage Strategies based on Patent Data Investigation using TF-IDF and Network Analysis

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Abstract

We need to analyze the data about the competitors to establish strategies to achieve the competitive advantage, but it is very difficult to get the current data about them. However, the patent registration data about the competitors are open to the public while it is protected legally for 20 years. This research paper shows that we can establish strategies practically to achieve the competitive advantage against our competitor based on the big data analysis and machine learning tools. In other words, we showed how to establish strategies against the competitive companies based on the analysis of competitors' technological strategies using the quantitative and qualitative patent data that are open to the public using Frequency Analysis, Arc Analysis, Network Analysis, Heatmap Analysis, TF-IDF, LSTM and so on.

Keywords: competitive advantage, technological strategies, big data analysis, machine learning

Introduction

This research paper explores the value of data that were considered only raw data for information and knowledge and were not fully recognized 10 years age. The Economist(2017), newspaper in England says that the world's most valuable resource is no longer oil, but data. The total amount of data in the world was about two zettabytes in 2011 and about eight zettabytes in 2016, which showed that the amount increased four times in five years (Japanese Ministry of General Affairs, 2012). This could be called as the data explosion in the era of IoT(Internet of Things) and the amount increases geometrically in a short period time.

However, many companies are still using the data analysis as "Descriptive and Diagnostic Analysis" rather than "Predictive and Strategic Analysis" in these days. This research suggests how to establish strategies practically to achieve the competitive advantage based on the big data analysis and machine learning tools (Jun Sunghae(2013)).

We need to analyze the data about the competitors to establish strategies to achieve the competitive advantage, but it is very difficult to get the current data about them. However, the patent registration data about the competitors are open to the public while it is protected legally for 20 years. This research will show how to establish strategies against the competitive companies based on the analysis of competitors' technological strategies using the quantitative and qualitative patent data that are open to the public (Max H. Boisot, Ian C. MacMillan, Kyeong Seok Han (2008).

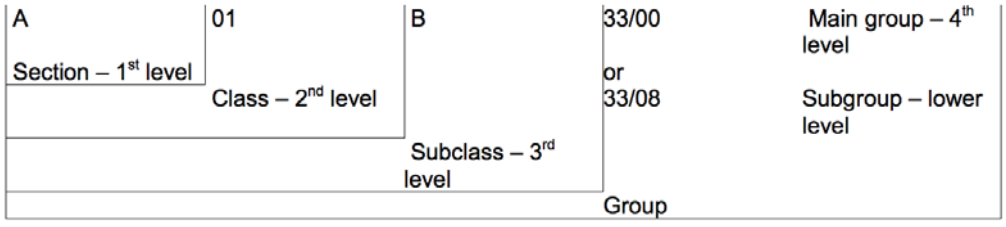
Theoretical Background

Patent Data

Patent systems have the regulations to protect the right of patent holders to promote the invention for the national development. Once the patent passed the evaluation processes, it will be open to the public after one and half years and its right will be exclusively protected for 20 years legally (KIPO(Korean Intellectual Property Office), 2018).

Configuration of Patent Data. Patent data include the quantitative data such as patent number, name, IPC(International Patent Classification), patent applicant, inventor, application date, registration date, open date, international patent application number, international patent application date, abstract, application items, family data, and so on. The patent data also include the qualitative data such as a whole patent description, related diagrams, etc. (KIPRIS(Korean Intellectual Property Rights Information Service, 2018).

Structure of International Patent Classification. International Patent Classification Patent codes were implemented in 1967 with about 70,000 codes and shared by about 180 member countries. As shown in [Table 1] IPC codes consist of Section, Class, Subclass, Main Group and Subgroup. [Table 2] shows that each section includes classified technologies. This scheme is an international standard, even though the system is not perfect.



[Table 1] IPC Code Structure [14]

SECTION	A HUMAN NECESSITIES	B PERFORMING OPERATIONS, TRANSPORTING	C CHEMISTRY, METALLURGY	D TEXTILES, PAPER	E FIXED CONSTRUCTIONS	F MECHANICAL ENGINEERING, LIGHTING, HEATING, WEAPONS, BLASTING	G PHYSICS	H ELECTRICITY
IPC	8,498	16,778	14,449	3,050	3,250	8,551	8,011	8,283

[Table 2] IPC Section Classification

Network Analysis

Network Centrality Theory. The theory is used to identify the importance of a node that is influential in the network. The theory includes three indices i.e. Degree Centrality, Betweenness Centrality, Closeness Centrality (Japanese Ministry of General Affairs(2012). We can identify the strategies and core technologies of the competitors using the network analysis.

Degree Centrality. This is an index to represent the importance level of a node which shows the number of links of the node. If there is a direction edge, we can assess the linkage effect based on In-degree Centrality and Out-degree Centrality. If needed, we can assess the Input and Output effect with the weighted direction edges. The node will be a core node in the network, if the linkage effect value is big enough to be considered as a key node.

Betweenness Centrality. This is an index to represent the number of nodes that are connected through this central node. If a node makes many nodes connected, the Betweenness Centrality of the node becomes very high. It is very important index, because the network will disappear with small Betweenness Centrality.

Closeness Centrality. This is an index to represent the close distance between two nodes. The accessibility and transferability is good, if the distance between two nodes is short as shown in the following equation:

$$C_C(v) = \frac{1}{\sum_{i \neq v} d(v,i)}$$

$d(v,i)$: the distance from node v to node i

Automatic Classification based on TF-IDF

TF-IDF(Term Frequency – Inverse Document Frequency) is a calculation tool to measure the weight for the information search and text mining that can be applicable to the automatic patent classification (Gerard Salton(1988)). TF-IDF suggested by Hans Peter Luhn(1957) is used as a theoretical background for the automatic information classification. The equation is as the following:

$$w_{t,d} = tf_{t,d} \times \log\left(\frac{N}{df_t}\right)$$

$tf_{t,d}$ = frequency of term in documents

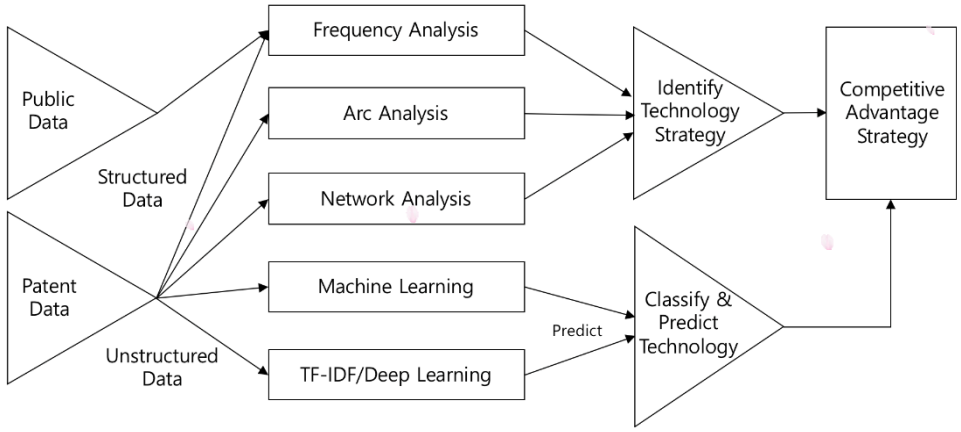
df_t = number of documents containing term

N = total number of documents

$$tf_{t,d} = 0.5 + \frac{0.5 \times f_{t,d}}{\max\{f_{w,d} : w \in d\}}$$

$$idf_{t,d} = \log\frac{|D|}{1 + |\{d \in D : t \in d\}|}$$

This research uses 5311 patent data of Company B collected from 2000 to 2014 using KIPRIS(Korean Intellectual Property Rights Information Service). Company B is a competitor of Company A which wants to establish strategies for competitive advantage based on competitor's patent analysis. The data consist of 55 fields such as patent number, name, IPC(International Patent Classification) code, patent applicant, inventor, application date, registration date, open date, international patent application number, international patent application date, abstract, application items, family data, and so on. We collected more data from KISTI(Korea Institute of Science and Technology Information), KIPO(Korean Intellectual Property Office), Google, etc.



[Figure 1] A Research Model to Establish Strategies for Competitive Advantage Based on Competitor's Patent Analysis-PATS(Patent Analytics for Technology Strategy) Model

After collecting the data, we set up a research model to process the big data analysis for establishing strategies to acquire the competitive advantage based on competitor's patent analysis is shown in [Figure 1].

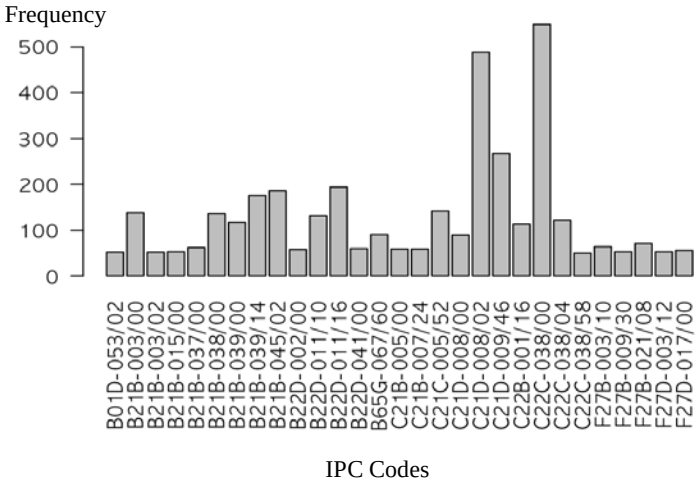
Exploratory Analysis of Competitor's Patent Data

In order to avoid too detailed classification with to small number of patent registrations we perform a frequency analysis of IPC Codes with more than 50 patent registrations.

Patent Technology Analysis

Frequency Analysis

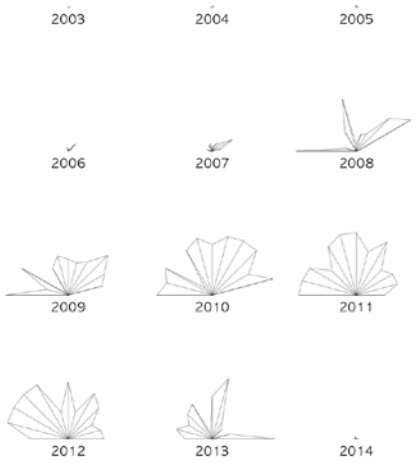
[Figure 2] shows that a few IPC codes such as C22C038/00, C21D008/02 and C21D009/46 have a very high frequency, which means that the competitor is not only developing manufacturing technologies, but also logistics technologies.



[Figure 2] A frequency analysis of IPC codes with more than 50 patent registrations

Plot Analysis

We performed the mosaic plot analysis to find the diversity of patents using yearly-based data. [Figure 3] shows that the numbers and types of patents has increased while the growth of company was realized during the periods.



[Figure 3] Mosaic plots of IPC codes with yearly-based patent registration numbers

Word Cloud Analysis

Word cloud analysis based on the patent names allows us to understand the competitor's technology trends. In the earlier stage the competitor looks interested in 'Rolled Steel' like technologies, but in the later stage it is interested in 'Apparatus' like technologies as shown in [Figure 4].

[Figure 4] The "Word Cloud" based on yearly-based patent registration names

Patent Family Analysis

The patent family analysis provides the insight to understand the competitor's strategies, because a patent family is a set of patents taken in various countries to protect a single invention. In other words, a patent family is the same invention disclosed by a common inventor(s) and patented in more than one country. [Figure 5] shows that the competitor, Company B, registers large patent family in China.

[Figure 5] The geographical distribution of patent registration of the competitor

Patent Network Analysis

The purpose of network analysis is to find out the competitor's key technology.

Centrality Analysis

[Table 3] shows that Closeness Centrality is very low (0.0001), which means that the patents are independent each other in the competitor. However, Degree Centrality is very high (8, 4and 3), which means that the competitor focuses on the steel manufacturing and cold-rolled coil to make automobiles.

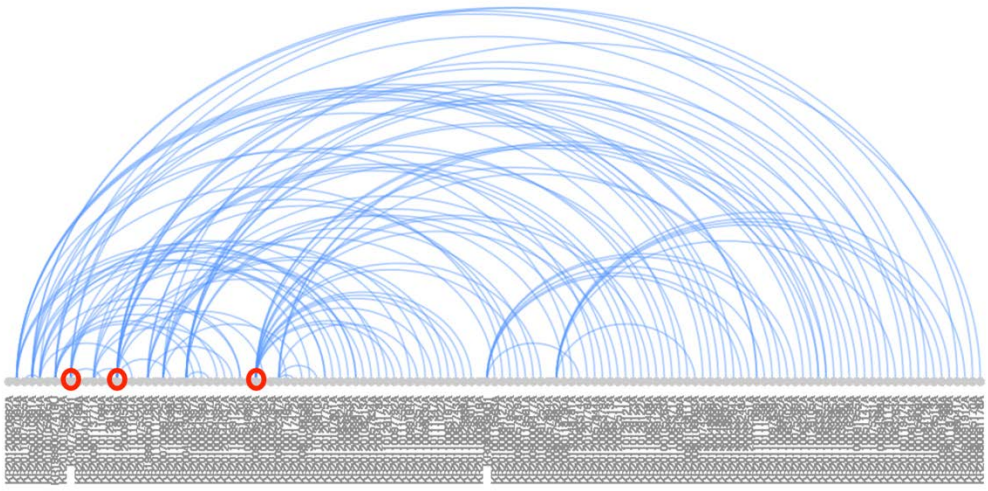
Network Analysis	Statistics	IPC Code
Closeness Centrality	KR2009000***** : 0.0001 KR2010002***** : 0.0001	C23C-022/72 B03C-001/22

Degree Centrality	KR2009002***** : 8 KR2008010***** : 4 KR2012003***** : 3	B22D-011/16 C21D-008/02 B22D-011/124

[Table 3] Centrality Analysis

Arc Analysis

The key patent can be identified through the IPC reference analysis. The competitor, Company B focused on sintering processes and the fuel raw material equipment as shown in [Figure 6]. [Figure 6] also shows that most referred patents are KR2009008***** with 15 times reference and KR2010011***** with 13 times reference.



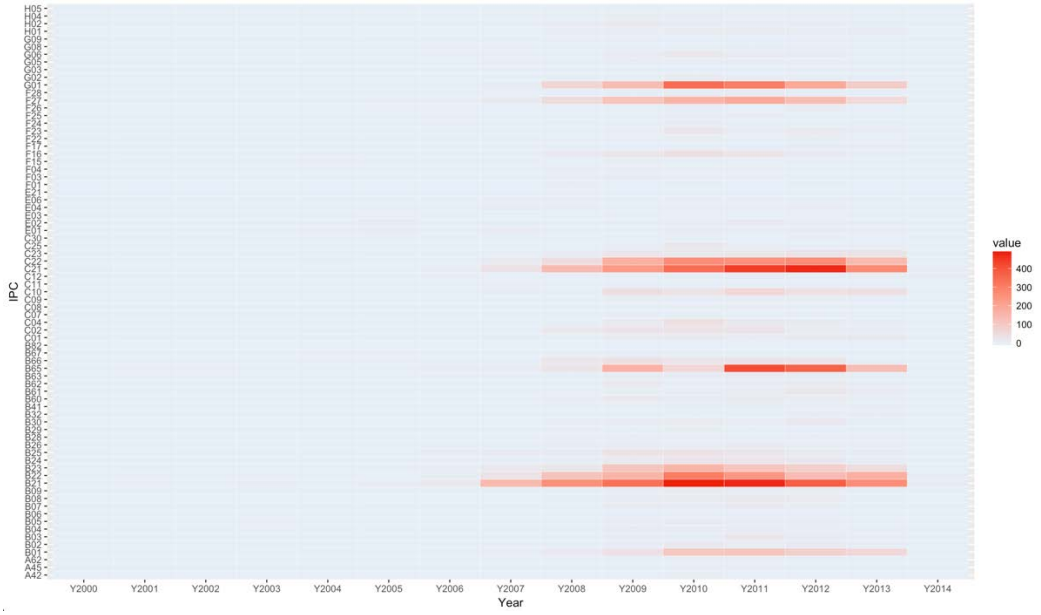
Registered IPCs

[Figure 6] The arc analysis based on registered IPC

Technology Prediction Model Based on the Technology Distribution

Heatmap Analysis

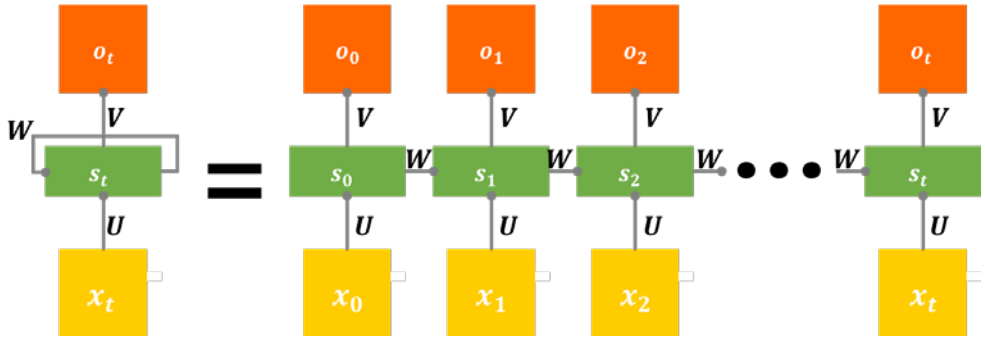
If we draw the frequencies of competitor's patents on each year, we can find that the competitor's patents are developed during certain periods as shown in [Figure 7].



[Figure 7] The yearly based frequency(Heatmap) of competitor's IPC codes

Technology Prediction Based on LSTM(Long Short-Term Memory)

RNN(Recurrent Neural Network) is a method of the deep learning based on neural network. RNN is an applied model evolved from DNN(Deep Neural Network). We want to forecast the competitor's technology strategies based on competitor's patent data and RNN method. [Figure 8] is an example of RNN model.



$$s_t = f(Ux_t + Wh_{t-1}) \qquad o_t = Activation(Vh_t)$$

where, x_t are input values at time t

s_t are hidden layer statuses at time t

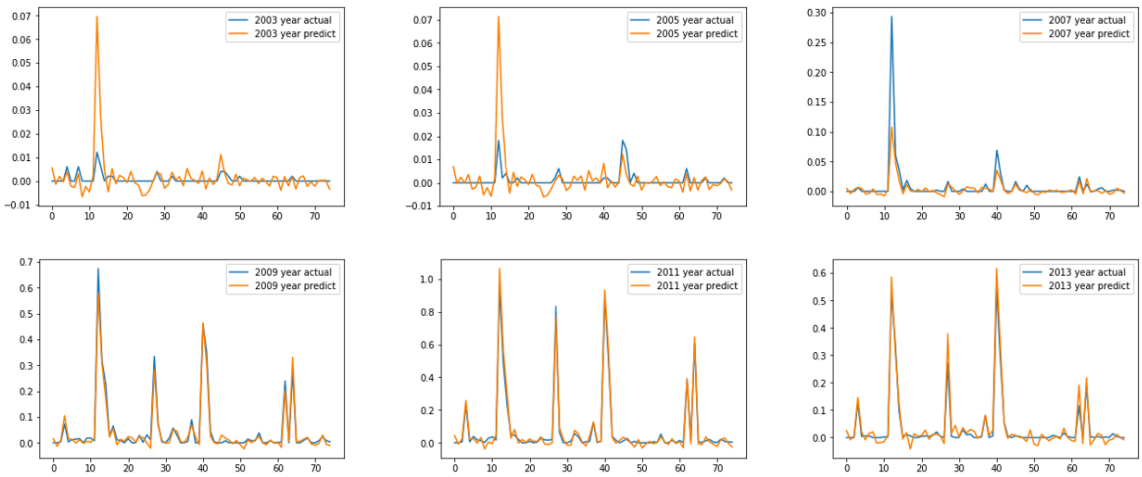
o_t are output values at time t

U, V, W are weight values attained after machine learning

[Figure 8] An example of RNN model

However, RNN has a vanishing gradient problem and we used LSTM(Long Short-Term Memory) model that is an improved RNN model. The forecasting results per year are shown in [Figure 9]. In the graph x-axis represents IPC codes and y-axis represents IPC registration frequencies. The accuracy is 81.82%, which is very

accurate.



[Figure 9] The forecasting accuracy of LSTM model

Automatic Classification of Competitor's Patent Data Based on TF-IDF

[Table 4] shows the main keywords for the processes summarized based on IPC codes, competitor's information, term-document and so on.

Main Process	Sub Process	Code	Keyword
Iron Making	Sintering	0101	Iron Ore, Subsidiary Raw Material, Sized Ore, Sinter, Limestone
	Coke	0102	Coke, Bituminous Coal, Coal, Powdered Coal, Pulverized Coal
	Subsidiary Products	0103	COG, BOG, Gas, Crude Light Oil, Cement
	Blast Furnace	0104	Pig Iron, Torpedo Car
Steel Making	Refining	0201	Iron, Scrap, Subsidiary Raw Material, Oxygen, Conventional Blowing, Argon, Nitrogen
	Refinement	0202	RH, Degassing, Inclusion, LF, Desulfur, Powder
	Continuous Casting	0203	Turndish, Mold, Cooling, Slab, Bloom, Billet
Rolling	Hot Rolling	0301	Reheating Furnace, Roughing Mill, Roll, Cooler, Winding, Hot Coil
	Cold Rolling	0302	Automobile, Annealing, Galvanize, Plating, Steel Sheet, Directional Properties

[Table 4] Classified processes and the keywords

[Table 5] shows the part of patent classification of the competitor calculated by TF-IDF (Term Frequency – Inverse Document Frequency) statistics. The accuracy of the forecasting was 76%, which will be more improved using SVM(Support Vector Machine) and Word2Vec.

Patent Number	Iron Making				Steel Making			Rolling		Domain Expert Judgment
	Sintering	Coke	Subsidiary Products	Blast Furnace	Refining	Refinement	Continuous Casting	Hot Rolling	Cold Rolling	
KR2012006*****	100	200	0	200	300	1365	100	200	0	Refinement
KR2011006*****	36	26	203	28	100	110	200	300	100	Subsidiary Products
KR2011001*****	0	0	0	0	0	10	987	0	0	Continuous Casting
KR2010010*****	0	0	0	74	0	0	1580	100	0	Continuous Casting
KR2009007*****	0	1007	100	100	0	0	0	0	0	Coke
KR2009010*****	0	106	106	106	10	110	300	728	100	Hot Rolling

[Table 5] The part of patent classification of the competitor calculated by TF-IDF (Term Frequency – Inverse Document Frequency) statistics

Conclusion and Future Research

This research paper shows that we can establish strategies practically to achieve the competitive advantage against our competitor based on the big data analysis and machine learning tools. In other words, we showed how to establish strategies against the competitive companies based on the analysis of competitors' technological strategies using the quantitative and qualitative patent data that are open to the public using Frequency Analysis, Arc Analysis, Network Analysis, Heatmap Analysis, TF-IDF, LSTM and so on. In the future this research model will be able to be applied for other industries.

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Credit Risk Management and Capital Adequacy in Indian Banks

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Abstract

Building a balanced panel data of size of Indian banks and excess capital held by those banks for their credit risk from 2009 to 2016, we study the relationship between size of banks and excess capital for their credit risk. Size of banks is measured by deposits plus advances. Our findings suggest that bank size has a positive impact on excess capital held by Indian banks beyond the minimum capital required as per Basel norms. Moreover, we examine the relationship between banks ownership (public and private) and excess capital for their credit risk. The findings indicate that there is no any significant relationship between them. This study shows that the level of excess capital is dependent to the size of banks. We state that insufficient attention has so far been paid to research about capital adequacy and size of Indian banks. This study might be of assistance to regulators/policy-makers for assessing and deciding the capital requirements for credit risks while Indian banks are suffering from high and rising non-performing assets since last few years. In addition, this might be of interest to regulators implementing Basel III norms.

Keywords: Credit risk, capital adequacy, Indian banks, risk management, Basel Accord

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Innovation in public procurement process:
A proposal for quantitative analysis

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ABSTRACT

The implementation of innovations in the public sector offers opportunities for modernizing public management, with the goal of providing important improvements in public services. This article seeks to outline a proposed instrument for analyzing the innovation present in the Ministry of Health's process of public procurement of medicines and health inputs, based on the Coefficient of Content Validity (CCV). It enables quantitative assessment of content from instruments for collecting data. Five specialists in innovation took part in the validation. 42 items were put forward to analyze innovation in the context mentioned. The CCV was calculated in order to verify the clarity of language, practical pertinence and theoretical relevance for the instrument as a whole, in addition to the fulfillment of semantic validation, which uncovered the opportunity to construct a valid and reliable instrument with 32 items to analyze the organizational innovation.

Keywords: Public Sector Innovation; Content Validation; Coefficient of Content Validity; Public Procurement of Medicines.

1 – INTRODUCTION

The transition towards the modern nation-state, the landscape of which is represented mainly by critical factors such as: the new economy, underpinned by globalization, technology and knowledge; and the New Public Management, governed by premises of efficiency, flexibility, result, social and organizational learning, social control and responsibility. Managers who operate in this state are thus required to seek the use of management technology that is more appropriate for adding value and, in this sense, innovation emerges with the goal of providing important improvements in the efficiency, efficacy and effectiveness of state measures (Bresser-Pereira, 2006; De Vries, Bekkers & Tummers, 2015).

The Ministry of Health (MH) falls within this context. It is responsible for the Brazilian National Health System (SUS), the broadest social policy in the country and one of the largest public health systems in the world. Its strategic objectives, as per the planning for the 2011-2015 and 2016-2019, include the National Pharmaceutical Assistance Policy (NPAP), of which the basic premise is the free provision of medicines and strategic health inputs. It was noted that, in 2010, a specific area was created to oversee the logistical chain for medicines and health inputs, namely the Department of Health Logistics (DLOG). This logistics chain covers logistical planning, the procurement, storage and distribution of the above-mentioned inputs.

This procedural restructuring reveals the State as an innovative agent, acting as the legally instated responsible entity, and which implemented a new methodology in the area of procurement, developing an information system called the Electronic Procurement Process (EPP), since 2013. The process consists of a set of electronic and procedural documents, gathered organically throughout a procurement process for goods and services at the MH. This tool was created with the aim of optimizing the procurement process and guaranteeing the effective supply of medicines for citizens. Significant studies have been performed to analyze innovation, although these studies are scarce in the public sector, reflecting the need for quality and reliable analytical instruments for the innovation process in this sector, which is incipient in terms of innovation in public procurement (Bloch et al., 2009; De Vries, Bekkers & Tummers, 2015).

Thus, researchers in social science have become aware of the importance of validating content from measurement and assessment instruments, that is to say, their ability to measure precisely and reliably the phenomenon studied, and consequently to reproduce consistent results in space and time, with different observers (Pasquali, 1999; Netemeyer, Bearden & Sharma, 2003). However, approximately three years into the implementation of this innovation at the DLOG, it has become necessary to analyze its features and effects using

an instrument that grasps the perception of stakeholders who are directly involved. Hence, the goal of this article is to outline a proposed instrument for analyzing the innovation present in the MH's procurement process of medicines, based on content validation, following the CCV model advanced by Hernandéz-Nieto (2002). Consequently, based on the proposal, this study comprises sections that address the theoretical assumptions about public procurement of medicines, public sector innovation and content validation. Subsequently, the article outlines the method applied and the analysis of the data obtained, as well as the final version of the instrument for analyzing innovation. The article ends with considerations and suggestions.

2 – THEORETICAL BENCHMARK

2.1 - Public procurement of medicines

Public procurement can be defined as the process through which the government seeks to obtain the materials, services and equipment necessary for its functioning as per the norms and laws in force (Baily, 2000). Even if the public sector's procurement and contracting aim primarily to meet various government targets, it is incontestable that more cohesive employment of the economic and strategic potential of this demand can generate other objectives that are also associated with development.

The role that public procurement units have assumed since 1990 up to the present day, reflects a growing search for high quality, lower costs, enhanced speed and flexibility of public procurement and contracting, thus demonstrating managers constant concern over efficient use of public resources, which represent a significant portion of the budget. Good management of these resources is a complementary option for enhancing efficiency in public spending, as well as improving the performance of government organizations (Schooner, Gordon & Clark, 2008).

In Brazil, processes for public procurement of medicines observed a centralized management model up until 1997, and were carried out by the MH, although the decentralization of health measures in the public sector began in 1990. Since 1998, with the publication of the National Medicines Policy (NMP), the MH has highlighted the importance of distributing medicines free of charge to the population, increasing the responsibilities for operating the management of pharmaceutical aid within SUS. In this way, the adequate supply of quality medicines, obtained at reasonable prices, is a key aspect for the economic viability of the public procurement organizations responsible for these medicines, though this has emerged as a complex task for public managers. Hence, management and financing issues have added to problems of supply logistics as part of the set of great challenges faced by the NPAP within SUS (Bevilacqua, Farias & Blatt, 2011).

2.2 – Innovation in the public sector

Innovation has been a constant quest for entrepreneurs, members of government and academics, with the aim of delivering a higher value-added product or service to citizens. It is understood as a motor of social and economic development, the solution to social problems and the remedy for the lack of competitiveness (Schumpeter, 1982; De Vries, Bekkers & Tummers, 2015).

Since the 1990s, the change in context and the emergence of new approaches and models for analyzing innovation, have led to the creation and updating of instruments for measuring and analyzing innovation activities. The public sector is no different and despite the reduced number of empirical studies investigating the phenomenon of innovation in this sector, the studies undertaken by De Vries, Bekkers & Tummers (2015), Bloch et al. (2009) and Bloch (2011) were all selected, since they remained closer to the locus and phenomenon examined in this article. In line with the need to analyze the public sector innovation, De Vries, Bekkers & Tummers (2015) developed a heuristic framework that consolidated a systemic literature review, involving 181 articles and books published between 1990 and 2014 on innovation in the sector. This framework links the main antecedent factors, types and features, plus the results of public sector innovation, as displayed in Table 1.

Table 1 - Systematization of the definition, categories, description and variables proposed by De Vries, Bekkers and Tummers (2015) on public sector innovation

Definition of innovation	Category	Description	Variable
Innovation in the public sector is understood as an idea, practice or object considered new for an adopting unit, with the objective of generating public value	Environmental antecedents	Context in which the public organization operates to innovate	Environmental pressures Participations in Networks Public organizations that adopt the same innovation Regulatory aspects Competition
	Organizational antecedents	Features and structure of the public organization	Availability of resources Leadership styles

		that innovates	Degree of aversion to risk/learning environment Incentives/rewards Conflicts Organizational structure
	Individual antecedents	Features of individuals who innovate	Employee autonomy Organizational Position Knowledge and skills Creativity Demographic aspects Commitment to and satisfaction with job Innovation acceptance
	Types of innovation	Behavior of public organizations that innovate	Process: administrative or technological Product or service Governance Conceptual
	Outcomes of innovation	Substantive results of the implementation of innovation	Increase or reduction in effectiveness Increased efficiency Involvement of private partners Involvement of citizens Increased customer satisfaction

Source: Developed by the authors, adapted from De Vries, Bekkers & Tummers (2015).

In addition, Bloch et al. (2009) developed a framework as a basis to measure innovation within public organizations at the organizational level. This framework is adapted to the reality of the MH and outlined in Table 2; it therefore focuses on the fundamental elements of innovation activities in this context.

Table 2 - Systematization of definition, categories, description and variables proposed by Bloch (2011) and Bloch et al. (2009) on innovation in the public sector

Definition of innovation	Category	Description	Variable
Innovation in the public sector is the implementation of significant change in the way the public organization operates or supplies its products.	Types of innovation	Classification of innovation activities, based on the Oslo Manual, and adapted to the public sector	Product Process Organizational Communication
	Process of innovation	Specifies the way innovation occurs at the public organization	Collaboration and learning Diffusion of innovation Organizational culture Productivity of innovation
	Outputs for innovation	Goods, services or activities delivered by the innovating public organization	Types of innovation Level of novelty of innovation Intangible outlets Social impacts
	Outcomes of innovation	Wider results of the activities of the innovating public organizations	Improvement for employee Benefit to users Other intangible effects (confidence, legitimacy)
	Structural	Factors or external	Demands of users and suppliers

	conditions	conditions that influence the innovating public organization	Organization of the public sector and incentive structure Political priorities Facilitators and barriers to innovation

Source: Developed by the authors, adapted from Bloch et al. (2009) and Bloch (2011).

Thus, the aim is to analyze innovation in the public sector and the studies undertaken by the authors De Vries, Bekkers and Tummers (2015), and Bloch et al. (2009) outline categories and variables to devise a reliable and suitable instrument for measuring innovation in this context.

2.3 – Content validation

Content validation can be understood as a means of developing new measures for a given phenomenon, since it represents a method for associating abstract concepts with observable and measurable indicators; or, in a broader sense, content validation applies when there is a proposal to assess the degree to which each element of a measurement instrument is representative of a specific construct (Netemeyer, Bearden & Sharma, 2003).

Pasquali (1999) endorses this understanding and highlights the importance of content validation in the process of developing and adapting measurement instruments, as the growing demand for assessment instruments from researchers has not followed the concern regarding the calibration of the quality of these instruments or the applicability to our cultural context. Hence, Cassepp-Borges, Balbinotti & Teodoro (2010) have outlined techniques to adapt instruments from one culture to another via translation and validation of content, with the aim of systematizing these procedures so that they are used in the most diverse fields of knowledge.

Content validation is linked to studies that examine the clarity, representativeness and relevance of items, and to this end, assessing judges must be used for a subjective assessment that verifies whether the instrument measures what it purports to measure, in accordance with content bias (Cassepp-Borges, Balbinotti & Teodoro, 2010). Among the techniques applied for content validation, this article highlights the Coefficient of Content Validity (CCV), advanced by Hernández-Nieto (2002), resulting from the need for a new coefficient, in order to measure this validation, assess agreement among judges and present reliable results.

Hence, CCV seeks to measure the magnitude of the value obtained by judges, compared with the maximum possible value (optimal), in accordance with a Likert Scale, varying from one to five and demonstrating the equivalence of content among items (Hernández-Nieto 2002).

3 – METHOD

Regarding the means of investigation, the locus of the phenomenon analyzed was the MH and the objective was to examine the phenomenon of innovation in public procurement of medicines and health inputs within this context, by validating the content from the survey.

In order to validate the content, it was submitted - via a form sent by email - to 10 judges, all specialists in public sector innovation, with a minimum experience of three years in researching the construct under discussion, in line with the Coefficient of Content Validity (CCV), advanced by Hernandéz-Nieto (2002), which represents a quantitative analytical procedure for each of the 42 questions initially formulated.

Assessment of questionnaire items was performed through a Likert Scale, varying from one to five, where one represents a very low level of adaptation and five indicates greater intensity for the variable assessed. Hernandéz-Nieto (2002) recommends a minimum of five and a maximum of 10 judges to assess instrument items.

Each questionnaire item was assessed by five judges according to three criteria: clarity of language, which considers the language used in the items with respect to the responding population; practical pertinence, which analyzes whether each item was developed in such a way as to assess the concept of interest; and finally, theoretical relevance, which assessed the degree to which the item was associated with theory. Furthermore, qualitative validation was performed through the insertion of a column entitled "observations", in order for judges to put forward improvements and suggestions regarding the items presented (Hernández-Nieto 2002;Cassepp-Borges, Balbinotti & Teodoro, 2010).

The method for calculating the Content Validity Coefficient (CCV), applied to validate the questionnaire, was performed by drawing on Hernandéz-Nieto's description (2002) and structured via the following stages:

a) Based on the judges' scores (one to five), the mean score for each item was calculated (Mx):

$$Mx = \frac{\sum i=1 Xij}{J}$$

Where, i = 1 and J represent the sum of the judges' scores and the number of judges who assessed the item, respectively.

b) Based on the mean, the initial CCV is calculated for each item (CCVi):

$$CCVi = \frac{Mx}{Vmax}$$

Where, Vmax reflects the maximum value the item can receive. In the case of the Likert Scale varying from one to five, the maximum value is five.

c) For each item, an error calculation (Pei) is necessary to discount possible bias from judges:

$$\text{Pei} = \left(\frac{1}{J}\right)^{J}$$

d) Thus, the final CCV (CCVc) for each item is:

$$\text{CCVc} = \text{CCVi} - \text{Pei}$$

e) The total CCV for the questionnaire (CCVt) is calculated for each of the assessment criteria (clarity of language, theoretical relevance and practical relevance):

$$\text{CCVc} = \text{MCCVi} - \text{Mpei}$$

Where, MCCVi reflects the mean for the content validity coefficients of the items and Mpei the mean for the errors of the questionnaire items.

f) Lastly, the mean for the CCVc of each questionnaire item is calculated in order to proceed to the assessment, in line with the guidelines of the aforementioned author, who attributes the cut-off score of CCVc > 0.80.

To validate each of the questionnaire items, the score of 0.80 was adopted as the cut-off for each of the above-mentioned analytical criteria. Items, in which only one of the variables obtained a mean CCV of below 0.80, were discarded and not included in the final version of the instrument for analyzing innovation in public procurement of medicines.

4 – DATA ANALYSIS

The research questionnaire was devised following the dimensions and variables outlined in the models of De Vries, Bekkers and Tummers (2015), and Bloch et al. (2009), as displayed in Tables 1 and 2, to which two variables were added: sustainability and transparency of information, concerning the features of technological innovation in the context of the MH.

Initially, 42 items were created for the questionnaire, categorized according to three main blocks: items 1 to 10, regarding the features and results of innovation, in this case the EPP; items 11 to 38, which outline the management practices and perceptions of the organizational environment to promote innovation; and, lastly, items 39 to 42, which reflect practices concerning the innovation process at the MH.

For the purposes of assessment, the questionnaire was submitted to ten judges, all specialists in innovation, although five replied and performed the content validation process as per the Coefficient of Content Validity (CCV), advanced by Hernandéz-Nieto (2002), for each of the 42 questions initially formulated, in accordance with the sample form sent by email.

To validate each of the questionnaire items, a score of 8.00 was adopted as a cut-off benchmark for each dimension analyzed: 1) clarity of language, 2) pertinence of items, and 3) theoretical relevance. Items in which the measurement of the categories received a mean CCV of below 8.00 were discarded and not included in the final version of the questionnaire. Table 3 outlines the calculation inventory of the CCV.

Table 3 – Calculation inventory of the CCV to validate content from the instrument on innovation in the MH's procurement process of medicines

Item	Clarity of language	Practical pertinence	Theoretical relevance	Item Mean
1) Offers easy use	0.88	0.96	0.96	0.93
2) Provides a relative advantage to the physical process (role)	0.92	0.96	0.96	0.95
3) Can be tested	0.84	0.92	0.92	0.89
4) Is compatible with other systems of the MH	0.96	0.96	0.96	0.96
5) Is considered an innovation in the MH's procurement process of medicines	0.96	0.96	0.96	0.96
6) Generates intangible assets, such as improved security of information, in the MH's procurement of medicines	0.76	0.96	0.96	0.89
7) Promotes improvement in the work processes of public	0.96	0.96	0.96	0.96

servants involved in procurement of medicines				
8) Promotes an increase in the satisfaction of SUS users regarding the medicines acquired by the MH	0.88	0.96	0.96	0.93
9) Promotes transparency of information concerning the MH's procurement process of medicines	0.96	0.96	0.96	0.96
10) Promotes sustainability in the MH's procurement of medicines	0.80	0.92	0.96	0.88
11) Investment in R&D and innovation	0.84	0.96	0.96	0.92
12) Support for developing innovation within the agency	0.80	0.88	0.88	0.85
13) Provision of technological infrastructure for innovation	0.84	0.96	0.96	0.92
14) Perception that managers are the main sources of innovation within the agency	0.72	0.92	0.88	0.84
15) Perception that public servants are the main sources of innovation within the agency	0.68	0.92	0.92	0.84
16) Management of suppliers' demands to promote innovation	0.64	0.84	0.88	0,79
17) Management of users' demands to promote innovation	0.64	0.92	0.96	0.84
18) Development of innovation according to political priorities	0.80	0.96	0.96	0.91
19) Networking with other organizations to develop innovation	0.96	0.92	0.92	0.93
20) Adherence to innovation legislation	0.84	0.84	0.84	0.84
21) Use of innovation that is being adopted by other organizations with a compatible profile	0.84	0.92	0.92	0.89
22) Development of innovation according to competition with other public organizations	0.88	0.92	0.92	0.91
23) Availability of resources for investment in innovation	0.76	0.92	0.92	0.87
24) Influence of top leadership (management and upper advisory posts at levels 6, 5 and 4) in innovation development	0.68	0.88	0.88	0.81
25) Influence of top leadership (management and upper advisory posts at levels 3 and 2) in innovation development	0.68	0.88	0.88	0.81
26) Influence of top leadership (management and advisory post, level 1, and head of division) in innovation development	0.68	0.92	0.92	0.84
27) Application of risk management for innovation development	0.76	0.80	0.80	0.79
28) Existence of barriers to innovation development	0.92	0.92	0.88	0.91
29) Existence of facilitators for innovation development	0.92	0.92	0.88	0.91
30) Existence of incentives and rewards for those who innovate	0.88	0.92	0.92	0.91
31) Existence of conflicts that complicate innovation development	0.96	0.80	0.88	0.88
32) Existence of autonomy for public servants to develop innovation	0.96	0.96	0.96	0.96
33) Development of innovation based on skills and knowledge	0.64	0.84	0.84	0.77
34) Encouragement of creativity to develop innovation	0.88	0.96	0.96	0.93
35) Formation of multidisciplinary teams for innovation development	0.80	0.92	0.92	0.88
36) Perception that commitment to work influences innovation development	0.76	0.96	0.96	0.89
37) Perception that satisfaction with work influences innovation development	0.76	0.96	0.96	0.89
38) Sharing of knowledge concerning innovation development by the agency's units	0.76	0.96	0.96	0.89
39) Development of innovation strategy	0.76	0.84	0.84	0.81
40) Incentive towards collaboration and learning activities for innovation	0.88	0.88	0.88	0.88
41) Development of activities to diffuse innovation	0.80	0.92	0.96	0.89
42) Perception that the organizational culture favors innovation development	0.84	0.92	0.96	0.91
Totals	0.80	0.91	0.91	0.87

Source: Developed by the authors.

Following validation through the CCV model, items 16 and 33 received a score below 0.80, which was taken as the cut-off benchmark, and were then discarded from the final version of the instrument. Item 27 also

presented a score below 0.80, though since it was close to 0.80 and an important variable, it was included in the conception of the questionnaire.

Based on the contributions from the judges in the "notes" column in the form that was sent, the judges' collaboration was elicited through suggestions for developing the instrument, which represents a qualitative analysis, as a means of enhancing the quality of items. Drawing on these contributions, a new semantic validation was performed for the questions to be put to the MH. This validation provided some contributions that led to: the discarding of questions 3, 17, 22, 24, 25, and 26; as well as the incorporation of questions 30 and 31 into issues 28 and 29, since they address variables concerning the barriers to and facilitators of innovation. Furthermore, questions 1, 6, 8, 9, 10, 11, 18, 20, 37, 38 and 41 were reformulated based on these contributions.

Hence, the final version of the proposed questionnaire contains 32 questions about innovation, and it was filled in following the Likert scale entailing seven levels, varying from “Never” to “Always” or “Non-applicable (NA)”, as displayed in Table 4.

Table 4 – Instrument for analyzing innovation in the MH's process for public procurement of medicines

Section A – In this section, the questions verify the perception of the attributes of the Electronic Procurement Process (EPP) software			
Indicate the frequency and intensity with which EPP exhibits the following features and results			
Item	**Scale**		
1) Offers easy use	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
2) Provides a relative advantage to the physical process (role)	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
3) Is compatible with other systems of the MH	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
4) Is considered an innovation in the MH's procurement process ofmedicines	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
5) Generates intangible assets, such as improved security of information, in the MH's procurement of medicines	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
6) Promotes improvement in the work processes of public servants involved in procurement of medicines	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
7) Improves the procurement process for medicines acquired by the MH for subsequent distribution to states and municipalities	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
8) Promotes transparency of public information concerning the MH's process for procurement of medicines	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
9) Promotes sustainability in the MH's procurement of medicines, given that sustainability is a set of instituted measures that observe ecological norms so as not to harm future generations.	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
Section B – In this section, the questions verify the perception of the environment and structural conditions in which the EPP software was developed and functions			
In the context of the MH, indicate the frequency and intensity of management practices and of perceptions of the organizational environment for promoting innovation			
Item	**Scale**		
10) Investment in innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
11) Support for innovation development (through educational measures, incentives for diversity)	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
12) Provision of technological infrastructure for innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
13) Perception that managers are the main sources of innovation within the agency	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
14) Perception that public servants are the main sources of innovation within the agency	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
15) Development of innovation to serve political priorities	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
16) Networking with other organizations to develop innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
17) Adherence to innovation legislation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
18) Use of innovation that is being adopted by other organizations with a compatible profile	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
19) Availability of resources for investment in innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
20) Application of risk management for innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)

21) Existence of barriers, such as conflicts, to innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
22) Existence of facilitators, such as incentives and rewards, for innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
23) Existence of autonomy for public servants to develop innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
24) Encouragement of creativity to develop innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
25) Formation of multidisciplinary teams for innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
26) Perception that commitment to work influences innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
27) Perception that a focus on satisfaction with work influences innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
28) Sharing of knowledge concerning innovation development by the agency's units	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
Section C – In this section, the questions verify the perception of the MH's innovation process			
Indicate the frequency and intensity with which EPP exhibits the following practices concerning the innovation process			
Item	**Scale**		
29) Development of innovation strategy	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
30) Incentive towards collaboration and learning activities for innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
31) Development of activities to diffuse (propagate) innovation	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)
32) Perception that the organizational culture favors innovation development	0 (Never)	1 2 3 4 5 (Always)	NA (Non-applicable)

Source: Developed by the authors.

At the end of the validation process, the proposed questionnaire was developed with 32 items regarding innovation, in addition to five items concerning the socio-demographic profile of respondents, totaling 37 questions, aimed at assessing the perception that stakeholders associated with EPP have with respect to the variables outlined in the literature on innovation in the public sector. Thus, the content validation performed constitutes a mechanism for linking abstract innovation concepts to measurable indicators in the aforementioned context.

5 – CONCLUSIONS AND RECOMMENDATIONS

Validating the content of a given research instrument represents a means of enhancing its reliability in grasping the proportions at which the items constructed to measure a theoretical construct reflect all the important nuances of the concept to be measured (Pasquali, 1999). Thus, content validation is essential to infer the representativeness of items and in this sense, this article has outlined a proposal for an instrument to analyze the innovation present at the Ministry of Health, in order to optimize the public procurement process of medicines and health inputs, based on content validation. To this end, the (CCV), advanced by Hernandéz-Nieto (2002), was applied.

The article described all the procedures applied in the content validation, including the CCV, which is an important stage in developing the instrument proposed and creating a scale to measure innovation in the public sector, in the context of the MH's public procurement of medicines. However, there are other measures to assess the validity of instruments, as means to enhance their reliability, including the Kappa Agreement Coefficient to measure the theoretical dimension of items, referring to the ratio of the proportion of times judges agree to the maximum proportion of times judges could agree (Hernández-Nieto, 2002).

It is necessary to highlight that the innovation analysis, in the light of the instrument proposed, entails some limitations. Validating the innovation construct of the public procurement process of medicines clearly cannot offer generalizations for the instrument in statistical terms, though even the validation of the content of an instrument linked to specific contexts can be useful in gaining new methods for analyzing the innovation process in the public sector, as a way of increasing the quantity, quality and reliability of available instruments.

It is therefore evident that the validation of content from measurement and assessment instruments, applying techniques like the CCV, should be propagated, with the aim of enhancing the ability to measure precisely the reliability of the phenomena examined, thereby reproducing results consistently in time and space, with different observers (Pasquali, 1999; Netemeyer, Bearden & Sharma, 2003).

Furthermore, the instrument proposed following the process of validating the content described, made it possible to analyze each item individually, thus delimiting, by drawing on the literature suggested by the authors

Bloch et al. (2009) and De Vries, Bekkers and Tummers (2015), items that exhibit satisfactory psychometric properties and reveal an opportunity to analyze the innovation construct in the context of the Brazilian public sector.

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Automation and Craft-Based Management

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Abstract:

The principal thesis of this paper is that organizations, especially those affected by automation, require craft-based management to have an engaged and effective workforce. The first premise supporting this thesis is that automation reduces the algorithmic nature of work and increases the non-algorithmic nature of work involving creativity, context-sensitivity, and collaboration. The second premise supporting this thesis is that non-algorithmic work cannot be managed through the model of management as science but rather must be managed through the model of management as craft. In the paper, I examine the nature of non-algorithmic work and craft-based management as an alternative to algorithmic work and scientific management. I conclude by considering some general implications for selecting, organizing, and educating managers.

Keywords: Automation, Craft, Nature of Work, Management Philosophy, Practical Wisdom, Virtue
Word Count: 2723 (not including notes)

Main Text:

I: Automation and the Changing Nature of Work

Automation is not a new concept. As early as the fourth-century BCE, Aristotle speculated about the economic effect of statues that could perform the work of human beings.[1] A couple of hundred years ago, Karl Marx predicted that mature forms of capitalism would involve high levels of automation.[2] What does seem to be distinctively modern in current discussions of automation is a widespread anxiety about the disruptive effects of automation on the nature of work in technologically-advanced economies. Pessimistic forecasts of such disruption envision the elimination of a wide range of occupations – particular attention is given to the retail, food-service, and transportation, and manufacturing sectors, which employ a great number of people[3]; pessimists foresee a future without work for large groups of people along with associated social problems. Optimists, by contrast, accept that automation will disrupt the economy, but hold that new occupations will develop and expand to accommodate workers displaced from jobs lost through automation. One common example, cited by optimists, is the adoption of automated teller machines (ATMs) at banks from the 1970s and onward; instead of eliminating the occupation of bank teller, the number of teller positions increased as a result of banks being able to open more branches. While much of this debate concerns the scope of occupations that will be eliminated through automation and computerization, I think that it is more fruitful to think not so much about which jobs will be lost, but about how the character of work is changing as a result of technological developments.

It is unclear whether the example of the ATM will be representative of future disruption and displacement in other sectors of the economy (and so, whether this example warrants either the optimism or the pessimism described above). What is clear, however, is that automation has changed the character of retail banking to being more of a service-based profession: instead of processing deposits or doing other calculative tasks, tellers spend a lot of their time helping bank customers in a variety of non-calculative activities. While one can speculate about which types of occupations will be created and destroyed in the future, what can be observed now is the way in which automation is changing the character of a wide range of occupations. In general, I argue that work is becoming less algorithmic and more what I will call ‘phronetic’ in nature and that this has important implications for the structure of management within organizations.

Algorithmic labour is work that can be formalized into a series of discrete, well-defined steps that involve processing a given input to a determined output. Examples of algorithmic labour by human beings include such things as operating a keypunch, guiding an object down an assembly line, or even underwriting insurance. Due to its

[1] *Politics* 1.1253b

[2] 'Fragment on Machines', *The Grundrisse*

[3] See, for instance, the influential 2013 Oxford Martin study by Frey and Osborne, "The Future of Employment: How Susceptible are Jobs to Computerisation?".

algorithmic nature, such labour is highly susceptible to automation – indeed, the first example above represents a task that has been fully computerized and is no longer done by human beings; the second has been significantly automated with the use of robotics; and the third is beginning to be automated through artificial intelligence systems. Many, if not most, occupations involve some degree of algorithmic labour. Where such labour constitutes the entirety of an occupation, the occupation is at risk of being automated entirely. But a large number of occupations are only partly composed of algorithmic labour. In cases where automated processes are more efficient and cost-effective at performing such labour, these occupations will become less algorithmic in nature as people in these professions focus more on tasks that cannot be automated (or are much more difficult to automate). This has fairly serious implications for job design, so I will argue.

In contrast to algorithmic labour, there are tasks involving creativity, ambiguity, context-sensitivity, and social interaction, which cannot be neatly framed within the bounds of a well-defined algorithm. Such tasks are extremely difficult to automate, if not impossible. This type of labour is phronetic in character. The word 'phronetic' derives from the Ancient Greek word *phronesis*, which is often translated into English as 'practical wisdom'. Phronetic labour, then, should be understood as work that requires practical wisdom to be done effectively.[4] For Aristotle, the ancient Greek philosopher, practical wisdom has two important aspects: first, it is an intellectual virtue, or power, that involves deliberating about the appropriate means to achieve a given end or goal in situations of uncertainty; and second, it is a moral virtue that involves choosing and performing the right action at the right time in keeping with the development of a good character.[5] It is often the presence or lack of practical wisdom that respectively determines whether a professional is effective or ineffective in their work. For instance, a good physician neither overprescribes nor underprescribes medications, but prescribes the right amount to promote the health of her patients and does so with integrity of character. Phronetic labour involves reasoning about means and goals where flexibility and attention to context is important; and it has a social dimension, such that the moral virtues are necessary for it to be done effectively.

Understanding the phronetic aspects of work – especially as the algorithmic aspects of work become increasingly automated – has important implications for job design theory. It is better to consider jobs not as static positions that are fully-specified within a regimented system, but rather as dynamic, flexible, and semi-autonomous roles understood within the model of a craft. Amy Wrzesniewski, a specialist in organizational behavior, argues that employees should be seen as active crafters of their work in how their job is designed.[6] Job-crafting consists in an employee being able to deliberate about how best to realize certain goals relevant to her role within an organization and it involves structuring a position to include variety, complexity, skill development, limited autonomy, and a sense of how one's work contributes to the welfare of others. Job-crafting can be applied to a broad range of occupations and it has the effect of increasing employee engagement.[7] As Wrzesniewski shows in her research, hospital custodians with an understanding of the goals and purpose of their organization and the freedom to exercise judgment in their work regarding that purpose report high levels of job satisfaction.[8] These high levels of job satisfaction in turn increase employee engagement and effectiveness which makes an organization more productive.

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[4] My discussion of phronetic labour is indebted to Keith Breen's discussion of phronetic production in 'Production and Productive Reason', pp. 619-623.

[5] *Nicomachean Ethics*, VI.5

[6] 'Crafting a Job: Revisioning Employees as Active Crafters of their Work'

[7] According to the psychologist Barry Schwartz, organizations are capable of both vicious and virtuous cycles when it comes to structuring their work environment (*Why We Work*, p. 27). A virtuous cycle occurs when an organization provides employees with an environment that allows them to flourish in the ways described above: this leads to better work, which yields positive emotion that in turn leads to even better work. A vicious cycle, however, occurs when an organization suffers some setback and implements a system of rules and incentives, which in turn creates further setbacks by disengaging employees from their work. Underlying this vicious cycle, according to Schwartz, is a faulty view of human nature that sees human beings as primarily motivated by extrinsic factors such as money and fear, rather than the intrinsic value of their work (*Why We Work* p. 11ff.).

[8] 'Crafting a Job: Revisioning Employees as Active Crafters of their Work', pp. 191-192

As Jeffrey Pfeffer argues in *The Human Equation*, the success of a company overlaps with its capacity to provide meaningful work for its employees.

II: Models of Employee Management

In the previous section, we made a distinction between algorithmic and phronetic labour in understanding the character of the work done by employees. A related distinction can be made regarding the nature of managing these different forms of labour: algorithmic labour is best organized by management as science, but phronetic labour is best organized by management as craft. In this section, I wish to develop the distinction between these two models of management and argue for the superiority of craft-based management with regard to the increasingly phronetic character of work.

Scientific management owes its origins largely to Frederick Winslow Taylor's *The Principles of Scientific Management* published in 1911.[9] Taylor argued that workers, much like machines, could be scientifically managed in such a way as to be more efficient and productive. Taylor contrasts his new form of management with an older form of arranging work, a kind of craft-based management. In the older form, according to Taylor, workers were largely responsible for the manner and method of production. The role of management was limited to cultivating the initiative of the worker through different forms of incentive; Taylor argues that this form of management leads to great inefficiencies since too much is left to the initiative and judgment of the worker. In place of the old 'worker-first' system, Taylor proposes that workflow should be partitioned into discrete tasks, each of which is analyzed, systematized, and ultimately optimized for the sake of productivity. In this picture, the old 'rule-of-thumb' of the worker is replaced by scientific standardization, in which a centralized management takes the traditional knowledge of the worker and classifies, tabulates, and reduces it to a system of rules, laws, and formulae. Work, then, essentially becomes subdivided into a series of algorithmic tasks that maximize productivity. Taylor thinks that this systematization can be applied very broadly; indeed, he notes that one of the principal objects of his text is to illustrate that 'every single act of every workman can be reduced to a science'.[10] But this is an overstatement and reads more like an aspiration than a well-grounded fact. It is, however, beyond the scope of this paper to resolve the question whether all forms of labour, including phronetic labour, can be characterized algorithmically – and, in so doing, making it possible that all forms of labour might be automated. What can be said, however, is that there is a wide range of labour, especially phronetic labour, that cannot be framed within the bounds of well-defined algorithms and thus that cannot be managed scientifically. Accordingly, space should be made for a craft-based model of management, but one more robust than the version described by Taylor.

A craft-based model of management is the appropriate method for organizing phronetic labour to be productive within an organization. Within the craft-based model of management, the relationship between manager and employee is similar in many respects to the relationship between master and apprentice in the skilled trades or fine arts. If we understand work as a craft, the role of the manager is to facilitate the growth of judgment and skill within their employees – in other words, to guide workers to become better practitioners of their craft. To do this effectively, a manager must have some subject-matter expertise in the craft that they manage[11]; they must,

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[9] Taylor, however, should not be given full credit here. His system largely owes to the prevailing ethos of the time that science could be used to mathematize descriptions of natural processes in order to predict and control them. Relatedly, part of the impetus behind the development of the human sciences, such as economics, was to mathematize descriptions of human processes in order to predict them and facilitate better forms of social organization. Taylor's work should be understood against this backdrop as an application of this ethos to the nature of management.

[10] *Principles of Scientific Management*, p. 64. Taylor, furthermore, thinks that this system should be applied beyond industry to all walks of life, including the trades, agricultural work, churches, philanthropic organizations, government, the home, and the university.

[11] In large organizations, lower-level and front-line managers should themselves be good practitioners of the craft they manage (e.g., a kitchen should be managed by a chef, the construction of a bridge should be managed by an engineer, a university department should be managed by an academic, etc.). Senior-level managers, however, should be generalists with a broad understanding of the organization and its niche within the economy, but who also know

furthermore, possess a good character formed of certain virtues. To see why, it is helpful to think about the nature of work as a craft according to the philosopher Alasdair MacIntyre's concept of practices.

For MacIntyre, a practice involves both internal goods and standards of excellence. Music, for instance, possesses goods concerning beauty, intellect, and emotion. Concerning standards of excellence, we can tell the difference between good music and bad music with regard to the skill of the musician in facilitating these goods. Effective practitioners of any craft must come to appreciate these internal goods and to develop their skillset to meet the standards of excellence within their practice. A practice is social by nature: in order to master a craft, we must place ourselves in the appropriate relationship to other practitioners and beneficiaries of our craft. Good relationships amongst the various stakeholders of a practice are necessary for the healthy functioning of that practice. MacIntyre holds that certain virtues are necessary to sustain a practice:

> We have to learn to recognize what is due to whom; we have to be prepared to take whatever self-endangering risks are demanded along the way; and we have to listen carefully to what we are told about our own inadequacies and to reply with the same carefulness for the facts. In other words, we have to accept as necessary components of any practice with internal goods and standards of excellence the virtues of justice, courage, and honesty.[12]

Managers of phronetic labour within a craft practice require both the knowledge of the practical aspects of the craft – its exercise and standards of excellence – and the virtues to develop and maintain the healthy relationships necessary to help form employees as effective practitioners.[13]

Contrary to Taylor's sharp distinction between scientific management and craft management, I think that the craft-based model of management can be framed to include not only phronetic labour, but also the scientific management of algorithmic labour. Many craft practices are composed of both phronetic and algorithmic tasks. For instance, designing computer software has an obvious algorithmic dimension; but it also has important phronetic aspects, such as determining whether software meets a user's needs or engaging in certain kinds of troubleshooting. A good manager requires the practical wisdom to know the difference between situations that involve algorithmic labour and those that involve phronetic labour and how to organize work in such a way that allows automated, algorithmic processes to support the phronetic craft development of employees. In particular, managers who overextend a model of scientific management may do serious harm to the productivity of an organization in the following ways: treating employees as machines to be inflexibly regimented; attempting to evaluate the health of an organization solely through quantitative measures; and in failing to evaluate whether automated processes are actually benefitting an organization and its stakeholders. Management itself is a phronetic activity that cannot be reduced to a science.

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enough of the specific functions within the organization to coordinate lower-level managers. Another way of thinking of this is that lower-level managers are more closely engaged with the core productive practices of the organization while higher-level managers focus more broadly on sustaining the organization as an institution. For more on this, see Geoff Moore, *Virtue at Work*, pp. 108-109.

12 *After Virtue*, p. 191

13 In addition to employee management, managers – especially those at senior levels – must focus more broadly on managing the institutional aspects of their organization, which sustain its core productive practices. Healthy organizations, for instance, need to be fiscally responsible, compliant with various regulations, and aware of wider economic forces. Failure in these and other areas may harm the core productive practice of an organization. A bankrupt auto manufacturer, for example, cannot design and build cars. But in focusing on these institutional issues, managers should never lose sight of promoting the core productive practices of their organization. Compromising the core practice of an organization for the sake of external goods – say, by cutting research and development funding to engage in stock buybacks when an organization is profitable – is a form of bad management. For the distinction between managing core productive practices and managing institutional aspects of organizations and balancing the two, see Moore, *Virtue at Work*, pp. 107-109.

III: Implications for Selecting, Organizing, and Educating Managers

The craft-based model of management suggests that managers should have a range of relevant qualitative and quantitative skills. Phronetic labour involves understanding the effective use of algorithmic processes in order to make a craft more productive. Managers must both understand the nature of the work they manage in its phronetic and algorithmic aspects and know how guide the development of employees as effective practitioners. Frontline managers should be selected who are themselves good practitioners of the craft performed by the organization hiring them and senior managers should either be practitioners or demonstrate an aptitude to learn about the internal goods and standards of excellence associated with the core productive practice of their organization. In addition to the algorithmic and quantitative skills necessary for the job, managers should also be selected on the basis of possessing sound practical wisdom, including moral character (i.e., the virtues of justice, courage, and honesty) and the ability to deliberate about how best to achieve the goals of the organization, especially in situations of ambiguity and uncertainty. It is only on the basis of these traits that managers are able to facilitate the development of employees as craft practitioners and to run the institutional aspects of an organization to support its core productive practice.

By making a sharp distinction between managers and employees, scientific management has the tendency to create bloated bureaucratic structures that can weigh an organization down. Indeed, the example of efficient scientific management most touted by Taylor, the algorithmic loading of pig iron at Bethlehem Steelyard, was actually a failure: the consulting costs of Taylor and his team outweighed any savings brought about by the implementation of Taylor's methods. One can find examples of this type of failure up to the present day. In contrast to scientific management, craft-based management removes the sharp distinction between managers and employees in recognizing that all should deliberate about realizing the aims of an organization. As a result, some administrative responsibility can be given to employees as they demonstrate an ability to make decisions promoting the good of the organization as effective craft-practitioners. This has the benefit of making organizations administratively leaner. Here it is worth making a distinction between management – that is, the administrative tasks necessary for running any organization – and managers, professionals whose job is devoted to these tasks. In facilitating the growth of practitioners who are able to deliberate about how best to realize the goals of their organization, managers are able to download some of the function of management to employees. This decentralizing of management can benefit an organization by lowering the amount of administrative overhead and also by making it more flexible and effective in meeting day-to-day challenges as employees are empowered to make administrative decisions.

Management education should include a strong emphasis on the development of practical wisdom, in addition to gaining relevant technical skills. In particular, management should not be taught as though it were something essentially quasi-scientific, rational, and quantitative. While a high degree of numeracy and other quantitative skills are important for managers, management should be taught as an art with regard to making decisions and guiding practices in situations involving ambiguity and uncertainty where practical wisdom, virtue, and context-sensitivity are necessary. This means that the education of managers should broadly include a high degree of literacy, numeracy, critical thinking, and mentorship in practical wisdom. Examples of such education include taking a wide range of courses, using case studies that hone the traits described above, and having the opportunity to work with experienced managers in the field who possess practical wisdom.

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Formulation of Strategy and its Impact on Financial Performance

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Abstract

This research is aimed at identifying and compiling effective strategies on the performance of the company's team to achieve the highest performance according to Return on Total Assets (ROA) and Return on Equity (ROE) indices. In this research, strategies have been developed using the strengths and weaknesses of the internal environment, opportunities, and environmental threats. After identifying effective strategies, in the next step, the main criteria that the company has weighed through the method of group hierarchy process analysis is identified, as well as the strategies adopted by the Topsis method are prioritized. These strategies included: selecting a target market to implement market penetration strategy (Pars Special Energy Economic Zone); - collaborating with companies with higher financial, technical and specialized capacities to implement the partnership strategy; - upgrading the equipment and technology of the company; - improving the certification rankings. Qualification of the company's contract, in order to be able to participate in bigger tenders - Establishment of a quality management system and development of methods and procedures for all activities of the company. In the next step, how to implement the strategies adopted in the years 2006-2016, and finally, the financial performance of the company in the management of the old (2001-2005) and new management (2006-2016) is analyzed, and analyzed The impact of strategy development on improving the business environment and enhancing the performance of the company's team will be addressed. Finally, according to the specialties of the company's managers in the activities of oil and gas, the strategy of choosing a suitable target market, namely, the penetration of the Pars Special Energy Economic Zone market and the partnership strategy with the companies with higher capacity, were selected as the best strategies, the results of which are indicative of success. The team has participated in tenders, gaining an acceptable share of the market and also creating value for the company by increasing the performance according to the above-mentioned indicators.

Keywords: Strategy Formulation, Internal and External Factors, SWOT Matrix, Gross Income

1. Statement of the subject

Today, governments tend to mitigate their administrative and executive structures, and all of them try to outsource executive activities and focus on the direction and control of national projects. In Iran, in the last two decades, much of the government's executive activities have been delegated to the private sector, and the government has summarized its main responsibility for policy-making and the direction and control of these policies and monitors only the good conduct of its activities. Contractor companies are operating as an executive arm in various industries

But given that these companies are mainly subject to the policies and strategies governing their industry, they face more varied conditions in comparison with manufacturing companies, and they have less independence in the process of determining and deciding Enjoy. Therefore, monitoring environmental conditions, awareness of opportunities and threats ahead, analyzing the weaknesses and strengths of these organizations is very important and makes them better than the development of their goals and policies. Because the size and volume of the activities of the Ministry of Oil are so much that it is possible for all state-owned companies to carry out all activities, it is very difficult and requires a huge investment in the attraction of manpower, equipment and machinery, technical knowledge and... The Ministry of Oil entrusts its activities through the bidding mechanism to contractor companies or qualified advisors. Like other organizations, these companies are under the influence of the environmental and internal factors governing the industry. Hence, by knowing and analyzing the correct environmental variables and turning threats into opportunities and reducing the weaknesses and increasing the strengths, they should provide the prosperity and development of themselves and this industry, and how can they compete with other contractors Abducting a larger share of the labor market, and which strategies are successful in increasing financial performance. In this research, two stages of the management of the company's team have been investigated. The first phase relates to the old management of the company during the period from 2001 to 2005 and the second phase is from 2006 to 2016 and is related to the new management period.

2. Theoretical background and background

In addition to goals such as entrepreneurship, prosperity and ... the main goal of each company and firm is to work in the business market, obtaining the maximum market share and, ultimately, maximizing the profit of its organization. Companies have found that it is feasible to achieve preset goals only in the light of the elaboration and implementation of appropriate strategies. Therefore, developing a strategy with respect to changing political, economic, social and ... situations are very important and organizations should, in addition, Examine the internal and external environment and analyze the conditions of competitors, develop appropriate strategies.

According to Chandler, the strategy is An integrated, integrated plan that addresses organizational strengths and weaknesses to opportunities and environmental threats to achieve the goals of the organization (Chandler, 1969). According to Peter's definition, the strategy is simply to bring the organization from the current state to the ideal state (desired). (Pahlavanian, 2006). Kouzada believes that: The strategy is the relation between the medium and the goal (Kavazada, 2009). James Robin Quinn says the strategy is a pattern or design that combines the goals of the organization's policies and chains in an interconnected whole. Jack Welch, CEO of GE, was the first company to carry out strategy studies. The strategy is defined as follows: the strategy is to try to understand where we stand in the world today and not how we would like to see where we want to go. Instead, we need to look at where we want to reach (apostates, 2006). In the new strategic management perspective, questions about Future: What are the factors affecting the organization? What are the new competencies we need to get them? Should we change ourselves to create such competencies? (Lewis, 2008). Today, at the beginning of the 21st century, most governmental and non-governmental organizations in Western countries have adopted strategic management (Ventinen, 2009).

The strategy development process provides contractors with the opportunity to properly assess the opportunities and threats of their environment and obtain a precise and expert view of their position in the business market. In order to realize the main objective of the research, the following hypotheses can be elaborated:

Hypothesis 1: Developing and implementing a strategy to improve the business environment of the company is influential.

Second hypothesis: The formulation and implementation of the strategy in the financial performance of the company has a positive effect.

Hypothesis 3: In terms of changing political, economic, social and long-term strategies, they do not have the necessary efficiency.

Fourth hypothesis: in political, economic, social and ... conditions, strategies should be reviewed and, if necessary, revised in different time periods.

3. Framework for strategy formulation

A strategy is an approach that guides the organization to the best possible response to environmental factors (opportunities and threats). The result of this approach is to create a competitive advantage for the organization (Ghaffarian, 2007). Each of these definitions has a specific application in terms of the environment and strategic thinking. The strategy is a kind of innovation, and it focuses on the future. It is based on the direction of the managers, and the result will be determined when it has been accomplished. The wooden strategy was used to formulate a strategy. This framework provides tools and methods that are appropriate for a variety of organizations in a variety of sizes and helps strategists identify, assess, and select strategies. This framework has four main stages: (David, 2010)

1) Starting phase: At this stage, the mission of the designated organization and mission statement are prepared.

2) Input stage: In this step, the basic information required for strategy development is specified. This step involves identifying internal factors and external factors. More knowledge that can be obtained internally and externally leads to a shift in missions, even in the strategic management process. (Torallo, 2007)

3) Comparison Stage: At this stage, according to the information obtained from the previous steps, considering the mission of the organization, the main internal factors (key strengths and weaknesses) and the main external factors (opportunities and threats Strategic) is being adapted, and in fact there is a kind of balance between them. At this stage, internal and external factors are adapted using a variety of tools to identify strategies that are in line with the mission of the organization and are appropriate to internal and external factors. The tools used at this stage to adopt the factors are swat matrix and internal and external matrices. SWOT analysis of external and internal factors is explored to identify the opportunities threats to the strengths and weaknesses of the organization in the future and to develop appropriate strategies to address them (Marcoussa, 2009).

4) Decision Making Stage: Finally, using the Analytical Hierarchy Process and Expert Choice software to identify and select strategies are used.

4. Methodology

The present research is a descriptive and analytical study in which information gathering has been done through library and field studies. Also, Isar was research in the field of information gathering, questionnaires, and interviews. In this research, the method of data collection is as follows: First, using library research and studies (articles, books, dissertations) related to the subject, extracted some of the internal and external factors for the strategy's elaboration. And then, using the interview, we will collect supplementary internal and external factors. Then the matrices of SWAT will be discussed and we will discuss with the experts the ways and strategies to be taken. In the following, we prioritize and weigh the main criteria of the company to formulate the strategy through the hierarchical process of group process and finally, prioritize and rank the strategies derived from the SWAT matrix according to the main criteria using the TOPSIS method and the opinion of the experts. will be. Then, by looking at the company's documents, it collects information about how the company's financial strategy and performance are implemented. In other words, in order to analyze the research data, some methods such as SWAT, TOPSIS, and hierarchical analysis process (in order to prioritize strategies) and using specialized software have been used. This research includes two periods of years (2001-2005) and (2006-2016), but the main focus of the research was from 2006 to 2016, and the

collection of information and their analysis and analysis lasted 6 months. Also, the community surveyed included Meam Team in Tehran and other projects of the company located in Pars Special Energy Economic Zone, Ahvaz, Shiraz and Abbas harbor.

5. Data analysis

In this research, we propose a general methodology for choosing and designing a strategy in which two methods of multi-criteria decision making have been used, including the group hierarchical analysis process, TOPSIS. In this regard, the following steps are followed:

Step 1. Determine the mission statement of the team by experts:

"The company intends to become one of the first-rate companies in the contracting sector by improving the quality of service delivery with the approach of increasing the satisfaction of employers and continuously improving the technical, qualitative and specialized capabilities of the company and the manpower employed there."

Step 2. Identification of internal factors (strengths and weaknesses) and external factors (opportunities and threats) Based on previous research and interviews with experts:

Table 1. Internal factors based on Michael Porter's value chain model

		Value Chain	Strengths	weak points
Identification of internal factors Value Chain	**Main activities**	**Services**	-	1) Inappropriate project control and quality control system 2) lack of deployment of the quality system 3) Lack of quality policy to enhance customer demand 4) Dissatisfaction of previous employers with project implementation
		And the marketin g and oven	1) Take advantage of the relationships and experience of the new trading team	1) The lack of a well-documented trading system
		Extra Logistics	1) In contracting companies, according to the type of work, external logistics is more focused on delivering raw materials and equipment purchased to the site for the implementation of projects.	
		the operation	-	1) The absence of any major executive project in the past few years 2) Low productivity in the company
	Support activities	**Internal logistics**	-	1) Lack of operational procedures in any of the company processes
		Company infrastructure	1) The existence of sufficient financial capital in the company	1) The lack of an organizational structure

			to promote the level of technology 2) long history of the company	2) The absence of an adequate accounting system to estimate the immediate cost 3) lack of a clear plan and strategy for the future At Company
		Human resources management	1) The sense of job security for employees due to the superior look of managers to the human resources 2) Having young, expert and motivated manpower	1) Failure to establish a suitable occupational safety system HSE 2) The lack of proper engineering in the company 3) Lack of proper incentive system
		technology development	1) The proper condition of modern machinery and equipment, which is very rare in Iran	1) No research and investigation to produce high-profit margins
		Procurement	-	1) low quality of some **of the** equipment provided by suppliers.

Table (2) Identified external factors based on macro-environmental factors (PEST)

	Macro environment factors	**the opportunity**	**Threat**
Swimming swimmers external factors **P** **E** **S** **T**	**Agents or forces Political**	1) The unwillingness of foreign contractors to attend oil projects due to political circumstances 2) The announcement of new policies of the Ministry of Oil on the support of domestic companies and domestic investors in the oil and gas and petrochemical industries	1) Obstacles created to supply goods and equipment from abroad 2) Opening credit documents (LC)Rounded face many obstacles should be of
	Agents or forces Economic		1) High inflation rate 2) Severe exchange rate fluctuations in the market 3) Increase in manpower and labor wages
	Agents or forces social	1) A young and cheap labor force and a high unemployment rate	

		2) increase the average level of education and technical knowledge 3) Highly experienced and experienced human resources in the community	
	Factors or technological forces	1) Use of day technology to implement large oil projects It is easier than before	1) Low-quality equipment in Iran relative to the world

Table (3) - External factors identified based on Porter's five competitive forces model

	Five Porter Competitive Forces	**the opportunity**	**Threat**
Identification of external factors The Five Competitive Force	**Potential competitors (Threatening new rivals Enter)**	1) Entry into the contracting field, in particular, the contracting in the petroleum and gas industry requires high investment and the availability of expensive machinery and equipment, so entry into this industry has its own barriers and problems. (2) The laws and regulations that the Strategic Vice Presidential Executive has put in place for certification of contracting authority, faces newly established firms with many barriers	1 The presence of state-owned and quasi-governmental companies that use different rents and lobbies poses a major threat to private and independent contractors. Is.

		to start-up activities.	
	Alternative products (Threat of products or services replaced)	-	-
	Bargaining power of buyers	-	1) Given that the main customer of the contracting services is government companies, they naturally have a lot of leverage, depending on their nature and the support of the state-owned group. They are.

	Five Porter Competitive Forces	**the opportunity**	**Threat**
Identification of external factors The Five Competitive Force	**bargaining power Suppliers**		1) Due to the existing political conditions, suppliers, especially foreign suppliers, have taken full advantage of the sanctions imposed on Iran, which has increased the bargaining power of suppliers.

	Industry rivals (Competition among existing competitors)	1) Increasing the power of the company against competitors based on the composition of the board of directors and shareholders	1) The bidding o f competing companies in some tenders is sometimes lower than the initial estimate of the employer 2) Rivals sometimes weaken the position of the company, compared with them, in terms of financial strength by forming a large consortium among themselves.

Step 3- Formation of the SWAT matrix and providing solutions by experts, screening and selecting the most important strategies:

Table 4: Identified external factors based on macro-environmental factors (PEST)

Matrix SWOT	**Strengths S_** ∗ Take advantage of the relationships and experience of the new trading team ∗ Thirty years of the company record ∗ Existence of sufficient funds in the company to promote the level of technology ∗ The proper condition of modern machinery and equipment, which is very rare in Iran.	**weak points _ W** ∗ Lack of administrative procedures in the company ∗ Inappropriate project control and quality control system ∗ Lack of proper financial accounting system ∗ Lack of organizational structure ∗ Low Productivity ∗ Lack of appropriate motivational system ∗ Absence in any major project in the past few years

Opportunities O _ ∗ Hard rules for obtaining a certificate of contracting authority ∗ Increasing strength against competitors based on the composition of the board of directors and shareholders ∗ The difficulty of entering new contractors and Rafaba into this industry ∗ Unwillingness of foreign contractor to work in Iran ∗ Government supportive policies ∗ The high level of the workforce in the community	**Strategies (SO)** ∗ Upgrade of equipment and technical equipment ∗ Improvement of the certification of the qualification of the company's contract, in order to achieve greater participation in tenders.	**Strategies (WO)** ∗ Establishment of Human Resources Management System (recruitment, recruitment, training,etc.) ∗ Establishing an appropriate accounting system in order to obtain accurate financial information Establishing a quality management system and formulating procedures and procedures for all activities of the company
Threats _ T ∗ The formation of a consortium between several rival companies and participation in projects ∗ The lower prices of rivals compared to the employer's estimate ∗ The presence of state and non-governmental companies ∗ Issues related to the opening of a credit document ∗ High inflation rate	**Strategies (ST)** ∗ Selection of a Target Market to Implement Market Attendance Strategy (Pars Special Energy Economic Zone)	**Strategies (WT)** Collaboration with companies with higher financial, technical and specialized capacities in order to implement the partnership strategy

Step 4. Performing a Paired Comparison between the Priority Criteria and Weighting the Criteria for Compilation by the Analytical Hierarchy Process Process by Expert Choice Software:

Table 5, group decision matrix from 5 decision makers

Employers/ MarketOutcome	**Technical capability and equipment**	**Efficiency**	**Service delivery**	**Employer Satisfaction**	**Sweney**	**DM A group** **Inconsistency rate: 0.077**
4.92	**4.28**	**1.7**	**3.59**	**6.18**		**Sweeney**
0.34	**0.31**	**0.26**	**0.26**			**Employer Satisfaction**

2.05	**0.52**	**0.27**				**Variety of services**
4.28	**4.57**					**By the way**
3.90						**Technical capability and equipment**
						Employer / Market Vari ation

As a result, weights of each of the criteria are extracted:

Table (6), weights of the main criteria

row	Criterion	Weight
1	**Sweeney**	**0.339**
2	**By the way**	**0.317**
3	***Technical capability and equipment***	**0.144**
4	**Variety of services**	**0.09**
5	**Employer / Market Variation**	**0.073**
6	**Customer Satisfaction**	**0.035**

Step 5: Finalizing Priority and Ranking the Strategies Obtained from the Swat Matrix with respect to the Main Criteria Using the Topsis Method (Questionnaire 2):

After determining the weights of each criterion, it is time to prioritize the strategies using the TOPSIS method is. In this step, the questionnaire (No. 2) is distributed, which you can see the results of these questionnaires distributed among experts and peoples in the following tables.

Table 7: Group Assessment of Strategies Based on Evaluation Criteria by 5 Decision-makers

Employers / Marketplace	Technical capability and equipment	Efficiency	Provision of services	Employer Satisfaction	Sweeney	DM group
5.9328	**7.1304**	**6.28**	**7.7327**	**5.471**	**8.36**	Establishing a quality management system and developing executive

						procedures and procedures for all activities of the company
2.7019	**7.1374**	**6.04**	**3.2875**	**3.898**	**4.573**	Establishing an appropriate accounting system in order to obtain accurate financial information
2.4915	**2.4915**	**3.39**	**2.7019**	**5551**	**4.373**	Upgrade of equipment and technical equipment
5.578	**6.7875**	**4.74**	**5.9084**	**8.586**	**5.908**	Improvement of the certification of the qualification of the company's contract, in order to achieve greater participation in tenders.
2	**5.8515**	**7.13**	**1.6438**	**3.288**	**7.505**	Establishment of Human Resources Management System (recruitment, recruitment, training, etc.)
8.1907	**7.1599**	**4.78**	**7.1599**	**6.575**	**7.95**	Collaboration with companies with higher financial, technical and specialized capacities in order to implement the partnership strategy
6.9207	**6.9035**	**7.76**	**7.1895**	**6.645**	**8.586**	Selection of a Target Market to Implement Market Attendance Strategy (Pars Special Energy Economic Zone)

Now using the TOPSIS method and with the help of Excel software, priority is given to strategies:

Step One - Convert the existing decision matrix to an "unbalanced" matrix using the formula:

$$nij = \frac{rij}{\sqrt{\sum_{i=1}^{m} r^2 ij}}$$

N_d

	0.455	0.366	0.523	0.402	0.421	0.421
	0.249	0.261	0.222	0.387	0.421	0.192
	0.238	0.171	0.183	0.217	0.147	0.177
	0.321	0.574	0.400	0.304	0.400	0.396
	0.408	0.220	0.111	0.456	0.345	0.142
	0.432	0.440	0.484	0.306	0.422	0.581
	0.467	0.444	0.486	0.497	0.407	0.491

$W = \{w_1 w_2, \ldots, w_n\} \approx$ **(From DM)**

$$V = N_D W_{n\times n} = \begin{pmatrix} V_{11} & \mathsf{K} & V_{1n} \\ \mathsf{M} & \mathsf{O} & \mathsf{M} \\ V_{m1} & \mathsf{L} & V_{mn} \end{pmatrix}$$

$V=N_d*Wn*n$

0.154	0.116	0.075	0.036	0.031	0.015
0.084	0.083	0.032	0.035	0.031	0.007
0.081	0.054	0.026	0.020	0.011	0.006
0.109	0.182	0.058	0.027	0.029	0.014
0.138	0.070	0.016	0.041	0.025	0.005
0.147	0.139	0.070	0.028	0.031	0.020
0.158	0.141	0.070	0.045	0.030	0.017

Step 3 - Define the ideal solution and the ideal-negative solution for the ideal (A +) and ideal-negative (A-) option:

For an Ideal Option:

$$A^+ = \left\{ (\max V_{ij} \,|\, j \in J), (\min V_{ij} \,|\, j \in J') | i = 1,2,..,m \right\} = \left\{ V_1^+, V_2^+, ..., V_j^+, .., V_n^+ \right\}$$

For the ideal negative option:

$$A^- = \left\{ (\min V_{ij} \,|\, j \in J), (\max V_{ij} \,|\, j \in J') | i = 1,2,..,m \right\} = \left\{ V_1^-, V_2^-, ..., V_j^-, .., V_n^- \right\}$$

Step Four - Calculate Separation Size (Distance)

The distance between the I option and the ideal using the Euclidean method is as follows:

$$d_{i+} = \left\{ \sum_{j=1}^{n} (V_{ij} - V_j^+)^2 \right\}^{\frac{1}{2}}; i = 1,2,...,m$$

$$d_{i-} = \left\{ \sum_{j=1}^{n} (V_{ij} - V_j^-)^2 \right\}^{\frac{1}{2}}; i = 1,2,...,m$$

d1+	0.067	d1-	0.116
d2+	0.132	d2-	0.042
d3+	0.161	d3-	0.010
d4+	0.056	d4-	0.139
d5+	0.130	d5-	0.065

d6+	0.048	d6-	0.123
d7+	0.042	d7-	0.133

Step Five - Calculate the relative closeness of Ai to the ideal solution. We define this relative closeness as follows:

$$cl_{i+} = \frac{d_{i-}}{d_{i+} + d_{i-}}; 0 \le cl_{i+} \le 1; i = 1, 2, ..., m$$

It will be seen that if $A_i = A^+$, then $d_{i+} = 0$, and we will have $cl_{i+} = 1$ and if Ai=A-, then di-=0 and cli+=0 . Therefore, as far as the Ai option is close to the ideal solution (A +), the value of cli + will be closer to the unit.

cl1	0.634
cl2	0.239
cl3	0.060
cl4	0.714
cl5	0.335
cl6	0.721
cl7	0.761

Step Six - Ranking Options. Based on the cli + descending order, you can evaluate the available options of the hypothetical problem, which you can see in the table below.

Rating	Strategy	Weight
1	Selection of a Target Market to Implement Market Attendance Strategy (Pars Special Energy Economic Zone)	0.761
2	Collaboration with companies with higher financial, technical and specialized capacities in order to implement the partnership strategy	0.721
3	Improvement of the certification of the qualification of the company's contract, in order to achieve greater participation in tenders.	0.714
4	The establishment of a quality management system and the formulation of procedures and procedures for implementation of all activities of the company	0.634
5	Establishment of Human Resources Management System (recruitment, recruitment, training, etc.)	0.335
6	Establishing an appropriate accounting system in order to obtain accurate financial information	0.239
7	Upgrade of equipment and technical equipment	0.060

6-Conclusion

Hypothesis 1: The Meam Team has achieved a good market share by implementing 19 projects over five years (2006 to 2016), compared to 2001 to 2005 years in which the company was active in only one project. Chart (1) shows a good improvement in the business environment of the company.

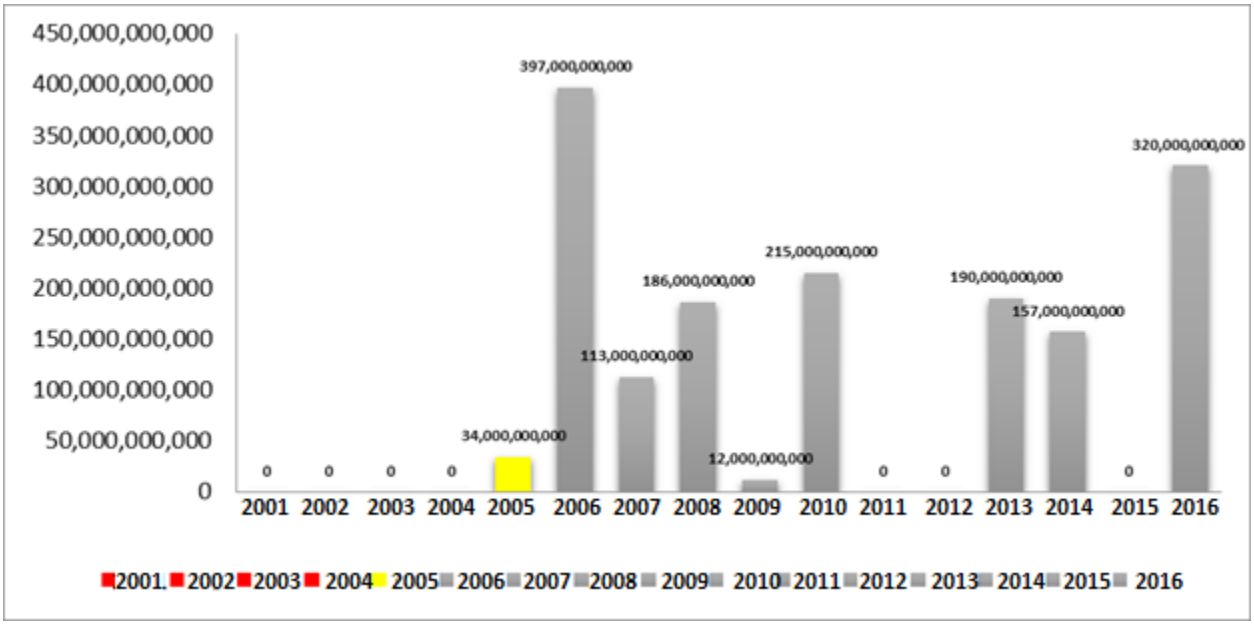
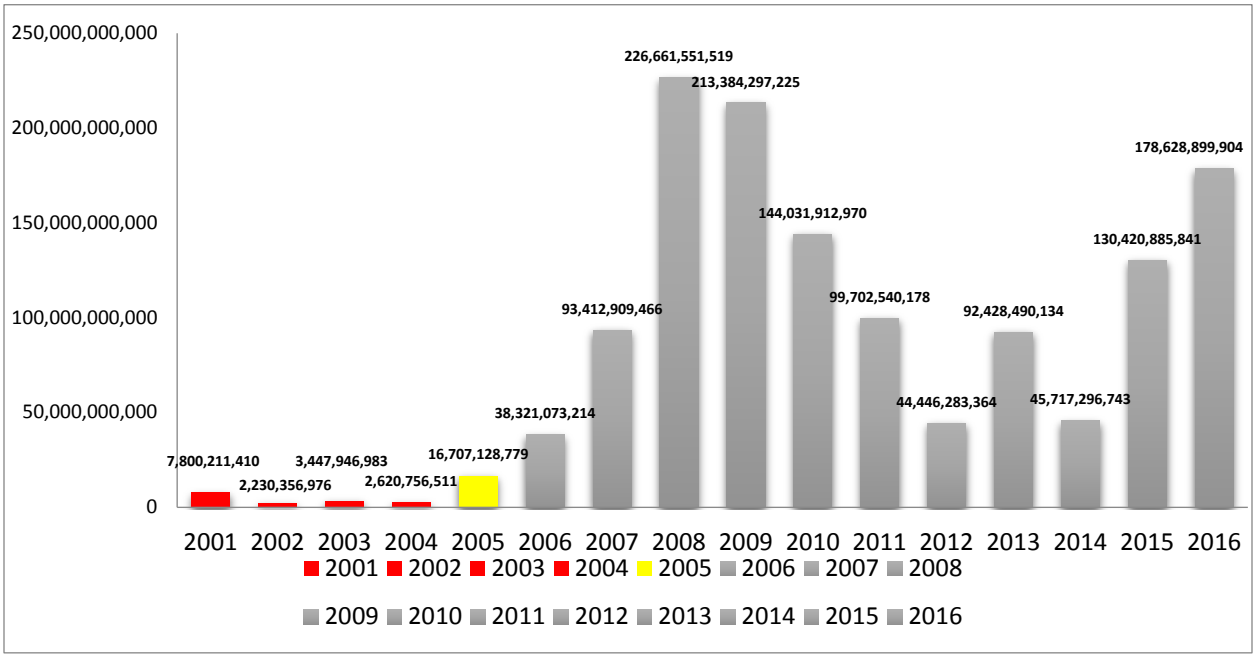


Chart (1) Accumulated contracts for the years 2001 to 2016

Second hypothesis: Gross income in the years 2006 to 2016, as compared to 2001 to 2005, shows how the financial condition of the company can be improved, as shown in Figure (2).



Graph 2: Gross income from 2001 to 2016 years

Hypothesis 3: In the following diagram, we see an inefficiency of a long-term strategy.

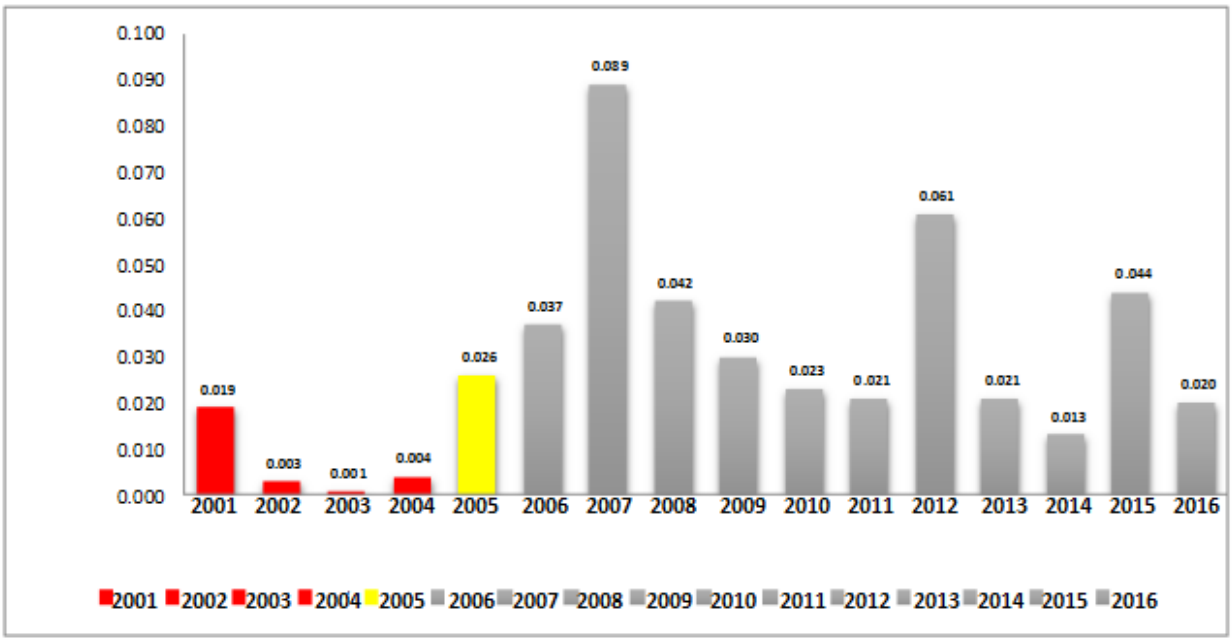


Chart (3) Return on Total Assets (ROA) from 2001 to 2016

Fourth hypothesis: In the diagram below, we need to refine the previous strategies and adopt new strategies.

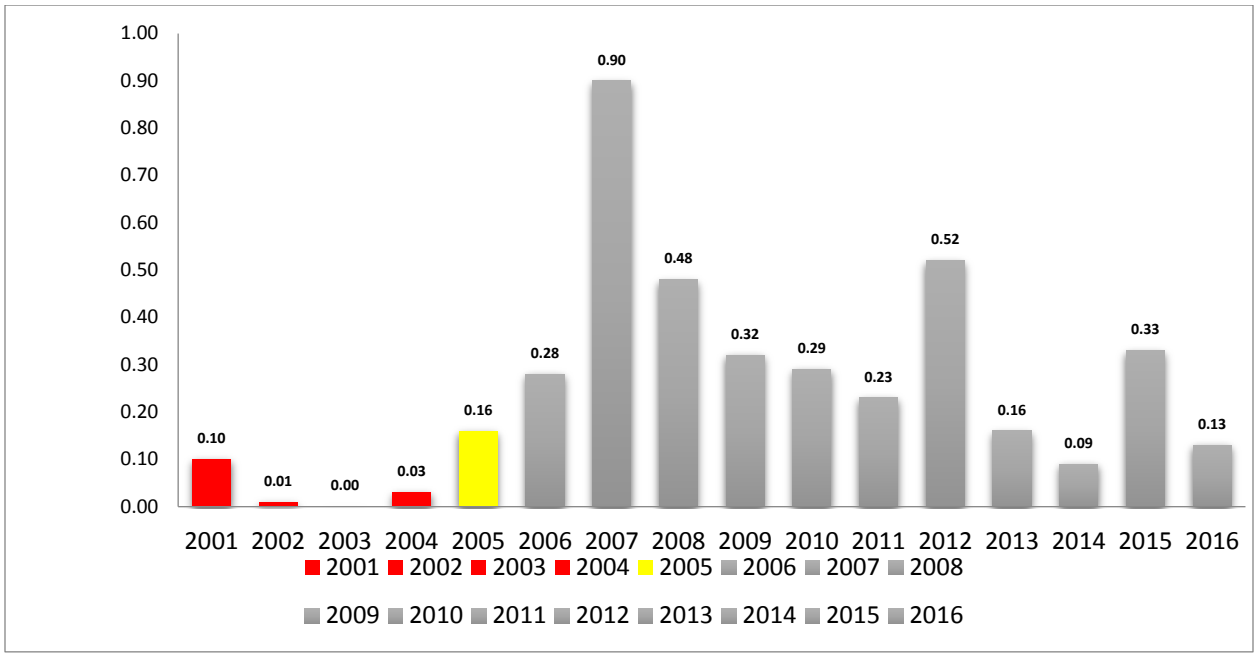


Chart (4) Return on Equity (ROE) from 2001 to 2016

As you can see, the Meam Team in the new management period has, in comparison with previous management, enjoyed a better financial performance and had a significant and irreversible growth.

7. Conclusions and suggestions

Research findings indicate that the company in the new management period, both in terms of improving the business environment and in terms of financial conditions, has had a better performance than the past ages. This important reflects the impact of the implementation of the strategies, On the performance of the company, however, the company has remained open at some time (2009 and 2016). This performance drop is due to reasons that are referred to in the discussion below. With regard to the first hypothesis, as stated above, the company, with its intelligent strategies, managed to succeed in improving the business environment in a very short time, both in terms of the number and size of the executed projects, the company performed well from Has left behind. In the second hypothesis, we also saw that the company managed to improve the financial performance of the company in the years 2006 to 2016 compared with 2001 to 2005 years, by making timely and timely decisions. It is clear that in the years prior to 2005, there was no strategy in the company's plans and goals, whereas since 2005, a company with the same capacities and the same rating, but with strategy development, in addition to earning profit and profitability Owners name their name in the South Pars region (Pars Special Energy Economic Zone) as a highly qualified contractor. According to the findings of the third hypothesis, due to the large changes in the decisions, policies and movements of government officials, as well as changes in the board of directors and managers of the companies we have participated in, and many other factors, we have proved the third hypothesis that strategies in We are long-term inefficient. As for the fourth hypothesis, we also found that in order to keep the growth chart upside down, it would be necessary for a company that is looking for innovative new packaging as well as improving the quality, taste, and taste to the consumer. The contracting companies will also adopt new strategies and need to modify the previous strategies. Based on the results, suggestions are presented as follows:

• Defining new markets for expanding activities and improving the business environment

• Changes in the nature and scope of executive activities with respect to the acquisition and upgrading.

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Building Sustainable local food systems in Christchurch, New Zealand: Barriers and opportunities to direct marketing between restaurants and chefs and farmers' market

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Abstract

This paper investigates restaurants and chefs' perceptions, motivations, and constraints in buying local food products from farmers' markets in a study conducted in Christchurch, New Zealand. Survey were conducted with restaurants and chefs. Results indicate that purchasing local food from farmers' markets was beneficial, but restaurants and chefs experienced challenges with purchasing. Common barriers for local food adoption from farmers' markets included time commitments, staff availability to visit market, and satisfaction with current wholesale distributors. Food products grown locally, fresher products, and higher quality of products were the major respondent motivations for local food adoption from farmers' markets.

Keywords: Local food; Purchasing; Restaurants; Chefs; Farmers' markets; Food wholesalers.

Introduction

Over the decade demand for locally grown food products has increased substantially among the public as well as academics and policy makers (Peters et al., 2009). Local foods have been primarily explored from the consumer's perspective (Martinez et al., 2010). Relatively limited research has been carried out in relation to how restaurants handle local procurement (Murphy & Smith, 2009; Duram & Cawley, 2012), benefits of local product usage (Inwood, Sharp, Moore, & Stinner, 2009), cost (Sharma, Gregoire, & Strohbehn, 2009), and purchasing decisions (Sharma, Moon, & Strohbehn, 2014). However, in contrast to the image portrayed in the food media with respect to the chef regularly purchasing supplies from the farmers' markets (CUESA, 2012; Martell, 2012), little is known about the role of restaurants and chefs as purchasers and users of local food from farmers' markets. This research therefore, examines restaurants and chefs' perceptions, motivations, barriers and constraints of buying and promoting local food ingredients on their menus from farmers' markets in Christchurch, New Zealand. Thereby helping to identify strategies for sustained local purchasing by restaurants and chefs.

Literature review

Local food systems

There is no consensus on defining "local" and what constitutes a local food system (Dunne, Chambers, Giombolini, & Schlegel, 2011; Hall & Gössling, 2013), although Hall (2013) provides several definitions based on consumer perceptions of definitions used by farmers markets. Local food systems are variously described as face-to-face agricultural markets (Hinrichs, 2000), politically constructed boundaries (Selfa & Qazi, 2005), and as an alternative to conventional food systems (Mount, 2012). However, local food remains an important component of food promotion and purchasing (Hall, 2013).

The local food movement

Local food systems are often viewed as a solution to many of the negative externalities associated with the global industrialized food system, such as deforestation, land use change, biodiversity loss, greenhouse gas emissions, food scares, and loss of cultural identity and traditional knowledge (Blake, Mellor, & Crane, 2010; Kremer & Deliberty, 2011). As a result, consumers increasingly demand ''information about the food's origin and how it is handled and transported'' (Bosona & Gebresenbet, 2011, p.293). Such demands can also be viewed as linked to a quest for authenticity (Sims, 2009). Due to these concerns, alternative food initiatives (AFIs) and movements have surfaced. To this end, Hall and Gössling (2016) argued that a local food system refers to deliberately formed food systems that are characterized by "a close producer-consumer relationship within a designated place or local area" (p.10). AFIs include a range of activities and provisioning agendas including direct marketing distributions (farmers' markets, roadside stands, community supported agriculture, and farm-to-school programs) (Hodges & Stevens, 2013; Hall, 2013), indirect marketing distribution (restaurants, foodservices, and retails) (Roy, Hall, & Ballantine, 2016), sustainable agriculture (Starr et al., 2003), and Fair Trade (Connell, Smithers, & Joseph, 2008).

Local food and consumers

The consumer has been the primary focus for research on local foods, especially in relation to farmers' markets and direct markets. Consumer studies have identified a number of benefits and constraints associated with local food purchasing decisions. Benefits ranges from perceived tangible and intangible characteristics including better appearance (Connell et al., 2008), fresher and tastier (Hall, 2013), healthier (Dodds et al., 2014), safer (Tobin, Thomson, & LaBorde, 2012), supporting the local economy (Roininen, Arvola, & Lähteenmäki, 2006), supporting the local community and farmers (Dodds et al., 2014), sustainability (Sims, 2009), less distance travelled (Roininen et al., 2006), more authentic (Pearson et al., 2011), and better treatment of workers and animals (Roininen et al., 2006). Furthermore, some consumers also perceive social benefits or social interaction that include trust and connectedness between consumers and farmers is an important motivation for purchase of local food directly from farmers and/or farmers' market vendors (Pearson et al., 2011; Hall, 2013). Consumers are often willing to pay a premium price for local foods although the importance of being local may vary by products (Denver & Jensen, 2014). Nevertheless, several barriers to purchasing local foods exist in relation to seasonal constraints and limited accessibility (Khan & Prior, 2010), higher prices (Zepeda & Deal, 2009), and unavailability (Hodges & Stevens, 2013).

Local food and restaurants

Previous literature has identified important attributes and the challenges and obstacles associated with purchasing locally produced foods by restaurants. Some of the perceived benefits of local food purchasing by restaurants include good public relations, supporting local producers, better quality and fresher food, superior taste, supporting the local economy, ability to purchase small quantities, and improved customer satisfaction (Inwood et al., 2009; Kang & Rajagopal, 2014; Roy et al., 2016). The perceived barriers to purchasing local food by restaurants include payment procedure conflicts, lack of knowledge about local sources, inconvenient ordering and delivery times, limited availability and amounts, variable costs, packaging and handling, lack of authority to choose suppliers, inadequate distribution systems, and additional time to process the food in the operation (Kang & Rajagopal, 2014; Roy et al., 2016).

Method

The selected sample location was Christchurch, New Zealand. The location was selected because of its demographics, culture, geography and climate, political system, local agrifood system that facilitate or limit the development of local food systems. The study is also notable as it is taken outside of the American context where the vast amount of research of the role of restaurants and chefs in local food systems has been conducted. Data was gathered through self-completed questionnaires with restaurants and chefs. Research occurred from February to April 2015 in Christchurch. Eligible foodservice businesses were selected for participation in the survey and put into a purpose built address database. The sample of restaurants and chefs was acquired from telephone directories and websites that maintain extensive foodservice establishment addresses. The final samples of foodservice establishments were cross-checked for valid addresses for the mailing list. The mailing list included full and limited service restaurants, hotel restaurants, cafés, buffet restaurants, and speciality/catering foodservice establishments. These establishments were independently owned or chain/corporate ownership, both franchised and non-franchised establishments. Deli-style foodservice establishments were excluded in this sample as these establishments are less likely to use local fresh food products and more likely to use pre-made products (O'Donovan, Quinlan, & Barry, 2012). A pilot test was conducted with ten Executive Chefs prior to administration of the final survey to assess the clarity of survey questions due to their familiarity with the topic (Diamantopoulos et al. 1994). A total 455 questionnaires (survey) were distributed in mail as well as in-person. The questionnaire were measured on a 7-point Likert Scale anchored from 1 (strongly disagree) to 7 (strongly agree). The final data collection effort resulted in 96 completed questionnaires, which contributed to a 21.09% (96/455) response rate and this is a typical response rate in other restaurant surveys (Brown, 2008; Casselman, 2010; Reynolds-Allie & Fields, 2012). Therefore, the usable response rate reported in this study compares favourably with these studies of a similar nature. In this study, frequency analysis was used to analyze respondents' demographic profiles, definition of local food, and other related questions measuring attitudes toward local food purchasing behaviours. Descriptive analysis was also conducted to obtain the means and standard deviations of the data. This was performed in order to further explain respondents' perceptions, motivations, barriers and constraints of buying and promoting local food ingredients on their menus.

Results and discussion

Based on 96 completed questionnaires, respondents defined "local food" as grown and/or produced with in the greater Christchurch area (Canterbury region). Of the 96 respondents, 69.79% identified their establishment as a casual/family full service restaurant, 13.54% stated their establishment is an upscale full service restaurant, and 81.25% identified themselves as independently owned (Table 1).

<Insert Table 1 here>

Results of the survey provides insights into restaurants and chefs local food purchasing motivations and perceived barriers to local food purchasing. Respondents indicated high level of perceived benefits to purchasing local food products from farmers' markets. The attribute food products/ingredients grown/produced locally, the ability to obtain fresher food products, and ability to get higher quality of products/ingredients were the most important reasons among respondents for local food adoption from farmers' market (Starr et al., 2003; Duram and Cawley, 2012; Hall 2013; Kang & Rajagopal, 2014; Roy et al., 2016). Lack of time and staff to visit the market, do not offer delivery, and satisfaction with current wholesale distributors (foodservice distributors) were the most perceived barriers to local food adoption from farmers' markets (Inwood et al., 2009; Schmit & Hadcock, 2012; Duram & Cawley, 2012). However, issues with delivery of the products appear less problematic (mid-level obstacle) in other studies (Strohbehn & Gregoire, 2002).

Conclusions

This study presented evidence that restaurants and chefs rated delivery of the products from farmers' markets as a barriers when it comes to local purchasing. In addressing this, Producer-Involved Distribution Systems (PIDS) can be considered another form of distribution that reduce the barrier of transportation and facilitates relegalization (Stott, Lee & Nichols, 2014). PIDS service allows the sharing of costs among several farmers for better services associated with storing, marketing, selling and transporting the products to the buyers. Interestingly, this study shows a preference of restaurants and chefs for wholesale distributors from which is purchased local food products, as they are able to efficiently and consistently provide products to restaurants. Similar to other studies (Inwood et al., 2009; Schmit & Hadcock, 2012), such preference is not unique to restaurants, although the vital role of wholesalers in foodservice supply chains is often lost in discussions of local food systems (Hall & Gössling, 2016). However, restaurants and chefs satisfaction with wholesale distributors clearly creates an alternative outlet for the farmers to move greater volumes of their products through these channels. The study therefore suggests that there is potential to further expand the sales of local food products to restaurants, thereby also potentially developing another route through to consumers to embrace local food.

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Table 1
Demographic characteristics of respondents (Segment and Ownership) (N = 96)

Segment	Frequency	Percent
Upscale Full Service Restaurant	13	13.54
Casual/Family Full Service Restaurant	67	69.79
Hotel Restaurant	3	3.12
Limited Service (Fast Food) Restaurant	5	5.20
Café	4	4.16
Buffet Restaurant	1	1.04
Speciality Foodservice (e.g. Caterer)	3	3.12
Other (Please specify)	0	0.00
Ownership		
Independently Owned	78	81.25
Chain/Corporate (centralized ownership)	11	11.45
Franchise (Owned separately, but part of a chain concept)	7	7.29

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A Supply Chain Decision Making Model for Replenishment Problem with Back-Order and Lost Sale

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A Supply Chain Decision Making Model for Replenishment Problem with Back-Order and Lost Sale

Abstract

In devising an appropriate supply chain decision making policy, a production manager often needs to consider issues such as multiple suppliers, quantity discounts, transportation batch and back-order. An integrated supply chain decision making model should cover the management of business activities and relationships internally within a firm, with upstream suppliers, and downstream customers along the supply chain. Studies of individual topics in supply chain management (SCM) have been done abundantly. Among them, inventory management has caught the most attention, and various inventory models and methodologies have been proposed. Replenishment with back-orders problem has been studied, and problems that consider both the ordering and the purchase aspects have also been found. This research first proposes a mixed integer programming (MIP) model to minimize the total cost, which includes replenishment cost, transportation cost, back-order cost and lost sale cost. In addition, multiple suppliers with different quantity discount schemes are considered, and vehicles with different loading limits are present. A particle swarm optimization (PSO) model is constructed next to deal with large-scale problems that are too complicated to solve by the MIP. A case study is presented to examine the practicality of the MIP and the PSO models.

Keywords: Supply chain management (SCM); Replenishment; Back-order; Lost sale; Mixed integer programming (MIP); Particle swarm optimization (PSO).

A Supply Chain Decision Making Model for Replenishment Problem with Back-Order and Lost Sale

Introduction

A good supply chain management (SCM) is important for firms to provide low cost and high quality products with greater flexibility in today's competitive market, and as a result, to survive and attain a reasonable profit. In devising an appropriate supply chain decision making policy, a production manager needs to consider multiple suppliers, transportation batch and quantity discounts. A supply chain decision making model should cover the management of business activities and relationships internally within a firm, with immediate suppliers, with the first and second-tier suppliers and customers along the supply chain, and with the entire supply chain. Inventory management is one of the most important topics in supply chain management, and various inventory and replenishment models have been developed.

The rest of this paper is organized as follows. Related works are reviewed in next section. Then, a mixed integer programming (MIP) model and a PSO model are constructed to solve the problem. A case study is demonstrated, and the conclusions are presented in the last section.

Review of Related Works

In this section, some recent works on the joint replenishment problem (JRP) are reviewed. Khouja and Goyal (2008) reviewed the literature on the JRP from 1989 to 2005, and discussed several new methods for solving the JRP, including genetic algorithms (GAs). Reviews of some of the past works can also be found in Moin and Salhi (2007) and Anderson, Christiansen, Hasle, and Lokketangen (2010). Due to the interrelationships between inventory replenishments and routing patterns, it can be difficult to find the exact solution for the inventory routing problem (Federgruen & Zipkin, 1984; Chien, Balakrishnan, & Wong, 1989). Scholars have tried to apply heuristics to obtain near-optimal solutions. Chiou (2005) aimed to minimize total inventory cost and transportation cost over a period of planning horizon, and developed heuristic solution procedure and iterative solution strategies to solve the complicated problem.

PSO is one of the popular metaheuristics methods applied in different fields. Some recent production management works using the PSO are reviewed here. Tsai and Yeh (2008) proposed a PSO approach for inventory classification problems and developed a flexible classification algorithm based on a specific objective or multiple objectives, such as minimizing costs and maximizing inventory turnover ratios, etc. Huang, Yang, and Hsu (2015) studied a two-stage parallel multiprocessor flow shop scheduling problem. An integer programming model, an original PSO and an improved PSO, called subgroup PSO, were applied, the effectiveness and robustness of the models were compared. Liu, Hu, Zhao, and Wang (2015) proposed a

hybrid PSO-GA algorithm for job shop scheduling in machine tool production. The genetic operators, such as crossover and mutation operators in GA, are used to update the particles in the PSO algorithm, and better solution quality and convergence rate are achieved.

Construction of the Models

In this section, various costs for determining the total cost in a system are introduced first, a MIP model is constructed next, and the PSO procedure is described last.

Various Costs

Eq. (1) shows the ordering cost, where o_{iv} is the ordering cost of part *i* from supplier *v* for each purchase and Z_{ivt} indicates whether an order of part *i* from supplier *v* in period *t* is placed.

$$Ordering\ cost = \sum_{i=1}^{I}\sum_{v=1}^{V}\sum_{t=1}^{T} o_{iv} * Z_{ivt} \tag{1}$$

Eq. (2) is the purchase cost. Based on the all-units discount brackets from suppliers and the purchase quantity in each period, the total purchase cost of the parts over the horizon can be calculated.

$$Purchase\ cost = \sum_{i=1}^{I}\sum_{v=1}^{V}\sum_{t=1}^{T} C(Q_{ivt}) * Q_{ivt} * Z_{ivt} \tag{2}$$

where $C(Q_{ivt})$ is the unit purchase cost of part *i* from supplier *v* in period *t*, Q_{ivt} is the quantity of part *i* purchased from supplier *v* in period *t*, and α_{tvr} indicates whether an order of part *i* from supplier *v* in period *t* is placed.

The transportation cost of the system is obtained by equation (3), which calculates the total costs of transporting parts from the suppliers to the manufacturer over the periods.

$$Transportation\ \ cost = R = \sum_{v=1}^{V}\sum_{t=1}^{T} r_v \times \left\lceil \sum_{i=1}^{I} Q_{ivt} \Big/ \varphi \right\rceil = \sum_{v=1}^{V}\sum_{t=1}^{T} r_v \times Y_{vt} \tag{3}$$

where r_v is the transportation cost per time from supplier *v* per period, φ is the maximum transportation batch size from supplier *v*, $\lceil \sum_{i=1}^{I} Q_{ivt} / \varphi \rceil$ is the smallest integer greater than or equal to $\sum_{i=1}^{I} Q_{ivt} / \varphi$, Y_{vt} is number of transportations from supplier *v* in period *t.*

Eq. (4) calculates the inventory holding cost of parts. Ending inventory of part *i* in a period is the sum of the beginning inventory of part *i* in the period and the purchase quantity of part *i* in the period and minus the quantity of part *r* used in production in the period. The inventory holding cost is as follows:

$$Holding\ cost = \sum_{i=1}^{I}\sum_{t=1}^{T} h_i * I_{it}^{+} \tag{4}$$

where I_{it}^{+} is the ending inventory of part *i* in period *t*, h_i is the unit holding cost of part *i* per period.

Eq. (5) calculates the back-order cost of parts.

$$\textit{Back-order cost} = \sum_{i=1}^{I}\sum_{t=1}^{T} b_i * k_{1i} * I_{it}^{-} \tag{5}$$

where I_{it}^{-} is the shortage of part *i* in period *t*, k_{1i} is the backorder ratio of part *i* , b_i is the unit back-order cost of part *i* per period.

Eq. (6) calculates the lost sale cost of parts.

$$\textit{Lost sale cost} = \sum_{i=1}^{I}\sum_{t=1}^{T} l_i * k_{2i} * I_{it}^{-} \tag{6}$$

where I_{it}^{-} is the shortage of part *i* in period *t*, k_{2i} is the lost sale ratio of part *i* , l_i is the unit lost-sale loss of part *i* per period.

Mixed Integer Programming (MIP)

In this sub-section, a mixed integer programming (MIP) model is developed to solve the multiple-supplier, multiple-product replenishment problem, and to devise the replenishment plan and production mode in each period in the planning horizon. The MIP model is as follows:

Minimize

$$TC = \sum_{i=1}^{I}\sum_{v=1}^{V}\sum_{t=1}^{T} o_{iv} * Z_{ivt} + \sum_{i=1}^{I}\sum_{v=1}^{V}\sum_{t=1}^{T} C(Q_{ivt}) * Q_{ivt} * Z_{ivt} + \sum_{v=1}^{V}\sum_{t=1}^{T} r_v * Y_{vt} + \sum_{i=1}^{I}\sum_{t=1}^{T} h_i * I_{it}^{+} + \sum_{i=1}^{I}\sum_{t=1}^{T} b_i * k_{1i} * I_{it}^{-} + \sum_{i=1}^{I}\sum_{t=1}^{T} l_i * k_{2i} * I_{it}^{-} \tag{7}$$

s.t.

Constraints.

Objective function (7) is to minimize the total cost in the planning horizon. The costs include six kinds of costs: ordering cost, purchase cost, transportation cost, holding cost, back-order cost and order sale cost.

Particle Swarm Optimization (PSO)

In this research, the PSO procedure is developed based on the constriction factor proposed by Kennedy and Eberhart (1995).

Step 1. Initialize particles with random positions and velocities. With a search space of *d*-dimensions, a set of random particles (solutions) is first initialized. Let the lower and the upper bounds on the variables'

values be λ_{min} and λ_{max}. We can randomly generate the positions, λ_n^e (the superscript denotes the e^{th} particle, and the subscript denotes the n^{th} iteration), and the exploration velocities, v_n^e, of the initial swarm of particles:

$$\lambda_0^e = \lambda_{min} + rand(\lambda_{max} - \lambda_{min}) \tag{8}$$

$$v_0^e = \frac{\lambda_{min} + rand(\lambda_{max} - \lambda_{min})}{\Delta} = \frac{Position}{\Delta} \tag{9}$$

Step 2. *Evaluate the fitness of all particles.* The performance of each solution is evaluated with the fitness function.

Step 3. *Keep track of the locations where each individual has its highest fitness.*

Step 4. *Keep track of the position with the global best fitness.*

Step 5. *Update the velocity of each particle*:

$$v_{n+1}^e = \omega_n \times v_n^e + \varphi_1 \times rand_1 \times (pbest_n^e - \lambda_n^e) + \varphi_2 \times rand_2 \times (gbest_n - \lambda_n^e) \tag{10}$$

Step 6. *Update the position of each particle:*

$$\lambda_{n+1}^e = \lambda_n^e + v_{n+1}^e \cdot \Delta \tag{11}$$

Step 7. *Terminate the process*. If the standard deviation of fitness is less than an error, a predetermined (CPU) time is reached, or a maximum number of iterations is attained. Otherwise, go to *Step 2*.

Case Study

The proposed MIP and PSO models for joint replenishment problem with back-order and lost sale are applied in a case study here. The MIP model is implemented using the software LINGO 10, and the PSO is implemented using the software MATLAB (2015).

A case is presented here. The planning horizon contains three periods, and the demand of the finished good in each period is shown in Table 1. Table 2 also shows each kind of cost and the total cost of the firm in the horizon. Since both the MIP and the PSO lead to the same results, the total cost is the same, i.e. \$115,140. In addition, Figure 1 shows the PSO result generated from MATLAB. The computational time for the MIP and the PSO is 2 seconds and 156 seconds, respectively. For PSO, the initialized particle swarm size is selected as 50, and the maximum evolution number of the particle swarm is 1000. It can be seen that the PSO converges after the 38th generation.

Table 1

Demand of Finished Goods (d_{it})

Period (t)	1	2	3
Demand	d_{11}=90, d_{21}=100	d_{12}=20	d_{13}=90, d_{23}=150

Table 2

Relevant Results in Each Period under the Case Using the MIP and the PSO

Decision variables	t=1	t =2	t =3
Z_{ivt}	$Z_{111}=1, Z_{221}=1$		$Z_{113}=1, Z_{223}=1$
Q_{ivt}	$Q_{111}=100, Q_{221}=100$		$Q_{111}=96, Q_{221}=150$
$C(Q_{ivt})$	$C(Q_{111})=180, C(Q_{221})=150$		$C(Q_{111})=180, C(Q_{221})=140$
Y_{vt}	Y_{11} =1, Y_{21} =2		Y_{13} =1, Y_{23} =3
I_{it}^{+}	$I_{11}^{+}=10$		
I_{it}^{-}		I_{12}^{-} =10	

Ordering cost	Purchase cost	Transportation cost	Holding cost	Back-order cost	Lost sale cost	Total cost
$360	$71,280	$42,000	$100	600	800	$115,140

Conclusions

Replenishment problem with back-order and lost sale has been studied in this research. The objective is to order the optimal quantities of different parts from right suppliers in different periods to reduce the total cost for the firm. Both a mixed integer programming (MIP) model and a particle swarm optimization (PSO) model are constructed to solve this joint replenishment problem with back-order and lost sale to minimize the total cost in the system during a planning horizon. The case study shows that the PSO model can generate optimal solutions under a short duration of time. When the problem scale is small, both the MIP and the PSO can lead to optimal solutions within a reasonable time. However, when the problem becomes complicated and reflects real application more, the MIP model may require a long computational time and may still not obtain the optimal solution. Therefore, the PSO model is an effective and efficient algorithm to search for solutions.

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A Goal Programming Approach for Vehicle Routing Problem with Time Windows

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Abstract

Supply chain management is very important in today's competitive business environment, and logistics is one of the main areas in the management. Vehicle routing problem (VRP) is a popular research problem in the logistics area because it a challenging combinatorial optimization problem in which a number of vehicles need to serve various demands of customers in different locations. This study aims to solve the problem under which a manufacturer needs to purchase materials from multiple suppliers with different time windows and to ship the materials back to the company in multiple periods, and different vehicles, with different assignment costs, loading capacities and unit travelling costs, are available. A mixed integer programming (MIP) model is constructed to minimize the total transportation cost, which includes vehicle assignment cost, travelling cost, tardiness cost, and earliness cost and for the manufacturer. Genetic algorithm (GA) is applied to solve the problem so that a near optimal solution can be obtained when the problem is too difficult to be solved using the MIP. A case of a food manufacturing company is used to examine the practicality of the proposed MIP model and the GA model.

Keywords: Vehicle routing; Time windows; Mixed integer programming (MIP); Genetic algorithm (GA).

A Goal Programming Approach for Vehicle Routing Problem with Time Windows

Introduction

Vehicle routing problem (VRP) is a core issue in logistics, and it refers to a class of combinatorial optimization problems in which customers are to be served by a number of vehicles (Adelzadeh, Asl, & Koosha, 2014). VRP was first introduced by Dantzig and Ramser (1959), and the main objectives of the problem are minimizing the total travelling cost, time, or distance with a fleet of vehicles, starting and ending their routes at the depot while satisfying various demands of customers. Some recent works of VRP, especially the adoption of metaheuristics, are reviewed here. Adelzadeh et al. (2014) proposed a mathematical model and devised a heuristic solving procedure for multi-depot vehicle routing problem with fuzzy time window and heterogeneous vehicles that have different capacities, velocities and costs. The fuzzy concept was applied to describe the service levels associated with time windows, and a multi-objective model was developed. A three-stage algorithm was first used to break down the problem to some common VRPs, and a heuristic approach was developed to obtain an initial solution. Many VRP are solved by heuristics these days to obtain a near-optimal solution. Since the introduction, different types of VRP have been tackled to incorporate real-world issues (Abdoli, MirHassani, & Hooshmand, 2017).

Genetic algorithm (GA) has been applied in solving VRP. Some works are reviewed here. Baker and Ayechew (2003) stated that unlike other heuristics which had considerable progress in solving VRP, GA had not made a great impact. The authors developed a conceptually straightforward GA to solve the basic VRP and a hybrid heuristic, which incorporated neighborhood search into the GA. A comparison with other heuristics showed that the GA was competitive in terms of computing time and solution quality. Ombuki, Ross, and Hanshar (2006) studied the VRP with hard time windows and treated it as a multi-objective problem with two objectives: number of vehicles and total distance traveled. A multi-objective genetic algorithm approach using the Pareto ranking technique was developed so that the weighted sum, which might cause solution bias, did not need to be applied. Alvarenga, Mateus, and de Tomi (2007) studied the VRP with time windows and proposed a two-phase approach that incorporated GA and a set partitioning formulation. The objective was to minimize the travel distance, and the authors stated that the approach outperformed past heuristic methods in terms of the minimal travel distance. Vidal, Crainic, Gendreau, and Prins (2013) further proposed a hybrid genetic search with advanced diversity control to tackle four types of VRP: VRP with time windows, periodic VRP with time windows, multi-depot VRP with time windows, site dependent VRP with time windows. Some

evaluation techniques were introduced to the GA to efficiently evaluate and prune neighborhoods and to decompose large instances.

In this study, A VRP problem that considers a manufacturer purchasing materials from multiple suppliers and shipping the materials back to the company is studied. Different vehicles with different assignment costs, loading capacities and unit travelling costs are available. In addition, the tardiness cost and earliness cost to a supplier are considered. Both a mixed integer programming (MIP) model and a genetic algorithm (GA) model are constructed to solve the problem. The rest of this paper is organized as follows. In the next section, a MIP model and a GA model for solving the VRP are constructed. Then, a case study is performed to examine the MIP and the GA models. Some conclusion remarks are made in the last section.

Formulation of the Vehicle Routing Problem with Time Windows

Mixed Integer Programming (MIP)

In this section, a coordinated approach for the vehicle routing problem with time windows that considers soft time window and heterogeneous vehicles is proposed by the MIP and the GA.

An MIP model is constructed to solve the vehicle routing problem with time windows which considers vehicle assigning and travelling cost, tardiness cost and earliness cost.

$$\sum_{t=1}^{T}\sum_{v=1}^{V}\sum_{j=0}^{I}\tau_v \times X_{t,0,j,v} + \sum_{t=1}^{T}\sum_{i=0}^{I}\sum_{j=0}^{I}\sum_{v=1}^{V}\pi_{i,j} \times \rho_v \times X_{t,i,j,v} = Z_1 \quad (1)$$

$$\sum_{t=1}^{T}\sum_{i=0}^{I}\sum_{v=1}^{V}p_i \times L_{t,i,v} = Z_2 \quad (2)$$

$$\sum_{t=1}^{T}\sum_{i=0}^{I}\sum_{v=1}^{V}q_i \times E_{t,i,v} = Z_3 \quad (3)$$

$$\text{Min } Z = Z_1 + Z_2 + Z_3 \quad (4)$$

s.t.

Constraints.

Eq. (1) calculates the vehicle assigning and travelling cost, where τ_v is the fixed cost for assigning vehicle *v*, $X_{t,0,j,v}$ is a binary variable, indicating whether vehicle *v* departs from the depot (*i*=0) to supplier *j* in period *t*, $\pi_{i,j}$ is the travelling time from supplier *i* to supplier *j*, ρ_v is the travelling cost per unit of time, $X_{t,i,j,v}$ is a binary variable, indicating whether vehicle *v* travels from supplier *i* to supplier *j* in period *t*. Eq. (2) calculates the tardiness cost, where ρ_i is the tardiness cost per unit of time, and $L_{t,i,v}$ is the tardiness time of vehicle *v* when arriving supplier *i* in period *t*. Eq. (3) calculates the earliness cost, where q_i is the earliness cost per unit of time, and $E_{t,i,v}$ is the earliness time of vehicle *v* when arriving supplier *i* in period *t*. Objective function (4)

is to minimize the total transportation cost in a planning horizon, including the three kinds of costs: vehicle assigning and travelling cost, tardiness cost and earliness cost.

Genetic Algorithm (GA) Model

In this research, the GA is used to solve the multi-period vehicle routing problem with soft time window and heterogeneous vehicles so that near-optimal solutions can be obtained in a short period of computational time for large-scale problems. The proposed procedures are as follows (Lee, Kang, Lai, & Hong, 2013; Lu, Liu, Niu, & Zhu, 2014; Kang, Pearn, Chung, & Lee, 2016):

Step 1. Code scheme.

In the travelling salesman problem, there are basically five different vector schemes to represent a tour among cities: a path representation, an adjacency representation, an ordinal representation, a position listing representation, and an adjacency listing representation. Due to its simplicity, the path representation has been frequently adopted in the GA to solve the travelling salesman problem.

Step 2. Initial population of chromosomes.

The initial population is generated randomly. Two types of chromosomes are used, partially matched crossover (PMX) and tie break crossover (TBX), and the chromosome type is determined randomly.

Step 3. Fitness function

The fitness function for each chromosome is defined as Min *TC*, where *TC* is the summation of vehicle assigning cost, travelling cost and tardiness cost. Min *TC* is the minimum cost among all the chromosomes across the population.

Step 4. Crossover operation

The standard two-cut-point crossover operator is applied to the selected pair of parent-individuals by recombining their genetic codes and producing two offspring.

Step 5. Mutation operator.

A mutation operator is used to counteract premature convergence and to maintain enough diversity in the population. This is done by changing a randomly selected gene in the genetic code (0-1, 1-0).

Step 6. Selection of subsequent population.

Parent selection is the selection of the subsequent population after mutation and crossover operations in a generation. Individuals with higher fitness values are more likely to be selected for the mating pool, and vice versa. Individuals are sorted by their fitness values, and the number of reproductive trails of each individual is then allocated according to its rank.

Step 7. Elitism selection.

In the GA applications, the concept of elitism is widely used. Elitism selection guarantees the survival of best individuals created during all generations. Under a non-elitist GA, some individuals might not survive due to crossover of mutation.

Step 8. Termination.

Repeat the processes of crossover, selection and replacement until the objective function is optimized or the stop criterion is met.

Case Study

The case study is based on a manufacturer in the food industry. Assume that there are one manufacturer, several suppliers and several vehicles. The objective is to minimize the total transportation cost, which includes the vehicle assigning and travelling cost, tardiness cost and earliness cost. Software packages, LINGO 10 and MATLAB 2015, are used to solve the problem and compare the results from the MIP and the GA. In the case, there are three suppliers. Table 1 shows the travelling time matrix among suppliers. There are two vehicles, one small vehicle and one medium vehicle. The loading capacities for the small and medium vehicles are 50 and 100 units, respectively. The assignment costs for the small and medium vehicles each time are \$500 and \$1000, respectively. Vehicle 1 is a small truck, while vehicle 2 is a medium truck. The planning horizon contains three periods. The travelling costs per minute for the small and medium vehicles are \$9 and \$12, respectively. The tardiness cost and earliness cost per minute to a supplier are \$30 and \$10, respectively. The earliest time and latest time arriving to supplier 1 without penalty are 200 and 260 minutes, respectively, in the day. The earliest time and latest time arriving to supplier 2 without penalty are 180 and 240 minutes, respectively, in the day. The earliest time and latest time arriving to supplier 3 without penalty are 250 and 310 minutes, respectively, in the day. Table 2 shows the demand from each supplier in each period.

Table 1

Travelling Time Matrix among Suppliers Unit of measure: min

w_{ij}	j=0	j=1	j=2	j=3
i=0		90	60	72
i=1	90		96	186
i=2	60	96		90

i=3	72	186	90

Table 2

Demand from Suppliers for a Case

Period	Supplier 1	Supplier 2	Supplier 3
1	21	40	26
2	35	63	30
3	22		23

Table 3

Relevant Results in Each Period Using the MIP and the GA

Decision variables	t=1	t =2	t =3
$X_{t,0,j,v}$	$X_{1,0,1,2}=1$	$X_{2,0,3,1}=1, X_{2,0,1,2}=1$	$X_{3,0,1,1}=1$
$X_{t,i,j,v}$	$X_{1,1,2,2}=1, X_{1,2,3,2}=1,$ $X_{1,3,0,2}=1$	$X_{2,3,0,1}=1, X_{2,1,2,2}=1,$ $X_{2,2,0,2}=1$	$X_{3,1,3,1}=1, X_{3,3,0,1}=1$
$L_{t,i,v}$	$L_{1,3,2}=38$		
$E_{t,i,v}$	$E_{1,1,2}=110$	$E_{2,1,2}=110, E_{2,3,1}=178$	$E_{3,1,1}=110$

Assignment cost	Travelling cost	Earliness cost	Tardiness cost	Total cost
$3,000	$10,314	$5,080	$1,140	$19,534

The solutions of Case obtained by the MIP model and by the GA model are the same, as shown in Table 3. In period 1, vehicle 2 travels from the depot to supplier 1, to supplier 2, to supplier 3, and then back to the depot. The tardiness time of the vehicle when arriving supplier 3 is 38 minutes, and the earliness time of the vehicle when arriving supplier 1 is 110 minutes. In period 2, vehicle 1 travels from the depot to supplier 3, and then back to the depot, while vehicle 2 travels from the depot to supplier 1, to supplier 2, and then back to the depot. The earliness time of vehicle 2 when arriving supplier 1 is 110 minutes, and the earliness time of vehicle 1 when arriving supplier 3 is 178 minutes. In period 3, vehicle 1 travels from the depot to supplier 1, to supplier 3, and then back to the depot. The earliness time of vehicle 1 when arriving supplier 1 is 110 minutes. The assigning cost is $3,000, the travelling cost is $10,314, the earliness cost is $5,080, the tardiness cost is $1,140,

and the total transportation cost is $19,534. In this case, the computational time using the MIP is 0.9 seconds, while the computational time using the GA is 203 seconds. The results show that the MIP is effective for this case.

Conclusions

This paper studies a vehicle routing problem with time windows. In this problem, a manufacturer needs to outsource different amount of materials from different suppliers using different vehicles with limited loading sizes and limited travelling distances in each period. A mixed integer programming (MIP) model is proposed first to minimize the total transportation cost for the manufacturer, and the optimal vehicle routing and loading size of each vehicle in each period can be generated. When a problem becomes too complicated to solve by the MIP, the proposed genetic algorithm (GA) could be used to obtain near optimal solution in a short computational time.

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Accountants as Gatekeepers in Real Estate Transaction: The Money Laundering Syndrome

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Abstract

This paper aims to examine the role of accountants as gatekeepers in anti-money laundering compliance in real estate transactions. The paper seeks to answer questions on ways in which accountants are involved in real estate transactions and mandatory compliance with regulatory authorities in Canada. The data for the study came from semi-structured interviews with accountants, lawyers, and government officials. Preliminary results reveal that there is a conflict between accountants' obligation to disclose and loyalty to their clients. Accountants often do not see why they are obligated to disclose their clients' information to government agencies. The importance of the client in terms of the amount of revenue contributed to the accounting firm also plays a significant role in accountants' reporting decision- making process. Although the involvement of accountants in real estate purchase and sale transactions is limited to lawyers or notaries, they are often involved in designing financing schemes, which may involve money laundering activities. The paper is of wider public policy interests to both accountants and regulators. It is hard not to see Chartered Professional Accountant (CPA) Canada and government regulators using the findings to better understand the decision-making processes of accountants in their reporting practices to regulatory authorities.

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Framing Price Promotion: The Effects of the Price Frame and the Saving Frame

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Abstract

This article examines the effects of the price frame (regular price only, sale price only, both regular and sale prices) and the saving frame (percentage discount and absolute discount), which are displayed in a price discount advertisement, on consumers' perceptions. Laboratory experiment results showed that presenting a sale price and an absolute-discount amount generated better consumer perceptions. Also, price consciousness and needs for cognition (NFC) were found to have moderating effects in the relationship between the price and saving frames, and the perceived quality of an advertised product.

Introduction

When sellers offer a discount on products or services, they need to decide on which price-related information to use in order to promote the discount in advertisements. Della Bitta, Monroe, and McGinnis (1981) identified two types of cues typically adopted in price-discount advertisements. One is known as *price cues*, which include a regular or a normal price, and a sale price. The other is called *semantic cues*, which involve expressions that facilitate consumers' ability to evaluate an offer (e.g., "regular," "usually," "special," "manufacturer's suggested retail price") and frames presenting savings (e.g., percentage off or dollar off). Since consumers are likely to use such information to assess a given offer, these cues, besides the actual discount amount, also influence consumer perceptions of the offer. Thus, the aforementioned sellers' decision is considered important, and understanding consumer responses to such information is essential in creating effective ads.

Advertisements on price discounts are comparative in nature since sellers attempt to promote their sale price by emphasizing the temporary reduction of the original price. Accordingly, research on comparative price advertisements has obtained considerable attention from marketing researchers and have produced a significant number of studies. Comparative price advertisements present a reference price (e.g., regular price, another retailer's price) together with

a sale price, emphasizing that the former is clearly higher than the latter. Previous studies on this topic have mainly examined how the level and/or semantic cues of advertised reference prices and characteristics of the ads, such as consistency and distinctiveness, affected consumer perception (e.g., Alford & Engelland 2000; Burton, Lichtenstein, & Herr 1993; Lichtenstein & Bearden 1988, 1989; Lichtenstein, Burton, & Karson 1991; Suter & Burton 1996). Within this topic, one identifiable narrow scope is the investigation of saving presentation frames. The amount of price reduction can be framed either in percentage or absolute terms (Chen, Monroe, & Low 1998). The percentage-discount frame is defined as a relative indicator of the extent of the reduction from 0% and 100% (e.g., percentage off). Meanwhile, the absolute-discount frame refers to the actual monetary savings that consumers receive from the price promotion (e.g., dollar off or cents off). Previous studies on this topic have shown the differences in consumers' responses to the two frames. However, some research issues have remained unexplored; thus, this article seeks to address such issues. One concern is that the price information used in previous studies is not consistent, making it difficult to generalize some of their findings. Another is that moderating effects of consumers' characteristics, such as price consciousness and needs for cognition (NFC), have not been examined. Such characteristics have been shown to significantly affect consumers' responses to price promotions (e.g., Inman, Peter, & Raghubir 1997; Lichtenstein, Ridgway, & Netemeyer 1993). Finally, we examine whether the two frames influence the quality perception of an advertised product. To the best of our knowledge, no study to date has looked into this effect. We believe the current study is worthwhile and would lead to a better understanding of consumer responses to advertisements promoting discounts.

Conceptual Framework

Saving Presentation Frames

Chen et al. (1998) was the first study that directly compared the percentage-discount and absolute-discount frames. In the context of a direct-mail advertisement with a 10% discount, they found that perceived savings were higher when the absolute-discount frame was presented for a high-priced product (personal computer). Alternatively, for a low-priced product (a box of floppy disks), the percentage-discount frame produced greater perceptions of savings than the absolute-discount frame. A subsequent study by Hardesty and Bearden (2003, Study 3) had a deeper exploration of this subject than Chen et al. (1998). Replicating four product categories (toothpaste, trash bags, detergent, and hand lotion), the results showed that differences in value perceptions between the two frames were insignificant when a moderate discount depth (25%) was offered. However, for a high discount depth (50%), perceptions were better when a percentage-discount frame was presented. Later, a meta-analysis of 20 articles by

Krishna, Briesch, Lehmann, and Yuan (2002) examined the relative importance of various price presentation factors on perceived savings. This analysis included examining the absolute-discount and percentage-discount frames and reported that both raised perceived savings, but the impact of the percentage discount was larger than that of the absolute discount.

The next three studies examined the effect of the saving presentation frame on consumers' price estimates. First, Chandrashekaran and Grewal (2006) examined the effect of the two frames on consumers' adjustment of internal reference prices of a pack of batteries. The prices were measured before and after observing a retail ad. They presumed that the percentage-discount frame was congruent with how consumers process savings information in that they pay more attention to the sale price when the percentage discount, rather than the absolute discount, was presented. As expected, the results revealed that the change in the internal reference prices was stronger at a percentage discount and when consumers' prior internal reference prices were lower than the sale price (perceived loss). Second, Bambauer-Sachse and Dupuy (2012) expanded Chandrashekaran and Grewal (2006) by including two moderators: consumers' confidence in estimating prices and product involvement (high for jeans and low for shirts). They showed that the absolute-discount frame generated a more significant change in internal reference prices than the saving frame when consumers were less involved and less confident. Conversely, the percentage-discount frame generated a larger change in internal reference prices than the absolute-discount frame when consumers were more involved but less confident. Third, DelVecchio, Krishnan, and Smith (2007) examined the effects on consumers' expected price in their next shopping trip. They used a simulated-store context where six hypothetical brands of shampoo were displayed on a shelf. It revealed that a high discount depth (43%) presented with a percentage-discount frame leads to a higher expected price of the focal brand compared to when it was presented with an absolute-discount frame. For the low-depth discount (13%), the expected price did not differ between the two frames.

A more recent study by Suri, Monroe, and Koe (2013) focused on consumers' math anxiety, defined as the tense feeling that interferes with manipulating numbers and solving mathematical problems. They demonstrated that consumers with high math anxiety preferred the absolute-discount frame more than the percentage-discount frame because the former was easier to process. Those with low math anxiety showed no difference in preference toward the two frames. Finally, Coulter and Roggeveen (2014, Study 2) examined the effects of numbers indicated as retail price, sale price, and absolute-discount frame. They presumed that if these numbers were multiples of one another, they would be fluently processed and would therefore be better evaluated. The regular price was set at $58, the sale price $29, the absolute-discount frame $29, and the percentage-discount frame 50%. They then compared four cases by varying the numerical information and the presentation order in an advertisement: regular/sale/absolute/percentage, regular/sale/percentage/absolute, regular/sale/absolute, and regular/sale/percentage. The result was that the fourth

combination, which had a multiple of only two numbers (regular price $58/sale price $29/percentage discount 50%), had lower processing fluency, deal liking, and purchase intention than the other three combinations.

The above evidence suggests that the percentage- and absolute-discount frames generate different consumer responses. However, one problem identified here is that the price information presented to participants is inconsistent across the studies. For example, Chen et al. (1998) and DelVecchio et al. (2007) presented a regular price but not a sale price, Bambauer-Sachse and Dupuy (2012) presented a sale price but not a regular price, and Chandrashekaran and Grewal (2006) presented both. Accordingly, the findings are too varied to be generalized. This is therefore the focus of this article: to investigate the effect of saving presentation frames by systematically manipulating the additional price information presented to participants. More specifically, we compare the price frames where only the regular price is presented, where only the sale price is presented, and where both prices were presented in addition to the saving frames. We targeted regular and sale prices because these are basic discount-related information. No study to date has performed this comparison, so this may lead to a richer understanding of consumer perceptions toward saving presentation frames.

We presume that the three basic price frames may elicit different consumer perceptions. Berkowitz and Walton (1980) showed that a sale price with a percentage-discount frame was less preferred than a regular price with a sale price. Della Bitta et al. (1981) showed that presenting a sale price only had a lower perceived value than a regular price with an absolute-price discount. These results imply that consumer preference on sale price depends on the saving presentation frame. We predict that a sale price would be most preferred when the absolute-discount frame is presented with it, compared to other cases because this information includes the amount they have to pay and the amount they can save simultaneously. Presenting a sale price is expected to be more valued than a regular price since consumers are generally more interested in the price they have to pay.

Consumer Characteristics

We also looked into the moderating effects of two consumer characteristics—price consciousness and needs for cognition (NFC)—to understand the underlying process of consumer responses to the saving presentation frames. These concepts have been widely adopted in consumer behavior research. Price consciousness is defined as the degree to which the consumer focuses exclusively on paying low prices (Lichtenstein et al. 1993). Consumers with high price consciousness were found to spend more time looking at store ads, buy more products on sale, and spend more money on such products (Lichtenstein et al. 1993); they also have a narrower latitude of acceptable prices (Lichtenstein, Block, & Black 1988), use firms' messages in judgments (Inman et al. 1997), and have higher store brand usage (Ailawadi, Neslin, & Giadenk 2001) compared to those with a low price consciousness. Another characteristic, NFC,

refers to the tendency to engage in effortful cognitive activities (Motyka, Grewal, & Kohlli 2016). High-NFC consumers, compared to low-NFC consumers, tend to be less influenced by purchase quantity limits (Inman et al. 1997), have an increased store brand usage, have lower out-of-store promotion usage (Ailawadi et al. 2001), have higher acceptable-price limits, and have higher value perceptions on price presentations using disfluent fonts (Motyka et al. 2016).

Based on these findings, we predict consumers with low price consciousness and low NFC are more susceptible to price and saving frames in advertisements because they tend not to process such information deliberately compared to those with high price consciousness and high NFC.

Method

Design and Stimulus

This study adopted a controlled experimental method with a three (price frame) by two (saving frame) between-subjects design. The three levels of the price frame presented both regular and sale prices (RP+SP frame), regular price only (RP-only frame), and sale price only (SP-only frame). The two levels of the saving frame were absolute discount and percentage discount. The price and saving frames were manipulated in a print advertisement of a fictitious new brand with a brief product description. Crossing the two frames resulted in the six advertisements. All had the same economic value. Participants were randomly assigned to one of the questionnaires incorporating an assigned advertisement, a scenario, and related questions.

A laptop computer was used as the experimental stimulus. This selection was based on certain criteria. First, most participants had some knowledge of the product's features and prices; thus, they could easily visualize the product. Second, it was usually interesting to most participants because they frequently use the product. Third, both males and females could be shoppers of the product. A pretest conducted with 18 students indicated that the perceived reasonable mean price was JPY88,472, the approximate conversion being $1 = JPY100. We also checked a large Internet shopping site that allows consumers to compare laptop prices and brands in various online stores. Based on this, we set the regular price at JPY90,000. A moderate price discount of 25% was selected following Hardesty and Bearden (2003). Accordingly, the sale price became JPY67,500.

Procedures and Measures

The sample consisted of 159 undergraduate students from a major university. Questionnaires were administered by paper and pencil in a classroom setting. Participants were asked to imagine shopping for a new personal computer

and stumbling upon a print ad. After seeing it, they evaluated the advertised offer based on the following dimensions: perceived savings (three items; Biswas and Burton 1993, 1994), price perception (two items; Voss, Parasuraman, and Grewal 1998), quality perception (two items; Dodds, Monroe, & Grewal 1991), and shopping intention (three items; Biswas and Burton 1993, 1994). All were measured on a seven-point scale. Multiple responses were averaged to form each index (α = 0.87 for perceived savings; r = 0.52, p < .000 for price perception; r = 0.5, p < .000 for quality perception; and α = 0.89 for shopping intention). Furthermore, two consumer characteristics were measured using a seven-point agreement scale: price consciousness (Lichtenstein et al. 1988) and NFC (18 items; Cacioppo & Petty 1984). NFC responses were then averaged to form an index (α = 0.87). The two characteristics were finally divided into high and low groups following the median split (4.4 for price consciousness, 5.0 for NFC).

Results

Table 1 shows the means for each treatment. We first carried out a two-way ANOVA involving price frame and saving frame as independent variables for each of the four dependent variables. It revealed the price frame's significant main effect on shopping intention (F (2, 153) = 3.6, p < .05). Subsequent multiple comparison tests showed that the SP-only frame condition had a higher shopping intention than the RP-only frame condition; the mean score of RP+SP was between the two conditions, but no significant differences between them were detected (M_{RP+SP} = 4.3, M_{RP} = 3.8, M_{SP} = 4.5). The main effect of the saving frame was significant on perceived savings (F (1, 153) = 3.8, p < .05), price perception (F (1, 153) = 7.1, p < .01), and shopping intention (F (1, 153) = 3.4, p < .1). For all variables, the absolute-discount frame had higher mean scores than the percentage-discount frame ($M_{Percentage}$ = 5.4, $M_{Absolute}$ = 5.7 for perceived savings; $M_{Percentage}$ = 4.2, $M_{Absolute}$ = 4.7 for price perception; $M_{Percentage}$ = 4.0, $M_{Absolute}$ = 4.4 for shopping intention). No significant interaction effect was found between the two factors.

Table 1. Means of dependent variables across conditions

	RP+SP		RP-only		SP-only	
	Percentage	Absolute	Percentage	Absolute	Percentage	Absolute
Perceived savings	5.74	5.67	5.19	5.58	5.30	5.96
Price perception	4.13	4.85	4.11	4.41	4.42	4.98
Quality perception	4.17	4.15	4.41	4.02	4.61	4.40
Shopping intention	4.09	4.42	3.68	4.00	4.25	4.71

Next, we conducted a three-way ANOVA for each dependent variable by including price consciousness as a moderator. Surprisingly, a three-way interaction effect among price frame, saving frame, and price consciousness was

revealed only for quality perception (F (2, 147) = 4.1, p < .05). A separate analysis for high- and low-price-consciousness groups confirmed that the interaction effect between price frame and saving frame on quality perception was significant for the low group (F (2, 55) = 4.9, p < .01; see Figure 1) but not for the high group (F (2, 92) = 0.8, n.s.). Simple tests for the low group found that the absolute-discount frame generated a higher quality perception than the percentage-discount frame in the SP-only frame condition (p < .05); this phenomenon was reversed in the RP-only frame condition. In the RP+SP frame condition, quality perception did not differ between the two discount frames.

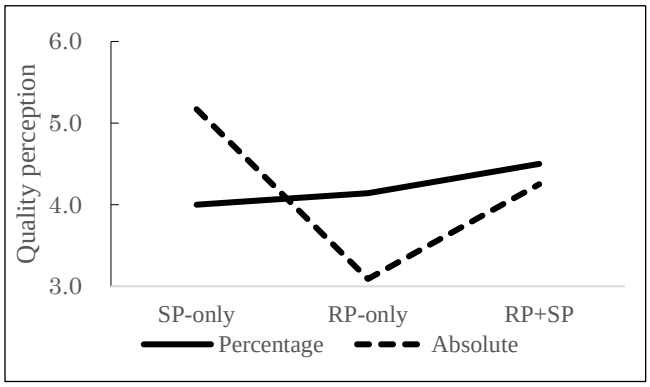

Figure 1. Moderating effect of price consciousness: Low group

Moreover, a significant two-way interaction effect between price frame and price consciousness was confirmed for price perception (F (2, 147) = 4.5, p < .05) as shown in Figure 2. Simple tests found that the low group had a lower price perception than the high group in the RP-only frame condition (M_{High} = 4.7, M_{Low} = 3.6, p < .01) while the high group had a lower price perception than the low group in the RP+SP frame condition (M_{High} = 4.3, M_{Low} = 4.9, p < .05).

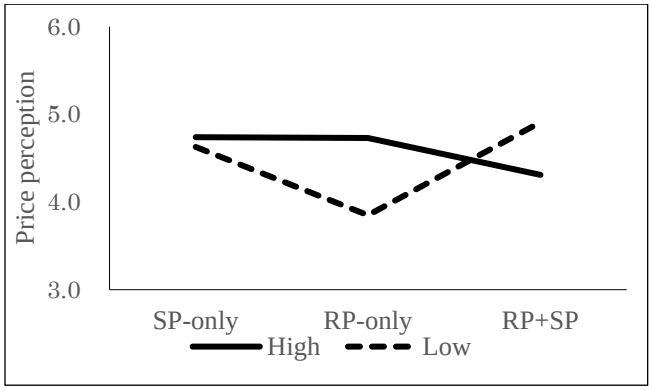

Figure 2. Moderating effect of price consciousness

A moderating effect of NFC was found, as the three-way interaction among price frame, saving frame, and NFC on quality perception became significant (F (2, 147) = 4.0, $p < .05$). A separate two-way ANOVA for high- and low-NFC groups confirmed a significant interaction effect between price frame and saving frame for the low group (F (2, 72) = 3.6, $p < .05$). The pattern is similar to the interaction effect for low price consciousness. Subsequent simple tests for this group revealed that the absolute-discount frame led to a higher quality perception than the percentage-discount frame in the SP-only condition ($p < .1$) whereas the absolute-discount frame generated a lower quality perception than the percentage-discount frame in the RP-only frame ($p < .05$).

General Discussion

This article examined how the price frame and saving frame in a price-discount advertisement can affect consumer perceptions. Several significant findings were derived from the study. First, the sale price generates a better shopping intention. Presenting the sale price with the regular price does not seem important in this context. However, displaying the regular price alone is not enough to increase the shopping intention despite the presence of saving information. Second, the saving frame influences consumer perceptions regardless of the price frame. The absolute-discount frame is better at generating perceived savings, price perception, and shopping intention than the percentage-discount frame. This is consistent with the findings of Chen et al. (1998), which showed that the absolute-discount frame increased perceived savings for a high-priced product (a personal computer). We additionally showed that this phenomenon occurs regardless of the price frame. Third, consumers' price consciousness influences the effect of the price and saving frames on quality perception. Consumers with a low price consciousness perceive an advertised product as having better quality when the sale price is presented with the absolute-discount frame rather than the percentage-discount frame. Conversely, when the regular price was presented with an absolute discount, consumers showed lower quality perception compared to when the regular price was displayed with a percentage discount. Fourth, price consciousness moderates the effect of the price and saving frames on price perception. Low-consciousness consumers do not generate price perception as soundly as high-consciousness consumers when a regular price was presented, but such perception becomes better than that of high-consciousness consumers when both regular and sale prices were shown. Finally, consumers' NFC influences quality perception. Low-NFC consumers perceive an advertised product as having better quality when the sale price is displayed with the absolute-discount frame compared when it is shown with the percentage-discount frame. Conversely, when the regular price was presented with an absolute discount, consumers had lower quality perception compared to when the regular price came with a percentage discount.

These results indicate that retailers should be cautious of selecting the price information presented to consumers when offering discounts. Providing only the regular price should be avoided although saving information is present. In particular, low-price-consciousness and low-NFC consumers do not prefer such information. As for the saving presentation frame, using absolute discounts is more preferable than percentage discounts. Remarkably, consumers with low-price-consciousness and low-NFC have an increased quality perception of an advertised product when the sale price and the absolute-discount frame are presented together. This is a rather new finding, as no studies have explored the impact of the price and saving frames on consumers' quality perception.

For future research, it may be interesting to conduct the same analysis for frequently purchased products such as food or daily necessities. Since consumers are highly familiar with such products as well as the shopping environment, they may simply focus on the sale sign and not necessarily spend much time processing the advertised information. These consumers may not appreciate information such as the regular price because it is simply unimportant to them.

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Tax and Economic Growth in Thailand

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Abstract

This research seeks to find out whether or not tax collecting from capital, labor, and consumption, undermines economic growth. The statistics used in this study are quarterly data of Thailand from 1993-2015 derived from the National Statistics Bureau of Thailand, Fiscal Policy Office and Bank of Thailand. To analyze, the regression method is adopted. The results drawn from this study suggest that average tax burden on labor is negatively related with Thailand's economic growth whereas average tax burden on capital and consumption do not have a significant association with the growth rates.

Keywords: Capital Tax, Labor Tax, Consumption Tax, Economic Growth, Thailand

1. Introduction and Literature Reviews

Richard A. Musgrave regarded as the father of the field of public finance defined the role of government into three types; allocation, redistribution, and stabilization of the economy. Taxation is a major channel for the government to achieve the goal in redistributing from the rich to the poor. Besides, taxation is a major source of government revenue. However, it is believed that many taxes produce distortion i.e. people would be discouraged to work and/or invest if the government impose too high of a tax. Thus, tax collection would lead to inefficiency and therefore hinder economic growth of a nation. To be more specific, tax collecting from labor and capital is believed to undermine the economic growth while tax from consumption is more benign (Hyman, 2010: 596). A huge number of empirical studies have been done in order to test the impact of these particular taxes on economic growth (for example Tomljanovich (2004) Myles (2007) Arnold et al (2008) Dackehag and Hansson (2012)). However, the research on this topic using data of Thailand is very limited. This research, therefore, can give a discrete explanation for Thailand, a developing country differing in background and socioeconomic context from their industrialized cohorts.

2. Model and Data

From the previous section, taxations which may have relationship with economic growth can be found using multiple regression analysis. The models can be presented as follows.

Model

$$GROWTH = \beta_0 + \beta_1 CAPITAL + \beta_2 LABOR + \beta_3 CONSUMPTION + \beta_4 EDU + \beta_5 TRADE + \beta_6 GROSS + \varepsilon$$

GROWTH is GDP growth of Thailand.

CAPITAL, LABOR, and CONSUMPTION are average tax burden on capital, labor, and consumption, respectively.

EDU is the percentage of federal budget on education in relation to Gross Domestic Product (GDP).

TRADE is trade openness.

GROSS is gross capital formation.

Data

The data used in the analysis is a quarterly data of Thailand from 1993-2015. The tax variables; CAPITAL, LABOR, and CONSUMPTION derived from Fiscal Policy Office of Thailand whereas other variables were collected from the National Statistics Bureau of Thailand and Bank of Thailand.

3. Regression results

The results derived from models in Table 1 show that economic growth in Thailand is not significantly driven by capital tax as well as consumption tax while labor tax is statistically and significantly related to the economic growth. That is, for example, for model 1, for every additional percentage of total labor tax revenue to GDP, one can expect growth rate to decrease by 2.11 percent. Next, the findings show that gross capital formation (GROSS) do statistically have impact on the growth rates as expected. However, the findings from all models show that government spending on education seems to have no significant impact on growth rates in Thailand.

Table 1 OLS regression results

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
D(GROSS1000)	0.04 (6.28)	0.04 (6.25)	0.04 (6.35)	0.04 (6.33)
D(EDU)	-0.81 (-0.67)	-1.15 (-0.95)	-0.81 (-0.69)	-0.99 (-0.79)
D(TRADE)	5.36 (1.40)	3.00 (0.81)	5.20 (1.42)	3.97 (1.03)
D(CAPITAL)	0.09 (0.50)	0.15 (0.82)	-	-
D(CON)	-0.18 (-0.45)	-	-	-0.33 (-0.82)
D(LABOR)	-2.11 (-2.21)	-	-2.17 (-2.33)	-
C	0.82	0.83	0.81	0.90

	(4.83)	(4.83)	(4.85)	(5.19)
No. of Observation	90	90	90	94
R^2	0.44	0.41	0.44	0.40
Durbin-Watson stat	2.43	2.52	2.45	2.49
Prob(F-statistic)	0.00	0.00	0.00	0.00
F-statistic	10.94	14.61	16.60	14.59

Note : The value in parentheses is t-statistics.

4. Conclusions

The results suggest that average tax burden on labor does undermine growth rates in Thailand. This implies that, for the case of Thailand, the government should consider this negative impact altogether with the positive effect of it on other aspects, for example, the redistribution function of government. The role of government is to balance these two objectives; allocation function and redistribution function, to the best interest of the society.

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The inference of Internet Addiction behavior - Taking perceived health status as Examples

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Abstract

Internet addiction is a common and prevalent situation for people in all countries, especially for young people. The behavior of Internet addiction is influenced by many factors and affects the entire society and culture. This study mainly wants to explore Internet Addiction behavior for perceived health status. In addition, also want to realize the impact of which health status. This study uses SPSS 24.0 statistical analysis and total of 1,566 valid samples were contacted in the survey. The result shows that when using the mobile phone for a long time, women are more likely than men to have eye soreness, muscle soreness or other physical discomfort. Those who with high score in self-rated Internet addiction were more likely late to sleep, therefore cause mental inactivity during the day. They also more use mobile phones before bedtime, and therefore reducing the sleep time or deterioration of sleep quality. Respondents under 40 years old are more likely than aged 40-59 those to use the phone before bedtime to reduce sleep time or reduce sleep quality. Respondents under the age of 29 are less likely to concentrate than those who are 40-59. Finally, Internet addiction problems will only become more and more prevalent, affecting people's physical health and mental health, and further research should continue to extend relevant epidemiological surveys.

Key word: Internet Addiction, Perceived health status, Gender

Introduction

According to the National Communications Commission (NCC), from the beginning of 2006 to the end of August 2015, the total number of mobile communication users climbed from 1.46 million to 29.45 million, which has grown by 27.99 million in ten years (National Communications Commission, 2015). These new groups are prone to symptoms of Internet addiction. Ivan Goldberg proposed the Internet Addiction Disorder, IAD, in 1996. In addition to the Internet Addiction Disorder, there are many words used to describe the damage to other life functions caused by inability to self-control, such as internet dependency, problematic internet use, pathological internet use etc. (Chou, Condron, & Belland, 2005; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000). In the past, many studies have attempted to find important factors that cause Internet addiction in real life, including psychological and environmental factors, and are known as risk factors for Internet addiction (Wang, 2009). The studies systematically reviewed the literature to identify risk factors such as low self-esteem, alienation from peers, poor family function, sense of boredom, schoolwork setbacks, nervousness, depression, and social anxiety.

According to Ko et al (2012) and Kuss & Griffiths (2014) collating past studies, US studies found that 4% of students (14-18 years old) have Problematic Internet use behavior; Norway has 2.0% of adolescents (12-18 years old) belonging

to Internet addiction; Finnish teens have an Internet addiction prevalence of 1.4% to 1.7% (12-18 years); Netherlands studies pointed out that 3.7% of adolescents (11-19 years of age) have potential Internet addiction; Spain's relevant studies indicate that adolescents have Internet use problems with a ratio between 5.0% and 6.1%; Greek students prevalence of Internet addiction was 5.3% to 15.2%; Italian studies found that 36.7% of high school students were Internet addiction, and another survey assessed 0.8% of high school students who had severe Internet addiction; Turkish survey found that , 5.0% to 11.6% of teenagers can be assessed as Internet addiction or overuse of the Internet.

There is a positive relationship between online time and Internet addiction (eg, Chou, Chou & Tyan, 1998; Chou & Hsiao, 2000; Lin, Ko & Wu, 2011; Yang & Tung, 2007), that is, the longer the Internet is used, the more likely it is that Internet addiction. In addition to using the Internet, Internet addiction may also be related to the nature of communication pleasure. The higher the user's enjoyment of communication, the higher the tendency of Internet addiction (Chou, Chou & Tyan, 1998; Chou & Hsiao, 2000); the personality traits of high happiness are related to the occurrence of Internet addiction (Suehuei Chen et al, 2003); in addition, seeking social or recreational motivation and satisfaction, positively related to Internet addiction (Yang & Tung, 2007). Related research also pointed out that there is a link between Internet addiction and partial mental disorders, including substance use disorder, Attention Deficit Hyperactivity Disorder (ADHD), depression, social phobia and hostility. (Ko et al, 2012; Yen et al, 2007; Yen et al, 2009).

In addition, the more severe the degree of Internet addiction, the more physical symptoms associated with it, including headache, insomnia, muscle numbness, dry eyes, blurred vision, etc. (Ministry of Education, 2016). According to environmental epidemiological observations, the popularity of 3C (Computer, Communication product, and Consumer Electronics) products has led to the emergence of new groups, the so-called “Phubber”, many people have use mobile phones for a long time, and they have been sitting unconsciously. Humpback, shoulder lift, tight posture tends to stiffen the neck, neck and shoulders, severe cases may cause tension headache, cervical anti-bow, arm pain, finger numbness plus the use of mobile phones with the concerns of macular degeneration and brain tumors, the problem of internet and mobile phone addiction has become more and more serious. This study wants to conduct epidemiological investigations related to internet addiction.

Methods

This study uses the secondary data of The Survey Research Data Archive “2015 Internet Addiction Study” for SPSS 24.0 statistical analysis. In this secondary data, Computer Assisted Telephone Interviewing (CATI) was used. CATI conducted a logic check to improve data quality. The distribution of sample in all counties and cities is allocated according to the stratification ratio, and the total population of each prefecture and city (meaning that it includes the Internet and non-Internet population) is allocated in a hierarchical manner. In other words, according to the September 2015 demographic data newly released by the Ministry of the Interior, this study allocates samples based on the ratio of population aged 12 years and over in all counties and cities. A total of 1,566 valid samples were contacted in the survey.

The questionnaire contains six parts: The first part investigates the respondents' personal internet usage, including the information equipment they have, whether the mobile phone with internet or not, the location of the Internet, the time

spent on the internet, and the use behavior; the second part surveys the subject of Internet addiction, self-assessment of Internet addiction, type and severity of addiction. The third part assesses Internet addiction among respondents by the CIAS Internet Addiction Scale (Chen et al, 2003). Indicators include core symptoms of Internet addiction and Internet Addiction-related issues; the fourth part is to assess the use of mobile phone addiction in the short version of the mobile addiction scale; the fifth part assesses the perceived health status of Internet addiction; the sixth part includes the personal social and economic situation, Such as gender, age and occupation.

Result

Analyze the characteristics of respondents, men accounted for 48.7%, women accounted for 51.3%. According to the distribution of age, the proportion of people aged 40-49 is relatively high, accounting for 25.6%, followed by 30-39 and 20-29, with 22.6% and 18.2% respectively; people aged 50-59 and 12-19 each accounted for 14.8% and 15.0%, while respondents aged over 60 only accounted for 3.7% of the online population. In terms of the degree of academic qualifications, the number of university graduates is the highest (38.1%), the number of senior high school graduates (30.5%). The highest proportion of student populations, accounting for 18.4%, professionals 12.5%; in addition, technicians and assistant professionals accounted for 11.3% and 11.6%, and service and sales staff accounted for 9.2%. Supervisors and managers accounted for 9.0%. From the residential cities and counties, New Taipei City has the highest proportion accounting for 17.6%, followed by Taipei City and Taichung citizens, all accounting for 12.4%; Kaohsiung citizens accounting for 11.6%, and the proportion of people living in other counties and cities less than 10% (as Table 1).

Table 1 Demographic Characteristic of Participants

Variable		Number	Percentage
Gender	Male	788	48.7%
	Female	830	51.3%
Age	12-19	242	15.0%
	20-29	295	18.2%
	30-39	366	22.6%
	40-49	414	25.6%
	50-59	239	14.8%
	>60	60	3.7%
Education	Elementary	26	1.6%
	Junior high	127	7.8%
	Senior high	494	30.5%
	College	210	13.0%
	University	616	38.1%
	Master	141	8.7%
Residence	Taipei city	201	12.4%
	New Taipei city	284	17.6%
	Taichung city	200	12.4%

	Kaohsiung city	188	11.6%

The survey found that 21.2% of people averaged 2-3 hours of Internet access every day, 17.9% of them surf the Internet 1-2 hour per day, and 14.6% had access to the Internet 3-4 hours. On average, people spend 3.4 hours a day on the Internet. From the age group, people aged 20-29 years are the longest on the Internet, with an average of 4.5 hours of Internet access per day; and with the increase of age, the time for daily Internet access is decreased, and the daily average of people above 60 years of age are 1.7 hours per day. In terms of educational attainment, the higher the academic qualifications, the longer the people spend surfing the Internet every day. People with a degree below the primary school average 1.4 hours of daily Internet access, and university or above has an average of 4.1 hours of daily Internet access. From the perspective of the Internet-enabled equipment, 95% of the people have a smart phone, 77.3% have a desktop computer, 51.8% have a laptop, 46.6% hold a tablet, and 21.4% have the Internet TV, 3.8 % had wearable mobile devices, 0.1% had other internet-enabled devices (such as game consoles), and another 0.5% said that they did not own any devices that could access the Internet. The survey found that 63.6% of the people most often use smart phones to access the Internet, and 20.2% use the desktop computer, compared with tablet (8.4%), notebook (4.5%), television (0.4%) or Wearable mobile devices (0.1%) have a ratio of less than 10%.

Analysis of people's Internet profiles showed that participating in the online community (eg, Facebook) is the most important cyber activity for the people, accounting for 44.9%; followed by the use of communications software (such as LINE), accounting for 38.9%. Search for life or leisure information (27.2%), watching videos (20.1%), reading news (18.8%), playing online games (18.1%), online shopping (7.6%), listening to music or broadcast (5.1%). Other less than 5% of online activities include viewing stock financial information (3.2%), reading comics or novels (2.5%), operating online communities (1.7%), and participating in live broadcasts (such as games and personal videos) (0.8 %). The survey found that except for work or academic studies, 26.7% of the people can continuously access the Internet for a maximum of 1-2 hours a day, 18.5% can stay on the Internet for 2-3 hours, and 16.5% can continuously access the Internet for 0.5-1 hours, 11.5% Internet access is available for 3-4 hours; the average of the people has continuous Internet access for 2.3 hours. The results of the t test show that men can continuously access the Internet for 2.4 hours per day, which is significantly higher than women (average 2.1 hours). In addition, when using the mobile phone for a long time, women are more likely than men to have eye soreness, muscle soreness or other physical discomfort, achieving statistically significant differences, as Table 2.

Table 2 T Test between Gender and perceived health status

Variable Set	Mean		T value	P value
	Male (n=788)	Female (n=830)		
Backache	2.01	2.11	-1.540	0.124
Negative physical health	1.90	1.93	-0.356	0.722
Reduce sleep time	1.58	1.53	0.893	0.372
Mental inactivity	1.74	1.71	0.597	0.550

Eye or muscle soreness	1.98	2.14	-0.303	0.002**
Poor sleep quality	1.68	1.71	-0.666	0.505
Not concentrate on work	1.48	1.46	0.461	0.645

** p<0.01

The ANOVA test analysis shows that the individual's continuous use of the Internet on a daily basis has significant differences due to differences in age, education, and occupation. The 20-29 years old people have a longer time on the Internet, and they can continuously access the Internet for 3.2 hours per day. Compared to the people aged 50-59, they can continuously access the Internet for a maximum of 1.3 hours per day. In terms of educational attainment, people with a high school degree or above can access the Internet for more than two hours per day on average. People with a primary education level or below can spend an average of 1.3 hours on the Internet each day. In addition, those who high scores in self-rated Internet addiction were more likely too late to sleep than median scores, it causes mental inactivity during the day. Those who with high scores more often use mobile phones before bedtime than low scores and therefore reducing the sleep time or deterioration of sleep quality reached a statistically significant difference, as Table 3. Respondents under 40 years old are more likely than aged 40-59 those to use the phone before bedtime to reduce sleep time or reduce sleep quality. Respondents under the age of 29 are less likely to concentrate than those who are 40-59, reach the statistically significant differences, as Table 4.

Table 3 ANOVA Test between Internet addition and perceived health status

Variable Set	Mean					Significance	Scheffe's Post Hoc Tests
	Very low (n=4)	Low (n=33)	Median (n=151)	High (n=105)	Very high (n=26)		
Backache	2.25	2.42	2.26	2.49	2.85	0.197	
Negative physical health	2.00	2.33	2.13	2.37	2.85	0.039*	
Reduce sleep time	1.75	1.61	1.73	1.93	2.19	0.195	
Mental inactivity	1.50	1.91	1.81	2.33	2.38	0.004**	4>3
Eye or muscle soreness	2.50	2.47	2.54	2.73	2.83	0.408	
Poor sleep quality	1.50	1.66	2.20	2.35	2.13	0.008**	4>2
Not concentrate on work	1.25	1.55	1.75	1.90	1.77	0.245	

Scheffe's Post Hoc Tests: 1 Very low; 2 Low; 3 Median; 4 High; 5 Very high
* p<0.05 ** p<0.01

Table 4 ANOVA Test between Age and perceived health status

Variable Set	Mean						Sig.	Scheffe's Post Hoc Tests
	12-19 (n=242)	20-29 (n=295)	30-39 (n=366)	40-49 (n=414)	50-59 (n=239)	>60 (n=60)		
Backache	1.92	2.03	2.00	2.12	2.18	2.23	0.163	
Negative physical health	1.90	1.82	1.77	1.97	2.10	2.23	0.01**	
Reduce sleep time	1.52	1.54	1.45	1.56	1.68	1.87	0.143	
Mental inactivity	1.74	1.88	1.69	1.61	1.73	1.88	0.094	
Eye or muscle soreness	2.20	2.17	2.05	1.94	2.01	2.02	0.024*	
Poor sleep quality	1.92	1.89	1.78	1.50	1.42	1.52	0.000**	1,2,3>4; 1,2,3>5
Not concentrate on work	1.71	1.63	1.47	1.31	1.30	1.55	0.000**	1 >3,4,5; 2>4,5

Scheffe's Post Hoc Tests: 1 12-19; 2 20-29; 3 30-39; 4 40-49; 5 50-59; 6 >60
* p<0.05 ** p<0.01

Conclusion and Suggestion

Men in the 12-19 age groups had a higher proportion of internet addiction risks than women, and women had a higher proportion of internet addiction risk in 20-39 age groups than men. The survey found that the number of people with internet addiction risk accounted for 3.5% on the premise of eliminating work or study, and the higher the age, the lower the proportion of internet addiction risk. In addition, if we distinguish between men and women, 10.4% of male aged 12-19 can be at risk of internet addiction, compared with only 5.0% of women. Compared to women, whether they are at the age of 20-29 (6.7%) or 30-39 (6.9%), the proportion of risks for internet addiction was higher than that of men (4.1% and 2.2%). Cross-analysis also showed that the higher the age, the lower the proportion of mobile phone addiction risk. From the 12-19 years old group, 18.4% belong to the risk of internet addiction, and dropped to the age of 60 and above, addiction risk was only 1.1%.

Relationship addiction may be related to internet usage patterns. For example, online community and communication surveys found that 39.8% of respondents think that they have addict to interpersonal relationships if they have self-rated internet addiction. 23.2% felt that they could not leave the mobile phone and there was a case of cell phone addiction; 22.2% believed that they liked to play games and there was an addiction phenomenon to the game; 15.2% said that they preferred various kinds of information and made them addicted to information on the Internet. Further analysis found that for respondents who believed that the relationship addiction may be related to the people's highest rate of participation in the Internet community (44.9%) and the use of communications software (38.9%). The survey also found that 52.6% of non-Internet addicted people feel that they have more interpersonal connections and interactions through the Internet, which is the benefit of the Internet; compared with Internet addicts, there are only 37.8%. In contrast, Internet addicts mainly think that Internet can bring a sense of entertainment (51.5%) and pass the time (42.7%).

This survey explores the relationship between perceived health status and internet addiction, but there are still more

issues for discussion. For example, is there a propensity for internet addiction because of a depression tendency? Or is it because of an internet addiction that leads to depression traits? Is it because of the pressure of work or schoolwork that leads to excessive use of the internet and internet addiction? Is it because of the excessive use of the internet that there is a tendency for Internet addiction, which results in a decline in the performance of work or academic study, and thus a stressful feeling? The interpretation of causality is different, and the method of intervention will be different. In addition, Internet addiction problems will only become more and more prevalent, affecting people's physical health and mental health, and further research should continue to extend relevant epidemiological surveys.

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The Development and Validation of the Conflicting Intentions to Knowledge Sharing Construct- Using Confirmatory Factor Analysis

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Abstract:

The significance of Knowledge Sharing in organisations is well established and previous studies have identified various antecedents to knowledge sharing behaviour and its positive and negative impact on it. Fewer studies have focused on the individual's attitude towards knowledge sharing, where in, an individual's attitude in terms of willingness and eagerness to share knowledge highly determined the knowledge sharing behavior. This paper explores deeply into the attitudinal dimensions of knowledge sharing and particularly in identifying the fluctuating mindset of individuals towards knowledge sharing through finding answer to the question "Does an individual undergo conflicting intentions to knowledge sharing?." The individuals who are willingly sharing knowledge at one point of time may feel uncomfortable at a later point of time to share knowledge in the same organisational and team level settings. This fluctuating mindset of individuals may affect their consistency in knowledge sharing behavior. In this study, a new construct namely "Conflicting Intentions to Knowledge Sharing" is designed and validated using confirmatory factor analysis, for capturing the fluctuating mindset experienced by individuals in organisations.