

GLOBAL JOURNAL

OF COMPUTER SCIENCE AND TECHNOLOGY: G

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VOLUME 13

ISSUE 2

VERSION 1.0



GLOBAL JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY: G
INTERDISCIPLINARY

GLOBAL JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY: G
INTERDISCIPLINARY

VOLUME 13 ISSUE 2 (VER. 1.0)

OPEN ASSOCIATION OF RESEARCH SOCIETY

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GLOBAL JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY
INTERDISCIPLINARY

Volume 13 Issue 2 Version 1.0 Year 2013

Type: Double Blind Peer Reviewed International Research Journal

Publisher: Global Journals Inc. (USA)

Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Changes in Facebook Behavior Over Time

By Mikhail Stal & Martin S. Fiebert

California State University, Long Beach

Abstract - Use of social networking sites has led to research concerning online behavior and personality. This study uses a model specifically developed to study the shifts in behavior of five defined types of Facebook users over a 5-year period as they exploit the site's Timeline feature. Analysis revealed a statistically significant difference in activity among Scrapbookers, $t(7) = 7.99$, $p < .01$ and ($M = 9.13$, $s = 3.23$) as well as among Social Butterflies, $t(7) = 7.13$, $p < .01$ and ($M = 7.38$, $s = 2.92$). The t-test found no discernable statistically reliable difference in the Observer category $t(7) = 1.53$, $p > .05$ and ($M = 0.5$, $s = .93$) nor in the Activist category $t(7) = 1.69$, $p > .05$ and ($M = 1.63$, $s = 2.72$), or Entrepreneur category $t(7) = 1.53$, $p > .05$ and ($M = 1.75$, $s = 3.24$).

GJCST-G Classification: K.6.0



CHANGES IN FACEBOOK BEHAVIOR OVER TIME

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Changes in Facebook Behavior Over Time

Mikhail Stal ^α & Martin S. Fiebert ^σ

Abstract - Use of social networking sites has led to research concerning online behavior and personality. This study uses a model specifically developed to study the shifts in behavior of five defined types of Facebook users over a 5-year period as they exploit the site's Timeline feature. Analysis revealed a statistically significant difference in activity among Scrapbookers, $t(7) = 7.99, p < .01$ and ($M = 9.13, s = 3.23$) as well as among Social Butterflies, $t(7) = 7.13, p < .01$ and ($M = 7.38, s = 2.92$). The t-test found no discernable statistically reliable difference in the Observer category $t(7) = 1.53, p > .05$ and ($M = 0.5, s = .93$) nor in the Activist category $t(7) = 1.69, p > .05$ and ($M = 1.63, s = 2.72$), or Entrepreneur category $t(7) = 1.53, p > .05$ and ($M = 1.75, s = 3.24$).

I. INTRODUCTION

The recent increase in the number of social networking sites has added a new dimension to human communication and interaction. Since its creation in 2004, Facebook (FB) has become the largest site, with over 1.06 billion monthly users across the globe (Tam, 2013). In general, people who use Facebook see it as a central part of their day, typically expending an estimated twenty minutes at that site (Cassidy, 2006). Social scientists have become interested in researching behavior around this extensive use of a relatively new and area of communication. A recent comprehensive review reveals that over 400 studies have been published to investigate a range of variables associated with FB use (Wilson, Gosling & Graham, 2012).

Recently a model to assess FB behavior has been proposed (Fiebert, 2013; Vaughn, Warren & Fiebert, 2012). It proposes a typology of FB users that has been used to study impression management as a function gender and sexuality (Alpizar, et al., 2012), and the offering of birthday greetings as a function of gender and relationship status (Fiebert, Tilmont, & Warren, 2013.).

The present investigation employs the proposed typologies (see below) to examine user behavior across the FB feature known as Timeline. In late 2011, Timeline was an optional feature, but by the end of 2012, it had become standard (Lessin, 2011; McDonald, 2012). Facebook Timeline is unique in that it organizes a user's posts (comments, photos, videos, and other activity) in chronological order, based on the time of the post. Thus an historical 'snapshot' of a FB user's activity is available for detailed analysis over a lengthy period of time.

This present study is a pilot investigation designed to examine FB typological behavior changes for eight individuals over the five years between 2008 and 2012.

II. METHODS

a) Participants

Analyzed Facebook profiles were randomly selected from the FB 'Friends' list found on every profile. A total of eight were chosen for analysis, four from a personal list of friends and four from a personal friend's list of friends. No mutual friends were involved, which provided 2nd and 3rd degree connections for analysis ensuring a more diverse subset of personalities. Of those users selected, six were male and two female. The ages of participants ranged from 20 to 45 ($M = 25.75, SD = 8.50$). Users had an average "friend count" of 669.62 (min = 165, max = 1399).

b) Typologies

Five different FB user-types categorize the major activities of the participant.

The typologies are:

i. Observer

The user spends a significant period of time examining the profiles of other users, and comments on others' status updates, profile pictures, and locations.

ii. Scrapbooker

The user posts photographs of family, friends, and corresponding descriptions on their own profile, emphasizes activities in which they participated, such as social outings.

iii. Activist

The user provides information on and supports political issues, and environmental or ecological causes. These may include participating in or organizing events for organizations.

iv. Entrepreneur

The user presents business-related activities, sales, products, or entertainment references. This may include promotion of consumer products or business enterprises.

v. Social Butterfly

The user spends the majority of his/her time communicating with others. This may include commenting on friends' posts and pictures, as well as replying to messages.

The last ten posts on each selected Facebook profile were coded over the past five years using a

previously developed coding sheet based on activity commonly seen on Facebook (Vaughn, Warren & Fiebert, 2012). Prior research (Vaughn, et. al., 2012) had found a high level of consistency among those doing the rating, with a kappa reliability coefficient of 0.97. Each posts was categorized into one of the above five categories based on the best fit with coding description.

c) Procedure

The selected Facebook profiles were analyzed using the FB Timeline feature in the course of the five years starting in 2012 and going back to 2008. Except for the user who created a FB profile in 2009, all were completed. Only information that was explicitly stated and visible on the profile was used for coding. Demographic data, gender, age, marital status, education, religion, and political views, as well as information on number of pictures uploaded and number of friends were collected.

Coding began with the most recent profile posts in 2012, starting at the current date of profile access. As a nominal level of measurement, each post was first entered into one of the aforementioned typologies. Next, the number of "likes" received for each post was coded, differentiated by whether it was posted by the person under examination or by a friend. Finally, the number of replies on the post was coded, including self-replies by the owner of the profile or 'other' replies by the user's friends. Then the user's activities, including "friending," commenting on a post, liking a post, or checking in at a location were examined. While not all information coded was used for analysis, this additional information provided a supplementary snapshot into the

user's activities over the years. After completing the coding for the year 2012, the process of coding posts and activities was repeated four more times, once for each year going back to 2008. When using the Facebook Timeline to code posts from other years, a date near the original date of access was used in the corresponding year to ensure close to one year's worth of time between coding points.

d) Analysis

Analysis for this study focused on FB posts and their typologies. For each profile the number of posts per year per category was entered into a spreadsheet. Next, the absolute difference between each year was calculated starting with the year 2008 and proceeding to 2012. This methodology was chosen because of cancellation effects found with some users' typologies if only the relative differences between years were calculated. Additionally, the absolute-differences methodology paints a clearer picture of activity changes over time. Higher absolute differences reflect more changes across typologies between years, with an absolute-difference of zero meaning no change in typology between years.

Absolute-difference is illustrated by the following example: If a user had ten Social posts in 2008 and six in 2009, the absolute difference would be four. They are totaled across all the years. See Figure 1 for an example subject. The number at the bottom of each column is the total absolute difference per subject. Total absolute difference per subject was entered into SPSS and analyzed against the null hypothesis, that there would be no change in typology activity across years resulting in an absolute difference of 0.

Figure 1 : An example of what a compiled absolute difference sheet looked like per subject

	Observer	Scrapbook	Activist	Entrepreneur	Social
Subject 1					
2012	0	0	0	0	10
2011	0	5	0	0	5
2010	0	3	0	0	7
2009	0	4	0	0	6
2008	0	0	0	0	10
	0	12	0	0	12

III. RESULTS

A one tailed, one sample t-test was conducted to investigate whether FB typology activity changed across typology-category over time. Results indicated a statistically significant difference in typology activity between years in the Scrapbooker category $t(7) = 7.99$, $p < .01$ and ($M = 9.13$, $SD = 3.23$) as well as in the Social category $t(7) = 7.13$, $p < .01$ and ($M = 7.38$, $SD = 2.92$). However, the t-test failed to reveal a statistically

reliable difference in typology activity between years in the Observer category $t(7) = 1.53$, $p > .05$ and ($M = 0.5$, $SD = .93$) as well as in the Activist category $t(7) = 1.69$, $p > .05$ and ($M = 1.63$, $SD = 2.72$), and in the Entrepreneur category and $t(7) = 1.53$, $p > .05$ and ($M = 1.75$, $SD = 3.24$).

An exploratory Pearson correlation coefficient was computed to assess the relationships between certain changes in typology activity. There was a positive correlation between activity changes in the

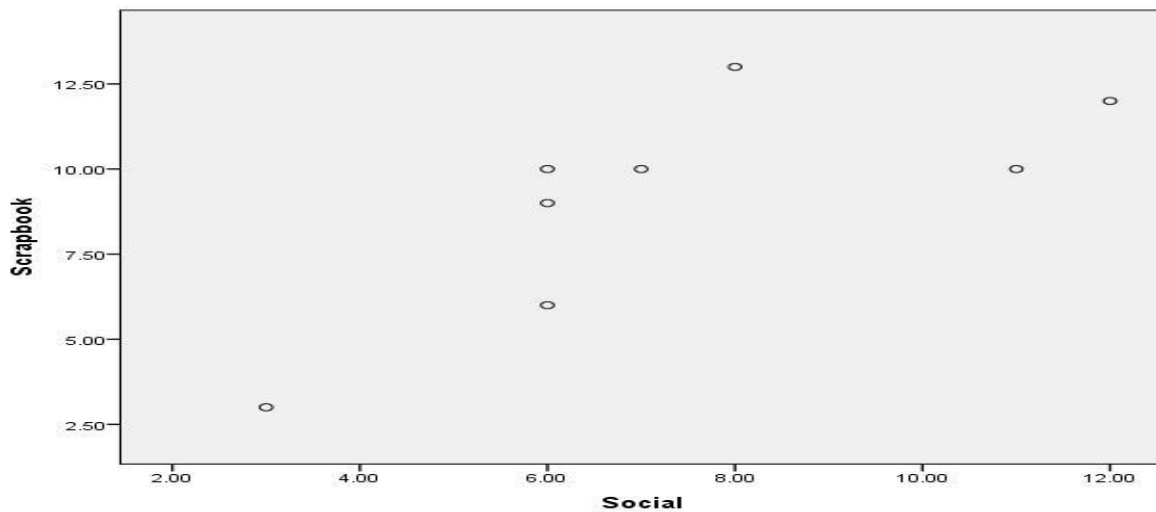
Scrapbook typology and the Social typology, $r = 0.736$, $n = 8$, $p < .05$, a scatterplot summarizes the results, Figure 2 (next page). No additional correlations were seen between other typology categories. Additionally, an exploratory Pearson correlation coefficient was also computed to assess the relationships between age and changes in typology activity across years. There was a positive correlation was found between a user's age and changes in the Entrepreneur typology, $r(8) = 0.869$, $p < .01$. Increases in age were correlated with increases in Entrepreneur typology activity. No additional correlations were seen between changes in typology categories.

IV. DISCUSSION

Results suggest that the number of FB posts per typology-category that users make changes

significantly over time in the Social and Scrapbooker categories. The Observer, Activist and Entrepreneur categories showed no changes. A strong, positive correlation was revealed in the relationship between activity changes in the Social and Scrapbook typology (see Figure 2 below). Activity fluctuations in the Social typology are linked to activity fluctuations in the Scrapbook typology. This may be the result of FB users discussing social events before and after an event. Users may be planning events or recapping their experience, thereby contributing to a spike in social posts followed by a tapering off of posts in that typology category. The spike in Scrapbook posts likely results from users posting pictures of their friends from their most recent meetings.

Figure 2



Among Entrepreneurs, as users aged, changes in their activity changed. This maybe the result of establishing careers and working. One of the evaluated users was a full time Yoga instructor who posted information on Yoga classes and related events. Another worked in Biotechnology and posted items on business advances in the field.

Limitations arise when looking at FB profiles of users because of variations in the privacy settings users have for their Timeline posts. Some varied in the number of posts displayed through the Timeline feature, during a specific period reverting to previous years. While examining current users in 2012, post activity was displayed consistently; however, when examining previous users displayed a variable number of posts, with some time lapses between posts.

Future research on Facebook Timeline should attempt to identify and select users who are deemed to actively post using Timeline. In addition, a larger sample size would help future longitudinal studies, allowing activity changes to be grounded in a longer time range each year.

In conclusion, Facebook typology activity across years varies among users. This brief examination into such activity provides a certain perspective on a user's online social life. The introduction of FB Timeline has opened a door to future investigation.

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GLOBAL JOURNAL OF COMPUTER SCIENCE AND TECHNOLOGY
INTERDISCIPLINARY

Volume 13 Issue 2 Version 1.0 Year 2013

Type: Double Blind Peer Reviewed International Research Journal

Publisher: Global Journals Inc. (USA)

Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Ethical Issues in Computer use: A Study from Islamic Perspective

By Abdul Kadar Muhammad Masum

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Abstract - Computer users are continuously facing ethical challenges as society adopts new and increasingly complex tools and technologies. These ethical challenges can be managed by Islamic code of life. In this paper, we have studied and tried to identify, how computer affects the ethical issues of the society. In this regards, we have traced some highly related issues to the ethics of computer usage, namely – misuse of time, honesty and integrity, privacy, security, intellectual property right, and computer crime. We have also tried to explain these issues in the light of Qur'an and Hadith. At the end of this paper, we have also suggested some measures that can help in promoting proper use of computer facilities by the Muslim masses without compromising the Islamic principles.

Keywords : *islamic ethics, computer ethics, privacy, security, computer crime.*

GJCST-G Classification: *K.8.m*



ETHICAL ISSUES IN COMPUTER USE A STUDY FROM ISLAMIC PERSPECTIVE

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Abdul Kadar Muhammad Masum

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I. INTRODUCTION

With the spectacular growth of high-technology industry, computers and communication have become the backbone of our new life style. Computers have created a host of potentially new misuses, and the computer-related crime has become a growing phenomenon that involves traditional criminal activities such as theft, fraud, forgery and mischief. So there are increasing opportunities for consciously or unconsciously engaging in unethical or illegal behavior.

Ethics is a branch of philosophy that is concerned with human conduct, more specifically the behavior of individuals in society. Ethics examines the rational justification for our moral judgments; it studies what is morally right or wrong, just or unjust (Stead and Gilbert 2001). Computer ethics can be defined as a dynamic and complicated field of study involving facts, concepts, policies and values regarding rapidly increasing computer technologies (Peterson, 2002). Computer ethics focuses on human endeavors influenced or directed by use of computer technologies (Kizza, 2002). Sending an e-mail, writing a program script, creating a database, generating graphics, designing software, processing information and buying software are such behaviors carrying ethical problems within their natures.

Islam places the highest emphasis on ethical values in all aspects of human life. Islamic teachings strongly stress the observance of ethical and moral

code in human behavior. Moral principles and codes of ethics are repeatedly stressed throughout the Holy Qur'an. Allah Says: *"You are the best nation that has been raised up for mankind; You enjoin right conduct, forbid evil and believe in Allah"* (Qur'an, 3:110). Besides, there are numerous teachings of the Prophet (PBUH) which cover the area of moral and ethical values and principles. The Prophet (PBUH) also says: "I have been sent to perfect noble character." (Sunnan Al- Bayhagee: 21301) This statement makes it clear that one of the reasons behind the Prophet's Mission was to elevate and perfect the moral character of the individual and society at large.

II. LITERATURE REVIEW

Research about computer ethics is not isolated from research about Islamic ethics. It is observed that most of the currently accepted western basic principles of ethics in research are consistent with the instructions of Islam. Walter Maner in mid 1970s defined the computer ethics as one which examines "ethical problems aggravated, transformed or created by computer technology" (Bynum, 1993). Moor (1985) states the computer ethics comprises: "(i) identification of computer-generated policy vacuums, (ii) clarification of conceptual muddles, (iii) formulation of policies for the use of computer technology, and (iv) ethical justification of such policies". Mason (1986) introduced four broad categories of information era ethical issues: privacy, accuracy, property, and access, otherwise known as PAPA. Peslak (2006) surveyed more than 200 individuals and verified that the four original PAPA issues were still viewed as timely and important ethical concerns. Using ethical dilemma scenarios, Conger (1995) conducted research that produced five clusters of IT related ethical issues. Two of the five clusters represented issues of responsibility and motivation which were not addressed in Mason's essay. In the year 1992, ACM adopted a new set of ethical rules called "ACM code of Ethics and Professional Conduct" which consisted of 24 statements of personal responsibility (Anderson, 1993). Gorniak-Kocikowska (1996) came up with the idea that computer ethics will eventually become a global ethical system and soon after, computer ethics would replace ethics altogether as it would become the standard ethics of the information age.

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Khanifar (2012) list a series of ethical issues that have strong ramification for information technology e.g., users' rationality, self-control, transparency, honesty, and privacy. These factors are among the core values that penetrated information technology in the form of a new set of ethics e.g., "cyber ethics", "internet ethics", "computer ethics", to name but a few. Their common denominators seem to be efficacy, proficiency, responsibility, and accountability. If these values and practices are not reinforced during one's educational training or one's intellectual development as a student, the false play is more likely to flow over into their professional environment (Underwood and Szabo, 2003). In organizations, professionals' awareness and organizational policies of ethical use of technologies often lag behind their rapid advancement. Hence, professionals at workplace may often be confronted with ethical dilemmas associated with technology that were perhaps not present a few decades ago. Based on a search result on articles published in journals, there appears to be a scant number on attitudes about ethical computer use and Islam. Al-A'ali (2008) concurred that "the relationship between information technology ethics and Islam has received very little or no attention". Some researchers who had attempted to study ethical computer use tended to conclude that personal religiousness, individuals' uncertainty, personal values and moral judgments influenced ethical behaviour in lieu of the lack of corporate code of ethics (Leonard and Cronan, 2005). Clark and Dawson (1996) highlighted the importance of religiousness as an influence of ethical judgments. Khalil and Abu-Saad (2009) found that there was a significant correlation between Islamic work ethic and individualism scales among Arab college students in Israel. Kumar and Rose (2010) investigated the influence of Islamic work ethic on innovation capability in the Malaysian public sector. They found support for the relationship.

III. OBJECTIVES OF THE STUDY

The foremost objective of the study is to link Islamic work ethics to computer use ethics. In addition, this paper will give intent look at;

- i. To review the underlying concepts of ethics and Islamic ethics for computer usage.
- ii. To find out some highly related ethical issues of computer use and its explanation in point of Qur'an and Hadith.
- iii. To propose some suggestions for managing these ethical issues in Islamic way.

IV. METHODOLOGY OF THE STUDY

The present study is based on secondary data particularly the literatures embodied Shariatic rules and non-Shariatic approaches for computer user. This paper makes a brief analysis of the traditional theories and

fundamental concepts of Computer ethics. The secondary data are derived from both Islamic and conventional literatures in this regard. It is worth mentioning here that the Holy Qur'an and traditions of Prophet (PBUH) have been chosen as good references of this study. Other relevant literatures are also studied and examined carefully to fulfill the defined objectives taken in the present study.

V. ETHICAL ISSUES IN COMPUTER USE

The Islamic ethics inspire the people to obey work ethics as well as the Computer ethics. In using computer, the users should focus whether they are violating any ethical issues such as –use of time, honesty and integrity, privacy, security, intellectual property right, and etc. Here all of the issues relating ethical concerns are illustrated in the light of Islamic principles and conventional ethics.

a) Use of Time

A recent survey in USA, conducted by the Kaiser Family Foundation, indicates that 8-18 year olds spend an average of 7 hours 38minutes using entertainment media across a typical day (Kaiser, 2010). Recent studies indicate that on average, teenagers in United Kingdom spend 31 hours a week in Internet and nearly 2 hours a week viewing pornography (The Telegraph, Feb 10, 2009). In Saudi Arabia there is a study that shows 20% of the children exposed to pornography activity every year (Ministry of Justice, 2011). Google, the world's most popular Internet search engine, has found in a survey that of the top 10 countries - searching for sex-related sites - six were Muslim, with Pakistan on the top. The other Muslim countries are Egypt at number 2, Iran at 4, Morocco at 5, Saudi Arabia at 7 and Turkey at 8. Non-Muslim states are Vietnam at 3, India at 6, Philippines at 9 and Poland at 10 (Wikiislam, 2013). This is very unfortunate and it indicates clearly how morality has been seriously degraded amongst the Muslims as a result of misusing computer facilities.

Our attitude towards time indicates our attitude towards the value of the capital of life. Allah Says: *"I swear by the time. Most surely man is in loss. Except those who believe and do good works, and exhort one another to accept truth, and exhort one another to be steadfast"* (Qur'an, 103:1-3). If we want to purchase something, we require financial capital; and if we want to do something in life, we require the capital of life, time. That is why the Qur'an exhorts us to value the time we have before life is up. To express the importance of time utilization, Prophet Mohamed (PBUH) says: *"A human being will remain standing on the Day of Judgment until he is questioned about his (time on earth) and how he used it; about his knowledge and how he utilized it; about his wealth and from where he acquired it and in what (activities) he spent it; and about his body and how*

he used it." (Al-Tirmidhi, Hadith 148) Verily, time is very important for our success both in this temporary world and the eternal world to come. If we waste time, if we abuse it, then we waste and abuse our lives. In the Life Hereafter we will be among the losers, who will suffer the torments in the Hell Fire, if Allah the Almighty will not forgive us. Therefore, if we really give value to our lives then, we must give due value to the importance of time.

b) *Honesty and Integrity*

Integrity means that data cannot be modified without authorization. Integrity is violated when an employee accidentally or with malicious intent deletes or tempers important data files, when an employee is able to modify his own salary in a payroll database, when a computer virus infects a computer, when an unauthorized user vandalizes a website, when someone is able to cast a very large number of votes in an online poll, and so on. Only the necessary amount of information should be collected and should not be fabricated or should not be used without permission of the individual. This is the honest and integrated approach to handle one's information in a workplace. In recent case, Media mogul Rupert Murdoch a British journalist and owner of "News of the world", who falls in this problem, because of dishonesty in performing his duty by sharing others information through Telephone and the Chief executive Dow Jones has resigned from her post (Wilkinson, 2011).

The Holy Qu'ran says: *"Woe to those who deal fraudulently, those who when they have to receive by measure from men, exact full measure. But when they have to give by measure to men, they give less than due. Don't they ever think that they will be called to account on a mighty day?"* (Qur'an, 83:1-5). A Muslim should not make a product or to provide service but cheats through false information using Internet as it is easy and less costly, Allah will without doubt see that and He will judge accordingly. Allah's Apostle Muhammad (PBUH) said: *"The honest Muslim trustee who spends what he is commanded to do and he gives that in full with his heart overflowing with cheerfulness and he gives it to one to whom he is ordered, he is one of the givers of charity."* (Sahih Muslim, Book 5, Hadith 2231) In another hadith, Prophet Muhammad (PBUH) said: *"Any man whom Allah has given the authority of ruling some people and he does not look after them in an honest manner, will never feel even the smell of Paradise."* (Sahih Bukhari, Book 89, Hadith 264) From above two hadiths, it is clear that a Muslim must be aware to his duty and responsibility. He should not do any work that is painful to another human being.

c) *Privacy*

Privacy is defined as the right of people not to reveal information about them, and the right to keep personal information from being misused. Information is increasingly valuable to policy makers; they covet it even

if acquiring it invades another's privacy. According to a recent Eurobarometer (IP/11/742), 70% of Europeans are concerned that their personal data may be misused. They are worried that companies may be passing on their data to other companies without their permission. 74% of Europeans think that disclosing personal data is increasingly part of modern life, but at the same time, 72% of Internet users are worried that they give away too much personal data, according to the Eurobarometer survey. They feel they are not in complete control of their data. This erodes their trust in online and other services and holds back the growth of the digital economy in general (Eurobarometer, 2011).

Without the permission of owner, any information cannot be accessed. Information may be the property of an individual, organization or data of national or international interest, which can be used against humanity or spreading terror in the society. Allah says in His holy book: *"O believers! Do not enter houses other than your own until you have sought permission and greeted their inmates"* (Qur'an, 24: 27). So from the Islamic principles you cannot access the properties others without their permission one can not disclose other privacy, this is the Islamic approach to the rights of privacy. Allah says in another chapter of Qur'an: *"O believers! Avoid immoderate suspicion, for in some cases suspicion is a sin, Do not spy on one another"* (Qur'an, 49:12). Prophet Mohammad (PBUH) said: *"O people, who have professed belief verbally, but faith has not yet entered your hearts: Do not pry into the affairs of the Muslims, for he who will pry into the affairs of the Muslims, Allah will pry into his affairs, and he whom Allah follows inquisitively, is disgraced by Him in his own house"* (Abu Dawud) In this Hadith, the Prophet tells us that it is prohibited for any person to come (physically) into ones property without permission or logically into ones computers resources for curiosity or to look at their contents without a prior permission of the owner and he should be aware of the limit of the given permission.

d) *Security*

Technology presents us ever increased security challenges. The security on the Internet and in computer networks, concerns the communication which can be accessed and manipulated by unauthorized intruders, who have no right to the information passed during the communication. Most countries in North America and Western Europe are among the countries with the highest Internet penetration rates. Cybercriminals make money from users in these regions by stealing their banking data, as well as by deceiving users and extorting money. Statistics show that many computers in these regions are infected with bots which collect banking information, spread rogue antiviruses and spoof user traffic: users from these regions accounted for over 70% of the victims of the Sinowal bot attacks, over 40% of the victims of attacks by SpyEyes bots that

collected banking details, and 67% of the rogue antivirus detections in the first half of 2012 (Securelist, 2012). Chart 1 and Char 2 shows the penetration rate of

Internet based on a world population of 7,017,846,922 and 2,405,518,376 estimated Internet users on June 30, 2012 (Internetworldstats, 2013).

Chart 1 : Internet users in the world, distribution by world region 2012

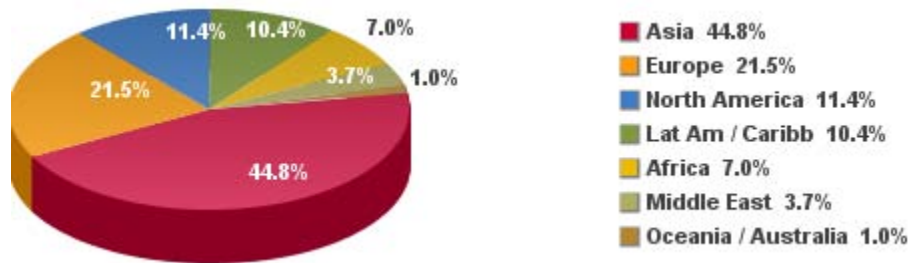
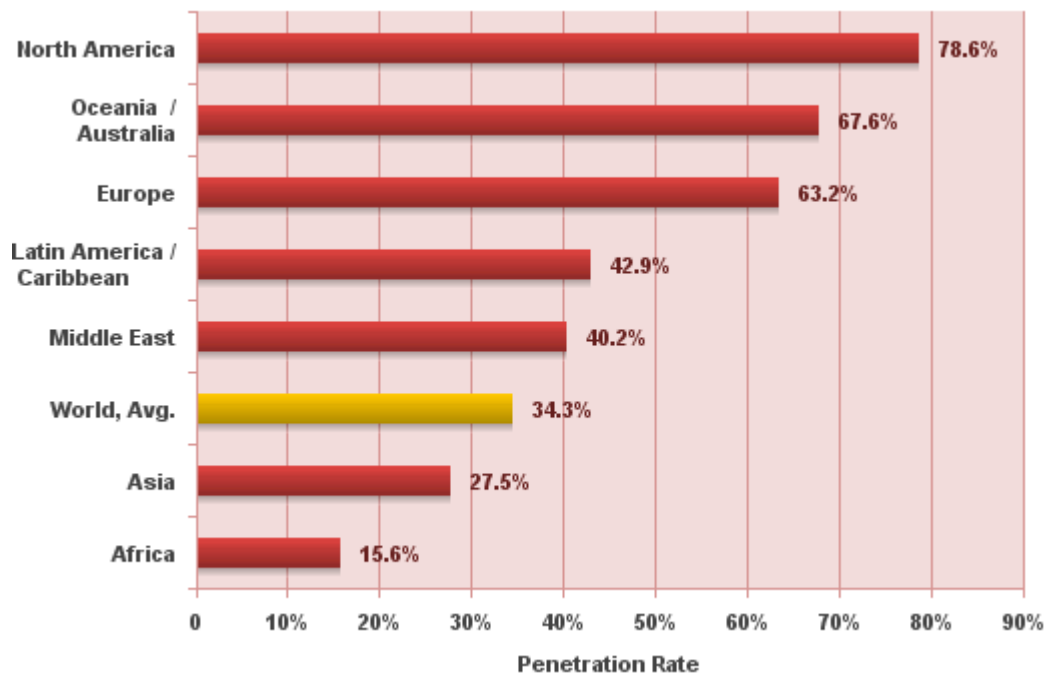


Chart 2 : World Internet penetration rate by geographic region, 2012



In Islam, breaking one's security system, it may be computer security, is prohibited. Qur'an says: *"Let there arise out of you a band of people inviting to all that is good, enjoining what is right, and forbidding what is wrong; They are the ones to attain felicity"* (Qur'an, 3: 104). Further, In Islam punishment is the best way to safeguard society against crimes and it is considered as social necessity. Allah says in Surah An Nisa: *"Whoever works evil, will be requited accordingly"* (Qur'an, 4:123). There are strict penalties for criminals according to Islamic law and these penalties are essential for peace, security disruption and frightening innocent people in a society. Allah's Messenger (PBUH) stated in his farewell speech: *"He will not enter Paradise whose neighbor is not secure from him wrongful conduct."* (Sahih Muslim, Book 1, Number 74).

e) Intellectual Property Right

Intellectual Property is considered to be intangible property created by individuals or corporations that is subject to protections under trade secret, copyright, and patent law. These are any type of software, song and its lyrics, e-book, idea, and others products that are intangible. Information Technology has made it difficult to protect intellectual property because computerized information can be so easily copied or distributed. A survey sponsored by the Business Software Alliance (2007) indicated that 52 percent of university student respondents in the United States and 25 percent of academics believed that the use of pirated software (swapping or downloading digital copyrighted files such as software, music, and movies without paying for them) was acceptable, even in the workplace. Siponen and Vartiainen (2005) found that 72.5 percent of Finnish students surveyed had

copied unauthorized software. The table 1 shows that the United States of America is the least pirated software user on the other hand Armenia has the highest number of pirated software user followed by Moldova, Azerbaijan, and Bangladesh.

Table 1 : Ten Highest and Lowest Country Wise Percentage of Software Piracy (Nationmaster, 2013)

Highest			Lowest		
No	Country	%	No	Country	%
1	Armenia	93%	1	Switzerland	25%
2	Moldova	92%	2	Austria	25%
3	Azerbaijan	92%	3	Denmark	25%
4	Bangladesh	92%	4	Belgium	25%
5	Zimbabwe	91%	5	Sweden	25%
6	Sri Lanka	90%	6	Finland	25%
7	Yemen	89%	7	Japan	23%
8	Libya	88%	8	New Zealand	22%
9	Venezuela	87%	9	Luxembourg	21%
10	Iraq	85%	10	USA	20%

Islam encourages Muslims to learn, but it also respects the laws of ownership. Plagiarism, piracy, misquotation, taking other people's property etc. are all nothing but theft, and deception. Islam advocates for seeking of one's permission before using his or her resource or property. Allah says in the Holly Qur'an: *"O you who believe! Do not consume your property among yourselves unjustly unless it be a trade amongst you, by mutual consent. And do not kill yourselves (nor kill one another). Surely, Allah is Most Merciful to you"* (Qur'an 4:29). The prophet Muhammad (BUPH) said: *"No thief is a believer at the time when he is stealing."* (Sahih Muslim, Book 1, Hadith 104) It is not permitted to get benefits of the contents of a computer or through it without permission. Prophet Mohammad (BUPH) said: *"It's prohibited to take the Muslim wealth without his complete permission"* (Al-Baihaqi, 1994). Unfortunately some Muslims are also involved in various kinds of online theft forgetting the teachings of their religion, Islam.

f) Computer Crime

The term "Computer crime" includes computer-related crime, computer crime, Internet crime, e- crime, digital crime, high-tech crime, online crime, electronic crime, computer misconduct and cyber crime. The attacks take different forms of cyber crime, such as hacking, the distribution of viruses, Trojans and worms, cyber-vandalism, password thefts, Click Fraud, Identity Theft, Spoofing, Sniffing and denial of service attack (DoS). The annual Norton Cybercrime Report (2012), based on self-reported experiences of more than 13,000 adults across 24 countries, calculates the direct costs associated with global consumer cybercrime at US \$110 billion over the past twelve months. The highest rate of cybercrime was found to be in the United States. The cost of global cybercrime has been estimated at \$ 114

billion annually; rising to \$388 billion when financial losses and time lost are included. (Baesystemsdetica, 2012).

Shar'iah has a very high level of proof for the most serious crimes and punishments. If proof is not as specified then the crime must be considered a lesser crime. The major myth is that judges in Islamic nations have fixed punishments for all crimes. The judge under *Shar'iah* is not bound by precedents, rules, or prior decisions as in English common law. The Almighty says *"Surely, he who appears before his Lord as a criminal, there is hell for him, in which he will neither die nor will he live. And he who will appear before Him as a faithful, who has performed good deeds-for all such people there are high positions, ever green paradise, beneath which canals will be flowing; they will live in them forever. This is the reward for him who adopts purity."* (Qur'an, 20:74-76) Some people asked Allah's Apostle, *"Whose Islam is the best? i.e. (Who is a very good Muslim)?"* He replied, *"One who avoids harming the Muslims with his tongue and hands."* (Sahih Bukhari , Book 2, Hadith 10) From the above Qur'anic Ayah and scenario, it is a teaching to the Muslims, not to violate any law set by Allah and access others information unethically (hacking), entering to use others recourse and create disturbance (Virus) and violate one's privacy especially of any state (Information warfare) and every time try to lead right and fair way of life.

VI. RECOMMENDATIONS

There are some processes that can play a great role to reduce the unfair means of using computer resources:

1. Islam reinforces the sanctification of one's heart and mind to make it ready for any practices. One has to submit himself or herself to the Allah (SWT) completely. Takwah (farness of Allah) must be achieved as the main characteristic of a Muslim so that he/she doesn't deed any offence which harmful for others. As He said in the holy Qur'an: *"O you, who have believed, enter into Islam completely (and perfectly) and do not follow the footsteps of Satan (Devil). Indeed, he is to you a clear enemy."* (Qur'an, 2: 208) This divine voice only, if someone follows, can make him or her perfect and keep away from anything unjust and unethical. To ensure the full enforceability of ethical practices their needs a well organized Islamic society and finally an Islamic state.
2. Islamic moral values should be practiced in family life thus a child can grow up with Islam from his early life. Therefore, safe and secure environments will be ensured for users, especially children and young person;
3. Policies and legal regulatory frameworks comprising Shariahtic view at the national level that are

consistent with existing or developing international legal instruments;

4. Government can introduce computer crime law based on Islam which addresses the individual before the crime is committed and hence is more of prevention than a cure.
5. Tracking softwares can be installed to monitor and to control computer users' daily activities with computer resources.
6. High levels of awareness of information security and cybercrime issues amongst users at home, in government and educational institutions, in the private sector, and amongst legal officers;
7. Effective regional mechanisms for detection and preventing cybercrime and improving protection against, detection of, and responses to, cybercrime; Secure information systems, networks and transactions in the public and private sectors;

VII. CONCLUSION

New development in technology and the creation of new media have good and bad effects to the society. The good effects are people can interact and work easily by using technology. In fact, the teachings of Islam can be conveyed to anybody without border. However, the bad effects are the society is exposed to many illegal and immoral activities such as the commission of computer crimes, degradation of moral value, social crises, destruction of marriage institution and insult on Islam. I have tried to show that there are some issues and problems that are unique to computer ethics. It is very important to develop the Islamic outlook to computer ethics especially since we know that most Islamic countries place it at the center of their legal codes for computer crimes like Saudi Arabia, Sudan and Iran. Facts decide the importance of the Islamic law to minimize computer crimes, by providing a worldly punishment as well as that in the hereafter.

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ECC: Economically Congestion Control in Communication Networks

By Yasser Narimani, Shahram Jamali & Ali Ghaffari

Abstract - Congestion control is a vital issue in computer networks, especially the Internet. It has always been one of the basic subjects in the field of research. According to the increasing number on the Internet users, its function and services, the traffic of the Internet is highly being increased. By developing in technology however, capacity of data transferring is increasing; but all these developments do not guarantee the utilization of the Internet when it faces traffic overload. For this reason, improvement in congestion control mechanism is a matter that guarantees the utilization of the Internet and lost against network overload. We believe that this issue can be evaluated in accordance with the theories in economy science. The main goal of these theories is to maximize public welfare for people in the society. On the other hand, economy is also the best mathematical tool in order to help recognize hidden dependencies among different network demanding. On this base, we have designed an economical system to give initial services for networkers by early servers. In this system, the width of the band needed for each service proposed as goods. Early servers and their contributors play the role of producers, and all the users are consumers. Proposed algorithm is paved in NS-2 simulated networks and has been compared with XCP and TCP algorithms. The results of this simulation show the success of the proposed way in high utilization and less packet losing.

Keywords : congestion control, economy science, micro economy, producer, consumer.

GJCST-G Classification: C.2.0



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Yasser Narimani^α, Shahram Jamali^σ & Ali Ghaffari^ρ

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I. INTRODUCTION

Congestion happens when the total number of demand precedes the capacity of the network. The result of this situation is increasing in round trip time, losing in packets and probability of congestion destruction. In such a situation, connection capacity is usually occupied and routing will be low. The goal of studies and research in the field of congestion control is to design and analyze contributed algorithm to share with network sources among competitive users.

According to the binary role of the network users, as senders and receivers, they can be simulated to an economical system. From the point of micro economy, there are three main elements in each economy system: goods, producers and consumers. The main goal of micro economy theory is to use the selfish trends of market staff in a way that it lasts in economy mediation and maximum social welfare.

Since the factors affecting in economical markets are naturally selfish and want to achieve their own interests, we believe that the behavior of network

users can be modeled in accordance with micro economy theory.

In the current study, using the theory of micro economy, we give a framework in which the producer are initial servers, and service routers who give services to other nodes. Consumers, in this economy are all network senders. The goods are as the same as band width. The given framework includes the affairs that are inspired by micro economy with the related algorithm.

a) ECCP Algorithm

Demand and contribution are economical models in which the effect of price on the amount is checked in a competitive market. Price effects on the consumers' demand. As a result, economy will get to its mediation in attention to price and amount. The amount of demand from the consumer side depends on the price of the product. Demand rule says that by fixing other factors, demands are less in high prices and high in low prices. In competitive markets, balanced price and balanced amount of goods are determined by demand and contribution. In higher prices, lack of demands is possible and results in over contribution. This over contribution puts pressure on the price and causes the price to return to its previous level (balanced price). After all, the price tends to be fixed and progressive.

b) Function of ECCP Algorithm

Our proposed algorithm works in two separate levels:

i. Router

When a packet is sent by a sender, at first time, related fields are encoded by 0, and when it is received by the router, the receiver labels the same fields and resends to router. Now the pack comes to the router, the price and the shipping costs of the packet are calculated by router and resent to the sender in the same fields. According to the price, the amount of asset and costs are known for the senders and they send other packets.

Price Calculation

Moment price is a function of utilization, queue length, available band width and round trip time. The relationship between factors and moment price as P_i comes below.

a. Utilization

Moment price has direct relation with utilization, since by the time utilization goes up it means that the

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whole band width is being used, so we probably will evident the loss of the packets and congestion. In this case, we suppose that when the utilization goes high, the price goes high.

$$P_i \propto \text{Utilization}$$

b. *Queue Length*

The moment price also has a direct relationship with queue length. In this case we propose that if the length of queue increases, the price will go up. According to this situation, sender, with the amount of asset in his hand, cannot buy lots of packets in high price. As a result, the length of the queue decreases and so as the congestion and packet loss will be vanished.

$$P_i \propto \text{Queue}$$

c. *Band Width*

From other hand, the price that we have proposed for the packet has a reciprocal relation with the band width, because if we had extra band width we would try to occupy all the band width to maximize the utilization of the system, so we have to decrease the price in order for the sender to have more packet demands.

$$P_i \propto \frac{1}{\text{Spare BandWidth}}$$

d. *Round Trip Time*

At last we suppose that the price has reciprocal relation with sending and receiving time of the packet.

$$P_i \propto \frac{1}{RTT}$$

According to what was mentioned, we can generally get the moment price with the below formula:

$$P_i = U * \frac{Q}{SB * RTT}$$

The price which has been calculated above is the moment price of the packets, but in order not to make moment decisions about price and shopping packets, we extract a function in which moment price and mean of previous prices are entered and then we will decide whether we buy the packets or not. The mentioned function is as below:

$$P_T = \alpha \frac{\sum_{i=n-1}^{n-M} P_i}{M} + \beta P_n$$

As it is seen in above relation, for moment and average price, there is a special weight proposed that declares α and β orderly.

Based on the studies and research, we proposed 0.85 and 0.15 for α and β orderly

II. COST CALCULATION

Each sender wants to send some packets (according to the congestion windows size) with certain price, so the shipping cost for each sender comes from the formula below:

$$\text{Cost} \propto Cwnd_i * P_t$$

From other hand, the overall cost of certain number of sent packets comes from the formula below.

$$C = \frac{Cwnd_i * P_T}{Rtt_i}$$

III. CALCULATION OF SENDER'S ASSET

In this stage, we calculate the total asset of a source to help him make clear of putting a number to the congestion window based on his asset and packet prices. For this reason, the relative asset of a source is being calculated as below.

If the whole available band width is proposed as SB, and the number of senders as f, so the formula will be:

$$ASSET_i = \frac{SB}{f}$$

In order to get the final asset of each sender, we subtract the costs from his relative asset.

$$ASSET_T = \left(\frac{SB}{f} \right) - \left(\frac{Cwnd_i * P_T}{Rtt_i} \right)$$

According to whatever mentioned, we have calculated moment price, final price, costs of senders, senders' relative asset and senders' final asset in router so far.

Now it's the time to put field packets in above amounts and send them to the sender to determine the area of the congestion window with them and start to resend the packets.

Therefore, we propose the amount of a field equals to the final price of the packet and final asset of the packet, and then send it to the sender.

P_T
finance _T

Figure 1 : ECCP Algorithm Fields

a) Sender

When a packet sent by router received by sender, the sender will check the related fields and make decision according to its amount, so two cases will appear:

- i. If the amount of final asset proceeds final price, it means that the source can send more packets in band width. The number of packets (congestion windows size) comes from the formula below:

$$Cwnd_i = \frac{ASSET - cost_T}{P_T}$$

According to relative asset, final cost and final price:

$$Cwnd_i = \frac{\left(\frac{SB}{f}\right) - \left(\frac{Cwnd_i * P_T}{Rtt_i}\right)}{\alpha \frac{\sum_{i=n-1}^{n-M} P_i}{M} + \beta P_n}$$

- ii. If the final asset of the source is less than final price, the source cannot send any packet, but in order to get a feedback from network situation and calculate needed fields, we just send one packet to get the amount of router fields and make sender able to decide on new amounts. In order to do this:

$$Cwnd_i = 1$$

b) Simulation

In order to simulate the proposed algorithm, we have used NS-2 software. The properties of simulation is as below: three hundred senders want to send data in which there is a bottle neck between two routers. Band width for sending data is 30 Mb/s.

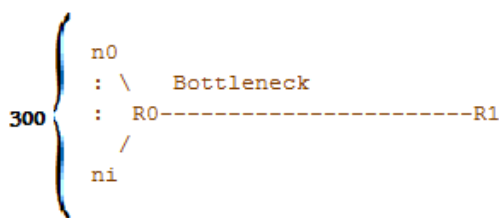


Figure 2 : Typology Simulation

c) Simulation Results

According to simulation, the results are given:

i. Utilization

Figure 3 shows the results related to utilization based on proposed algorithm.

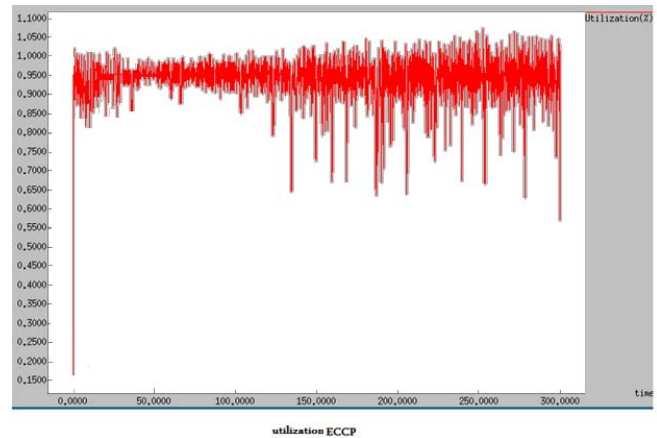


Figure 3 : Proposed algorithm utilization

Figures 4 and 5 show the results of utilization based on TCP and XCP protocols.

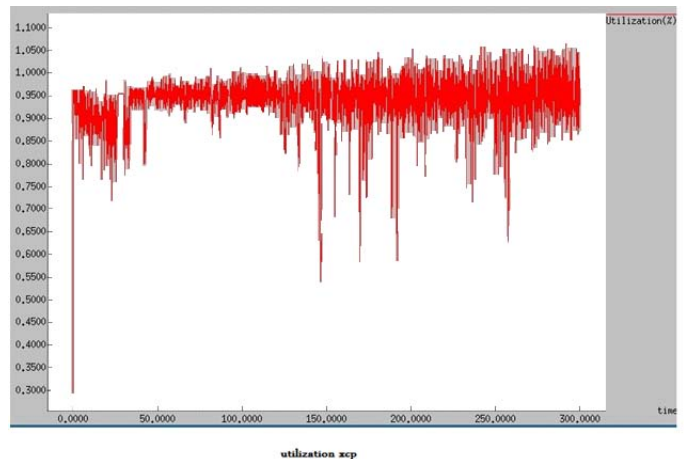


Figure 4 : Utilization of XCP protocol

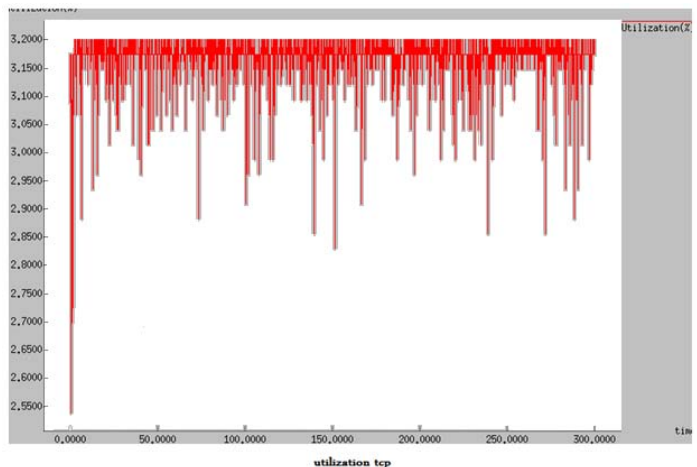


Figure 5 : Utilization of TCP protocol

We can easily see the high utilization of proposed algorithm related to XCP and TCP.

As it is seen, XCP protocol has been descended in early stages, and after sometimes more descending is seen. In TCP also we see more movements while our proposed protocol has less descending.

ii. *Losing of the Packets*

Figure 6 shows the results of losing packets based on proposed algorithm.

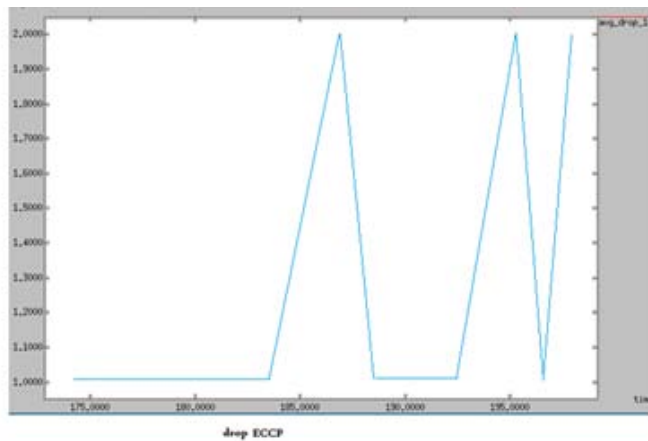


Figure 6 : Losing proposed algorithm

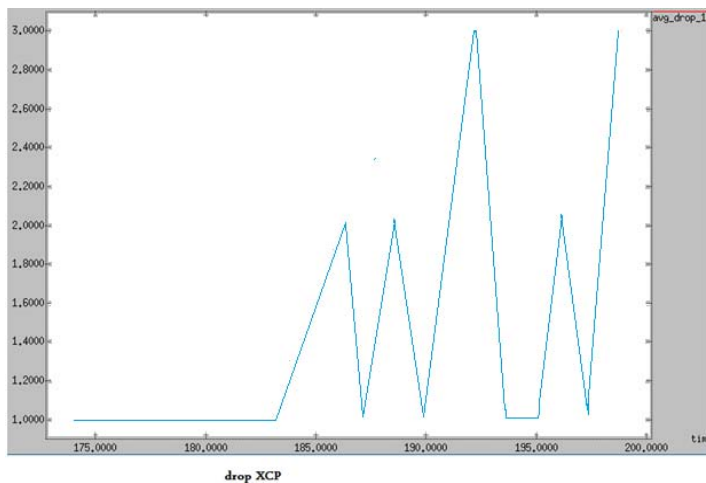


Figure 7 : Losing of packet in XCP

One of the advantages of XCP is that, the number of lost packets is zero, but as it was seen in figures above, the number of lost packets in simulated model in ECCP protocol is less than XCP protocol which cannot be prepared with TCP model.

IV. CONCLUSION

In this study, we worked on the evaluation of economic affairs for having better band width in computer networks, particularly on the Internet. For this aim, we modeled the behavior of networkers using theories in micro economy. According to the theories in

micro economy, the percent of changes in demanding products can be evaluated based on product price. For this reason, an algorithm has been designed to control the calculated price in router in accordance with senders' demanding. By this we can control the congestion in the network and improve utilization.



Using Fuzzy Analytic Network Process (FANP) in a SWOT Analysis

By T. Partani, S. V. Marashi & M. Haji Alishahi

Islamic Azad University, Iran

Abstract - The present study aimed at using Using fuzzy Analytic Network Process (FANP) In a SWOT Analysis.

On the other hand, In this research we tried to use of strengths, weaknesses, opportunities and threats (SWOT) analysis which is one of the most famous table technique in strategic planning process in identify strategic factors of organization and by discovering and identifying those factors, the organization can be build strategies that in SWOT are referred to as SO, ST, WO and WT strategies.

According to internal dependencies existed in most parts of strategic planning, therefore it was necessary to employ a technique which allowed us to measure its dependencies. In many of decision problems was desirable that relations among factors could be imagin as like as reality word.

The ANP powerful instrument with fuzzy phase got to allow modeling SWOT analysis to planners organization. This research was done in 2011, in Notash Afra Co. which works in the field of installation of water and energy projects in Tehran.

The present research in terms of purpose was an applied research; it was also considered as a descriptive research. In this research for determining importance weight, fuzzy analytic network process was used.

Keywords : *strategic planning, SWOT matrix, analytic network process, fuzzy analytic hierarchy process, chang's extent analysis method, triangular fuzzy numbers.*

GJCST-G Classification: *C.2.0*



Strictly as per the compliance and regulations of:



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The present research in terms of purpose was an applied research; it was also considered as a descriptive research. In this research for determining importance weight, fuzzy analytic network process was used. The used fuzzy method was Chang's extent analysis method (EA). Excel software had been used in calculations for analytic network process through using extent analysis method for determination of importance weights and MATLAB software had been used for reaching final results.

Research results showed that when dependence exists among SWOT factors, this dependence could change weight and priority of strategy alternative and eventually WO strategy with the final weight of 0.317 was selected as the best strategy.

Keywords : *strategic planning, SWOT matrix, analytic network process, fuzzy analytic hierarchy process, chang's extent analysis method, triangular fuzzy numbers.*

1. INTRODUCTION

Now a day quantity methods are more valuable and managers organization are interests on acquiring and utilizing those techniques and methods in encounter with their difficulties and problems organizations to ease. Chose a suitable strategy according to abilities and environmental conditions organization is the most important that a organization encounter with it.

Organizations have to chose of strategies which certify survivability them in competitions and it is possible only by strategic planning. In other words, companies must choose goals and strategies that ensure their survival in competition, based on their available resource and the information from the environment. This is possible in the form of strategic planning within strategic planning framework of the organization analyze capability and environmental condition and in accordance with its specific available goals and the method for reaching them. These factors play a key and vital role in the success of the organization. Many approaches and techniques can be used in strategic analysis in the process of strategic management [4]. Such as Boston consulting group, the porter model or GE model that was introduced by general Electric Company. But among these techniques, SWOT matrix analysis, which evaluates opportunities, threats, strength and weaknesses of the organization, is one of the most famous methods. In SWOT analysis two environments must be carefully analyzed and evaluated, one is internal environment, which requires identifying strength and weakness of organization and another one is external environment of the organization [8]. The data from environmental analysis can be shown systematically in a matrix [6]. Various combinations from four factors of matrix if analyzed properly, can be a good basis for the compilation and designing of strategy. But the analysis of SWOT has flaws in evaluation and measurement of steps [12]. Routinely, this method does not specify quantitatively the amount of influence of each of these factors on the proposed program or the chosen strategy [11].

In other words, SWOT analysis is not specifically an analytical tool for determination of relative importance of each of these factors. It does not also have the ability to prioritize the options for our strategy. This method usually gives a general and brief description of the impact of each factor while SWOT matrix should be able to specify quantitatively in the analysis the precise impact of each of these factors [5]. SWOT matrix must also be able to rank these factors in relation to a decision; in this way it provides opportunity for decision makers to analyze the importance of strategic factors in comparison with each other [17]. As a result of ignorance to deficiencies SWOT matrix analysis only provides a list of strategic factors or an incomplete qualitative examination of these factors.

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Due to the reasons SWOT matrix analysis could not fully and comprehensively carry out the process of strategic decision-making that enables organizations to do the right strategic decision. Kuttilla and et al developed a combined technique to eliminate defects in SWOT. This technique uses AHP¹ in the SWOT analysis [7.9]

For many years the ANP² as a comprehensive approach, used to solve many problems of decision making. In this research FANP³ the new and powerful tool of fuzzy analytic network process is used, which links fuzzy concepts with network analysis process. This method can be useful when the decision faced with several options and decision indicators. The theory of fuzzy system through using fuzzy logic theory and fuzzy sizes can enter parameters such as knowledge, experience and human judgment, in to the model. and in addition to creating flexibility in the model, provide a gray picture of the gray world.

Clearly, the results of such models due to providing real condition in the model, would be more accurate and practical [1]. The final output of this process, provides a method for determining importance weights of indicators and priority of options. SWOT analysis is not alone having this ability analyzing strengths, weaknesses, opportunities, threats. (SWOT) is one of the key elements of the strategic planning which is very challenging in the analytical method. Several methods are used to enhance the accuracy of results. Using the FANP in SWOT is one of the new issues which is the innovation of this research.

a) Research Question

This research has one main question as follows:

- What is the process of using FANP in SWOT?
- And how can its results be analyzed?

i. The analysis method of data and information

In this study in order to determine the importance weight, FANP is used. The used fuzzy method is Chang's Extent Analysis (EA) method. So in the various steps due to the extensiveness of information on one hand and the high volume of calculations on the other hand according to network analysis process technique of expansion analysis method, two computer programs are used. EXEL software is used for the calculations relating to analytic network process by using expansion analysis method for determination of importance weights, and for final results MATLAB software is used.

b) Research Method

The present research in terms of purpose is considered as an applied research. Applied research is a research that its findings could have scientific use. The subjective realm of the research is Fuzzy Analytic Network Process (FANP) and the local realm is Notashafra Company.

The reasons for the use of ANP in the SWOT matrix Although the technique of AHP eliminates the major flaws in the assessment and measurement of the SWOT matrix analysis steps, the main drawback of this method is that it couldn't measure the possible dependency between SWOT factors. In the AHP it is assumed that these factors are independent from each other in the hierarchical structure. Although the assumption is not always true in terms of effects on both internal and external environments, an organization can use internal strengths to take advantage of external opportunities, or by exploiting available opportunities in external environment it can improve internal weaknesses, or by using internal strength it can reduce the effects of threats in the environment or eliminate them. As it was said these factors are not independent from each other and in addition, a connection may exist between some of these factors. The technique of analytical hierarchy process of SWOT factors Weights, is calculated with the assumptions that these factors are independent from each other, but it is possible that these factors are related to each other and in this situation these dependencies can affect on SWOT factors weights and this will ultimately change priorities of strategic options. So it is essential that we use a state of SWOT analysis which considers the possible associations between SWOT factors in decision [18]. The proposed algorithm in this research uses FANP which makes it possible for us to measure dependency among SWOT factors. In many issues the favorable decision is the one that link real world; we can imagine the interrelationships among criteria. Being a powerful tool of FANP approach available modeling of SWOT factors for the decision –makers is why it became an attractive multi-criteria decision making tool. Dependence among SWOT factors affect both on the weights of SWOT factors branches and the weights of strategy options and may also change the priority of the strategy options. In summery this study shows the process for quantifying SWOT matrix analysis in the situation that there is dependence among SWOT factors.

i. Analytic Network Process (ANP)

Saaty in 1996, presented a method for multi criteria, this method is called analytic network process and the aim of its presentation is designing a model through which complex issue of multi decision is analyzed into smaller pieces and by reasonable value analyze them in to simpler components and then integrates these values to a final decision.

¹ . Analytical Hierarchy Process

² . Analytic Network Process

³ .Fuzzy Analytic Network Process

ANP is a developed form of AHP which is able to model the correlations and feedbacks among effective elements during a decision-making process. Furthermore, it considers all influences of internal effective components in a decision-making process which are subsequently entered into estimations. Therefore, the technique may be considered as a superior and distinctive model compared to previous ones [2, 15]. Thus, hierarchical up-down structure is not suitable for a complicated system. A feedback system can be shown as a network.

Structural difference between a network and a hierarchy is shown in the following figure. Elements in a cluster can affect the elements in other branches. A network can be organized as source cluster, intermediate clusters and sink clusters. Relationships within the network is shown with arcs and arcs direction shows the dependence [15, 2] interdependence between two cluster, which is called outer dependence and is displayed with a two-way arrow. Internal dependence among the elements of a cluster is shown by looped arcs [2, 16] (Figure1).

ANP consists of four main steps: making model and the issue structure: at first, the issue should be clearly stated and analyzed into a logical system like a network. The structure can be shown in Figure 1.

a. *Pair wise comparisons matrices and priority vector*

In network analysis process like analytical hierarchy process, decision elements in each cluster are

compared in pair wisely according to their importance in that criteria and the clusters also, are compared pairwise with each other according to their effects on the goal. Decision-makers are asked in terms of a series of pair wise comparisons. They were asked what effects two elements or two clusters have in comparison with each other on the above criteria.

Furthermore, if interdependent exists among elements of one part, we should specify the amount of each element effect on the other elements by using a pair wise comparisons matrix and getting special vector of each element.

Super matrix formation

Super matrix is like Markov chain process. For obtaining global priorities in the mutual influence system. The relative priority vectors should be entered in the appropriate columns of matrix. As a result, a super matrix is in fact a segmented matrix that each matrix part shows a relationship between two clusters in a system. Suppose a decision system which has C_K parts and $K = 1, 2, 3, \dots, n$ and each k cluster which has shown through $e_{k1}, e_{k2}, \dots, e_{kmk}$.

Priority vectors are obtained relatively in the second step; they got sectional and placed in the appropriate position in the super matrix according to the effect direction from one cluster to another. A standard for super matrix is shown in the following [15].

$$\begin{array}{ccccccccccc}
& & C_1 & & & C_k & & & C_n \\
e_{11} & e_{12} & \dots & e_{1m1} & \dots & e_{k1} & e_{k2} & \dots & e_{k\ mk} & \dots & e_{n1} & e_{n2} & \dots & e_{n\ mn} \\
& e_{11} \\
C_1 & e_{12} \\
& \vdots \\
& \vdots & e_{1m1} \\
& \vdots \\
& e_{k1} \\
& e_{k2} \\
W = C_k & \vdots \\
& e_{k\ mk} \\
& \vdots \\
& \vdots & e_{n1} \\
C_n & e_{n2} \\
& \vdots \\
& e_{n\ mn}
\end{array}
\begin{bmatrix}
W_{11} & \dots & W_{1k} & \dots & W_{1n} \\
\vdots & & \vdots & & \vdots \\
W_{k1} & \dots & W_{kk} & \dots & W_{kn} \\
\vdots & & \vdots & & \vdots \\
W_{n1} & \dots & W_{nk} & \dots & W_{nn}
\end{bmatrix}$$

c) *Select of the best position*

If the former super matrix in the third step covers all net work, option weights can be found in the normalized super matrix column. On the other hand, if a super matrix contained the connected parts, more calculations would be needed to achieve the overall priorities of options and finally the option which has the most weight is recognized as the best option.

i. *The proposed algorithm for SWOT matrix*

The hierarchical model and the presented network in this study are designed in a four-level analysis of SWOT matrix. Its structural difference can be seen in Figure 2. The purpose (selection of the best strategy) is placed in the first level, criteria (SWOT factor) in the second level, sub criteria (sub branches of SWOT factors) in the third level and in last level

alternative (strategy alternatives). Super matrix is a hierarchical SWOT matrix structure which is composed of four levels and is defined as follows:

W= Purpose
SWOT factors
Sub branches of SWOT factors
Alternatives

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ w_{21} & 0 & 0 & 0 \\ 0 & w_{32} & 0 & 0 \\ 0 & 0 & w_{43} & 1 \end{bmatrix}$$

In which :

W_{21} : is a vector which shows purpose effect on the criteria.

W_{32} : is a matrix which shows criteria effect on each of the sub criteria.

W_{43} : is a matrix which shows sub-criteria effect on any of the options.

I : is one unit matrix. (Figure2)

Figure model shows a state of hierarchical structure with interdependence between clusters without any feedback. Here SWOT factor, sub branches of SWOT factors and strategies, respectively are put in the place of criteria, sub criteria and alternatives and there is an internal dependence among factors. Based on the design shown in figure B the super matrix in this research which is used for SWOT is as follows:

W= Purpose
SWOT factors
Sub branches of SWOT factors
Alternatives

$$\begin{bmatrix} 0 & 0 & 0 & 0 \\ w_1 & W_2 & 0 & 0 \\ 0 & W_3 & 0 & 0 \\ 0 & 0 & W_4 & 1 \end{bmatrix}$$

W_1 : is a vector which shows purpose effect on the criteria

W_2 : is a matrix which shows internal dependence among SWOT factors

W_3 : is a matrix which shows SWOT factors effect on each of the sub branches of SWOT factors.

W_4 : is a matrix which shows the effect of the sub branches of SWOT factors on any other options.

In this research for better understanding matrix is used to show calculation details the main steps of the proposed framework can be summarized as follows:

Step one: Identifying the sub branches of SWOT factors (identification of strategic factors) and determination of strategic options with regard to the analysis of these factors.

Step two: Determining the importance degree of SWOT factors with assuming that there is no dependence between SWOT factors. (W_1 , i.e. matrix calculation)

Step three: identifying interdependences between SWOT factors and based on these relationship for dependency the matrix of each of the SWOT factors with regard to other factors is formed. (W_2 , i.e. matrix calculation)

Step four: Determining priority of SWOT factors, according to the dependency that exists between them. ($W_{\text{SWOT factors}} = W_1 \times W_2$)

Step five: Determining relative importance

degree of sub branches of SWOT factors

($W_{\text{sub branches of SWOT factors}}$ i.e. calculation)

Step six: Determining general importance degree of sub branches of SWOT factors.

($W_{\text{general sub-branches of SWOT factors}} = W_{\text{factors}} \times W_{\text{relative sub branches of SWOT factors}}$)

Step seven: Determining importance degree of strategy options with regard to each of sub branches of SWOT factor. (W_4)

Step eight: calculation of the final priority of strategy options, with consideration to internal relations among SWOT factors.

($W_{\text{alternatives}} = W_4 \times W_{\text{general sub branches}}$)

The main inputs required in the technique of network analysis process for calculation of W_1 , W_2 , W_3 , W_4 pair wise comparison are existed elements in each cluster which composed of a pair of wise comparison matrix. Pair wise comparisons matrices and output evaluation of them in the fuzzy analytical hierarchy process. In analytical hierarchy process according to the traditional method, pair wise comparisons are done based on the relative scale. Although a discrete scale has advantages in simplicity to understand and is easy to use but due to incompatibility with human mind's map cannot close us to the actual results.

This research is trying through using theoretical concepts of fuzzy sets and triangular fuzzy numbers with

the tools of analytic network process improve the results and make them closer to reality as much as possible.

In this study a method of fuzzy analytical hierarchy process is used that with regard to the specific model of network structure and existence of internal relationship change to fuzzy analytic network process. As we go on, we study some relationships and the main operators on the triangular fuzzy numbers and we also present a method for extent analysis.

ii. Group decision through change expansion analysis method

As previously noted, to calculate W_1, W_2, W_3, W_4 pair wise comparisons with verbal data are required. The mentioned matrices can be calculated by using fuzzy analytical hierarchy process methodology. There are several types of fuzzy analytical hierarchy process method but the calculation and level complexity of some of these methods are based on the least logarithmic squares method. In this research Chang Extent Analysis method is preferred because its stages are easier than other fuzzy analytical hierarchy processes.

Concepts and definition of fuzzy analytical hierarchy process based on the Chang Extent Analysis (EA) are as follow:

Consider two triangular fuzzy numbers

$M_1 = (L_1, m_1, u_1)$ and $M_2 = (L_2, m_2, u_2)$. (Figure3)

$M_1 + M_2 = (l_1 + l_2 + m_1 + m_2, u_1 + u_2)$

$M_1 \cdot M_2 = (l_1 l_2, m_1 m_2, u_1 u_2)$

$$M^{-1} = \left(\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1} \right) \quad M^{-2} = \left(\frac{1}{u_2}, \frac{1}{m_2}, \frac{1}{l_2} \right)$$

It should be noted that product of two triangular fuzzy numbers or reverse of a triangular fuzzy number, is not a triangular fuzzy number anymore and this relationship tells only an approximation of the true product of two triangular fuzzy numbers and reverse of a triangular fuzzy number. In the extent analysis method for each row of pair wise comparisons matrix, the value which is a triangular fuzzy number, is calculated as follow:

In which K present row number and I and J respectively present options and indexes.

In this method after the calculation of S_k you should get their largeness degree in relation with each other. In general, if M_1 and M_2 are two triangular fuzzy numbers M_1 largeness degree on M_2 is defined as follows.

$$S_k = \sum_{i=1}^n M_{ki} \times \left[\sum_{i=1}^n \sum_{j=1}^n M_{ij} \right]^{-1}$$

$$\begin{cases} V(M_1 \geq M_2) = 1 & M_1 \geq M_2 \\ V(M_1 \geq M_2) = \text{Hgt}(M_1 \cap M_2) \end{cases}$$

Otherwise also if $L_2 \geq U_1$, put zero.

In this case we have:

$$\text{Hgt}(M_1 \cap M_2) = \frac{u_1 - l_2}{(u_1 + l_2) + (m_2 - m_1)}$$

Largeness amount of a triangular fuzzy number from k , another triangular fuzzy number is obtained from the following relationship:

$$V(M_1 \geq M_2, \dots, M_k) = V(M_1 \geq M_2) \text{ and } \dots \text{ and } V(M_1 \geq M_k)$$

Also for the calculation of indices in pair wise comparisons matrix performs the following.

$$W'(x_i) = \min \{V(S_i \geq S_k)\} \\ k = 1, 2, \dots, n, k \neq i$$

Thus, the weight vector of indicators will be as follow:

$$W = [W'(x_1), W'(x_2), \dots, W'(x_n)]^T$$

It is the non-normalize coefficient vector of fuzzy hierarchy process [1].

Since the used numbers in change extent analysis method are triangular fuzzy numbers, so we assumed that decision-makers are set these words set for weighting, you can see its fuzzy scale and diagram in the Table below (Table1 and Figure4)

II. IMPLEMENT OF DECISION ALGORITHM

a) *The (First Step) Specifying organization strategic factors and determining strategy options with respect to this factors*

In this study, environmental analysis should be done at first. Analysis of external and internal environment is the first stage of algorithm implementation. A team of managers from different parts of the organization who were familiar with operation and organization environment was formed, which did environmental analysis. After identification of strategic factors (i.e. identification of strengths (S), weaknesses (W), Opportunities (O), threats (T) we selected possible strategies through the analysis of these factors. As you can see in the Table below, the organization is faced with four strategy alternatives, which are as follow:

1. *SO Strategy* : market development- the foreign goal market.
2. *WO Strategy* : professional reinforcing of manpower and infrastructure in the area of thermal power plants.
3. *ST Strategies* : development and implementing of new technologies.
4. *WO Strategies* : cooperation and strategic partnership.

In this study the aim of SWOT analysis is to prioritize strategy alternatives and selection of the best strategy for the organization (Table 2).

After the identification of organization strategic factors and strategy alternatives we should convert the issue into a hierarchical, in the way that we are able to analyze it by analytic network process (ANP). This network structure is shown in figure 5. The goal of the selection of the best strategy is in the first level of analytic network process model, SWOT factors (strengths, weaknesses, opportunities, threats) are in the second level, sub branches of SWOT factors which include 6 factors for strengths, 5 factors for weakness, 6 factors for opportunities and 5 factors for threats are in the third level of the model and according to SWOT matrix four strategies are selected for the organization that are in the last level of the model (Figure5).

b) *The (second step) determining importance degree with assuming no dependency exist among SWOT factors*

At this stage we assume that there is no dependence and interaction among SWOT factors (Strengths, weaknesses, opportunities, threats). We form pair wise comparisons matrix of SWOT factors with goal of the best strategy selection. The result of comparisons are shown in the below Table3).

$$W_1 = \begin{bmatrix} S \\ W \\ O \\ T \end{bmatrix} = \begin{bmatrix} 0.382 \\ 0.108 \\ 0.401 \\ 0.109 \end{bmatrix}$$

c) *The (third step) forming dependence matrix of each the SWOT factors with regard to other factors*

At this stage, the interdependence between SWOT factors (Strengths, weaknesses, opportunities,

$$W_{\text{SWOT factors}} = W_2 \times W_1 = \begin{bmatrix} 1.000 & 0.881 & 0.795 & 1.000 \\ 0.276 & 1.000 & 0.245 & 0.000 \\ 0.733 & 0.000 & 1.000 & 0.000 \\ 0.000 & 0.119 & 0.000 & 1.000 \end{bmatrix} \times \begin{bmatrix} 0.382 \\ 0.108 \\ 0.401 \\ 0.109 \end{bmatrix} = \begin{bmatrix} 0.445 \\ 0.153 \\ 0.341 \\ 0.061 \end{bmatrix}$$

e) *The (fifth step) Determination of relative importance degree of SWOT factors on sub branches*

At this stage, we should calculate the relative priority of sub branches of SWOT factors by using pair wise comparisons matrix. These matrices are as follow, respectively (Table 8, 9, 10 and 11).

Priority vectors obtained from the analysis of pair wise comparison matrix are as follow:

$$W_{(\text{strength})} = \begin{bmatrix} 0.191 \\ 0.163 \\ 0.128 \\ 0.189 \\ 0.177 \\ 0.152 \end{bmatrix} \quad W_{(\text{weaknesses})} = \begin{bmatrix} 0.298 \\ 0.197 \\ 0.271 \\ 0.090 \\ 0.144 \end{bmatrix}$$

f) *The (sixth step) Determination of general importance degree of SWOT factors sub branches*

Following results were obtained:

$$(W_{\text{general sub branches of SWOT factors}} = W_{\text{factors}} \times W_{\text{Relative sub branches of SWOT factors}})$$

threats) specified through analysis of each factor impact on other factors. After analysis these relationships were identified (Figure 6).

Based on the dependences that exist among SWOT factors, we formed pair wise comparisons matrix based on fuzzy numbers and extent analysis method. (Table 4, 5, 6 and7).

W2 matrix is formed by the obtained vectors of each Table (WJ). This matrix shows relative importance weights of SWOT factors in the situation that we recognize the interdependence between them which is displayed in the following matrix.

$$W_2 = \begin{bmatrix} 1.000 & 0.881 & 0.759 & 1.000 \\ 0.267 & 1.000 & 0.241 & 0.000 \\ 0.733 & 0.000 & 1.000 & 0.000 \\ 0.000 & 0.119 & 0.000 & 1.000 \end{bmatrix}$$

d) *The (fourth step) Priority determination of SWOT factors with the consideration of dependency among them*

At this step we should calculate priority of SWOT factors according to the dependency that exists between these factors; this vector is obtained from the product of W2 matrix in W1 vector.

As we see significant differences exist between the results obtained in the weights of SWOT factors in comparison with situation which ignore inner dependence among these factors and the results have been changed respectively for strengths from 0.382 to 0.445 and for weaknesses from 0.108 to 0.153 for opportunities from 0.401 to 0.341 and for threats from 0.109 to 0.061.

$$W_{(\text{opportunity})} = \begin{bmatrix} 0.245 \\ 0.167 \\ 0.216 \\ 0.158 \\ 0.085 \\ 0.128 \end{bmatrix} \quad W_{(\text{threats})} = \begin{bmatrix} 0.431 \\ 0.269 \\ 0.196 \\ 0.026 \\ 0.078 \end{bmatrix}$$

g) *The (seventh step) determining importance degree of strategy options with respect to each of the sub branches of SWOT factors*

At this stage, we should calculate importance degree of strategy options with respect to each of the sub- branches of SWOT factors. Due to the calculations volume to illustrate how to do this stage we only

$$W_4 = \begin{bmatrix} 0.345 & 0.335 & 0.361 & 0.372 & 0.439 & 0.446 & 0.205 & 0.177 & 0.078 & 0.205 & 0.108 & 0.111 & 0.078 & 0.236 & 0.306 & 0.388 & 0.351 & 0.264 & 0.115 & 0.206 & 0.077 & 0.351 \\ 0.301 & 0.286 & 0.225 & 0.266 & 0.297 & 0.281 & 0.334 & 0.333 & 0.487 & 0.357 & 0.395 & 0.375 & 0.444 & 0.324 & 0.226 & 0.327 & 0.294 & 0.241 & 0.343 & 0.346 & 0.524 & 0.260 \\ 0.211 & 0.222 & 0.199 & 0.226 & 0.207 & 0.251 & 0.267 & 0.316 & 0.302 & 0.293 & 0.341 & 0.339 & 0.408 & 0.387 & 0.310 & 0.252 & 0.303 & 0.254 & 0.338 & 0.302 & 0.328 & 0.316 \\ 0.134 & 0.157 & 0.215 & 0.136 & 0.057 & 0.022 & 0.184 & 0.174 & 0.133 & 0.145 & 0.156 & 0.175 & 0.070 & 0.053 & 0.158 & 0.033 & 0.052 & 0.241 & 0.204 & 0.146 & 0.071 & 0.073 \end{bmatrix}$$

h) *The (eighth step) determining the final priority of strategy alternatives*

At the end, we calculate the final priority of strategy options with regard to the relationship that

$$W_{\text{alternative}} = \begin{bmatrix} SO \\ WO \\ ST \\ WT \end{bmatrix} = W_4 \times W_{\text{general sub branches of SWOT}} = \begin{bmatrix} 0.282 \\ 0.317 \\ 0.278 \\ 0.123 \end{bmatrix}$$

Analyzing the results of fuzzy analytic network process (FANP) shows that WO strategy with final weight of 0.317 is chosen s the best strategy. Priority of strategy alternatives with regard to the method of fuzzy analytic network process is as follows in the order of priority:

1. Professional reinforcing of man power and infrastructure in the area of thermal power plants (WO) with a final weight of 0.317
2. Market development- the foreign goal market (SO) with a final weight of 0.282
3. Development and implementing of new technologies (ST) with a final weight of 0.278
4. Cooperation and strategic partnership (WT) with a final weight of 0.123

i) *Comparing the result s of fuzzy analytical hierarchy process with fuzzy analytic network process*

This case was also solved with a hierarchical structure (assuming there is no dependency between SWOT factors). In pair wise comparisons matrix for determining the final priority of strategy options in the method of fuzzy analytic network process is like pair wise comparisons matrix used in the fuzzy analytic network process and the results were as follows:

$$W_{\text{alternative (FAHP)}} = \begin{bmatrix} SO \\ WO \\ ST \\ WT \end{bmatrix} = \begin{bmatrix} 0.274 \\ 0.316 \\ 0.286 \\ 0.124 \end{bmatrix}$$

calculate the first and last Tables and put their resultant vectors respectively in the first and last columns of W4 matrix (Table 13 and 14).

These Tables should be conducted for all of the strategic factors and W4 matrix is obtained by putting the resultant vectors from each Table in the appropriate column:

existed among SWOT factors, through the following way:

In the analysis of fuzzy analytic network process, WO strategy with a final weight of 0.316 is selected as the best strategy. Also the priority of strategy options in the order is WO, ST, SO, WT. the analysis results of fuzzy analytical hierarchy process and fuzzy analytic network process have been compared in the Table below. As you see when we analyze the dependence among SWOT factors, this dependence impact on the strategies weights and strategies priority compared to the state that assumed these factors are independent from each other (Table15).

III. DISCUSSION AND CONCLUSION

In this study the technique of fuzzy analytic network process was selected as an analysis tool according to its capabilities. Analytic network process in decision making considers some angles of the issue which does not exist in fuzzy analytical hierarchy process. Internal dependence is of the most important strategic planning issues. With this technique we could identify and measure the dependence between SWOT factors and we could also identify and measure the dependence between SWOT factors and also we could specify quantitatively each of these factors' impact on the strategy alternatives. SWOT factors and strategy options changed to a model of fuzzy analytic network process. As we observed SWOT matrix network model is designed in four levels, the purpose (the best strategy selection), SWOT factors, sub branches of SWOT factors and the strategy options. Also to illustrate the impact of dependency among SWOT factors on both

the weights of SWOT factors sub branches and priority of strategy options, we also use the method of fuzzy analytical hierarchy process in the SWOT analysis in order to compare the results of these two approaches.

In both methods of fuzzy analytical hierarchy process and fuzzy analytic network process we used the same pair wise comparisons matrices; however, different results were obtained, the results of these two approaches were compared in Table 15. As you observed both weights and strategies rank was different from each other in fuzzy analytical hierarchy process and fuzzy analytic network process. Although these differences are predict Table because analytical hierarchy process does not consider the dependency among SWOT factors in the analysis and sole problem with the assumption that these factors are independent from each other. While in the method of analytic network process the dependence among SWOT factors takes in to consideration and with respect to these dependencies this issue can be analyzed. For this reason, fuzzy analytic network process can be a better modeling for the real world problems in comparison with a hierarchical approach. Other organization and companies that want to use this method in their strategic planning process should pay attention to this point that dependency among SWOT factors and its sub branches are largely related to organization types and their activities. In this study we only analyze dependency among SWOT factors, but it is possible that for other organizations dependency among sub-branches of SWOT Factors is more important than dependency among SWOT factors. In general it can be concluded in the cases that there is internal interaction or dependence among SWOT factors (strengths, weaknesses, opportunities, threats) or among its sub branches, the method of analytic network process must be used to prioritize strategic options, using these approaches and techniques enables organizations to take correct strategic decision. Also in the cases that there is no dependence among SWOT factors or among its sub branches or dependency is such that it can be ignored, the technique of analytical hierarchy process can be used.

a) Practical Proposals

1. It is recommended that the management of Frab Company focus on its goals and resources on WO strategy which is professional reinforcing of manpower and infrastructure in the area of thermal power plants.
2. It is recommended that before organization decides to implement strategic planning, by comprehensive training create necessary organizational knowledge and attitude and when running by using special structures such as self managed teams and using the methods like brainstorming pave the way for better and effective results.

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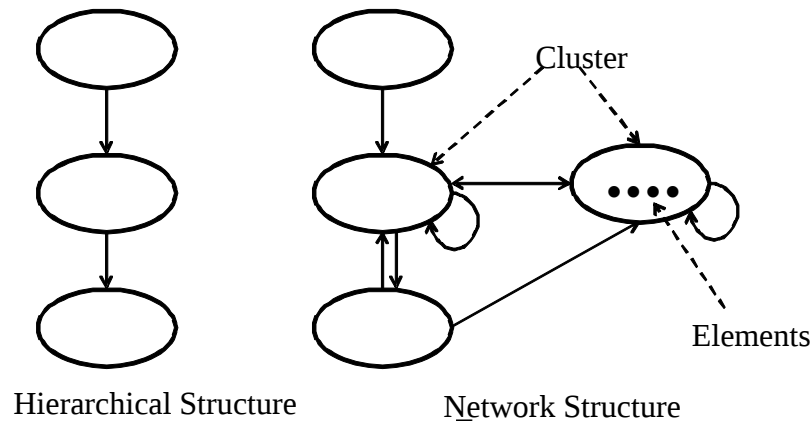


Figure 1 : The structural differences between network and hierarchy. Resources [16.2]

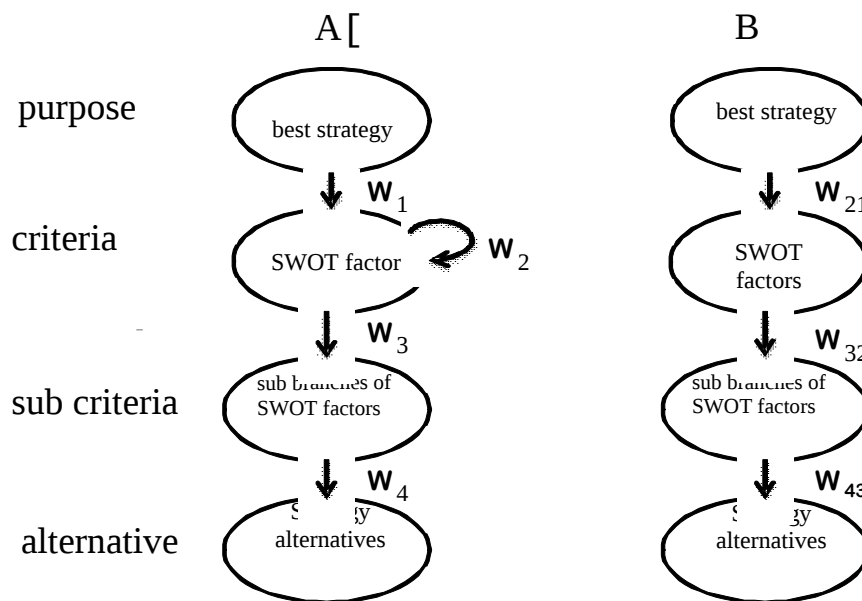


Figure 2 : Structure difference of SWOT model between a hierarchy of A and a network of B

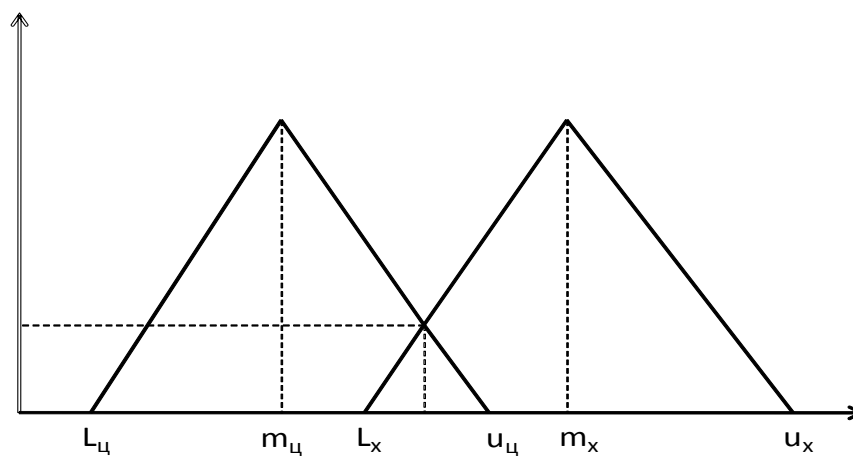


Figure 3 : Display of two triangular fuzzy numbers

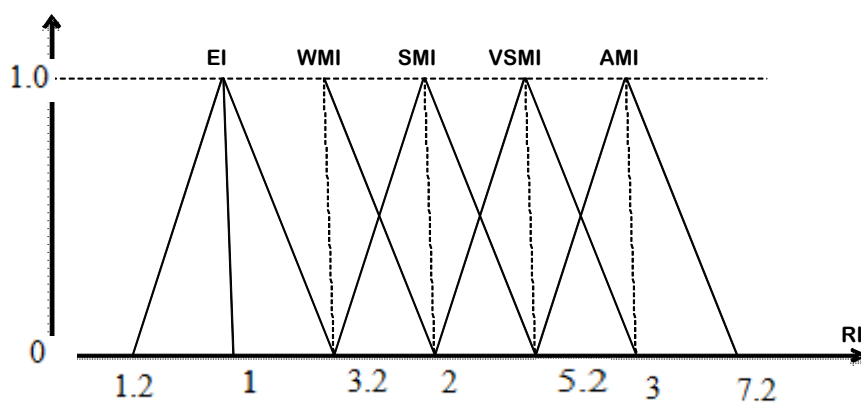


Figure 4 : Verbal scale for measuring the relative importance. Reference [3 and 14]

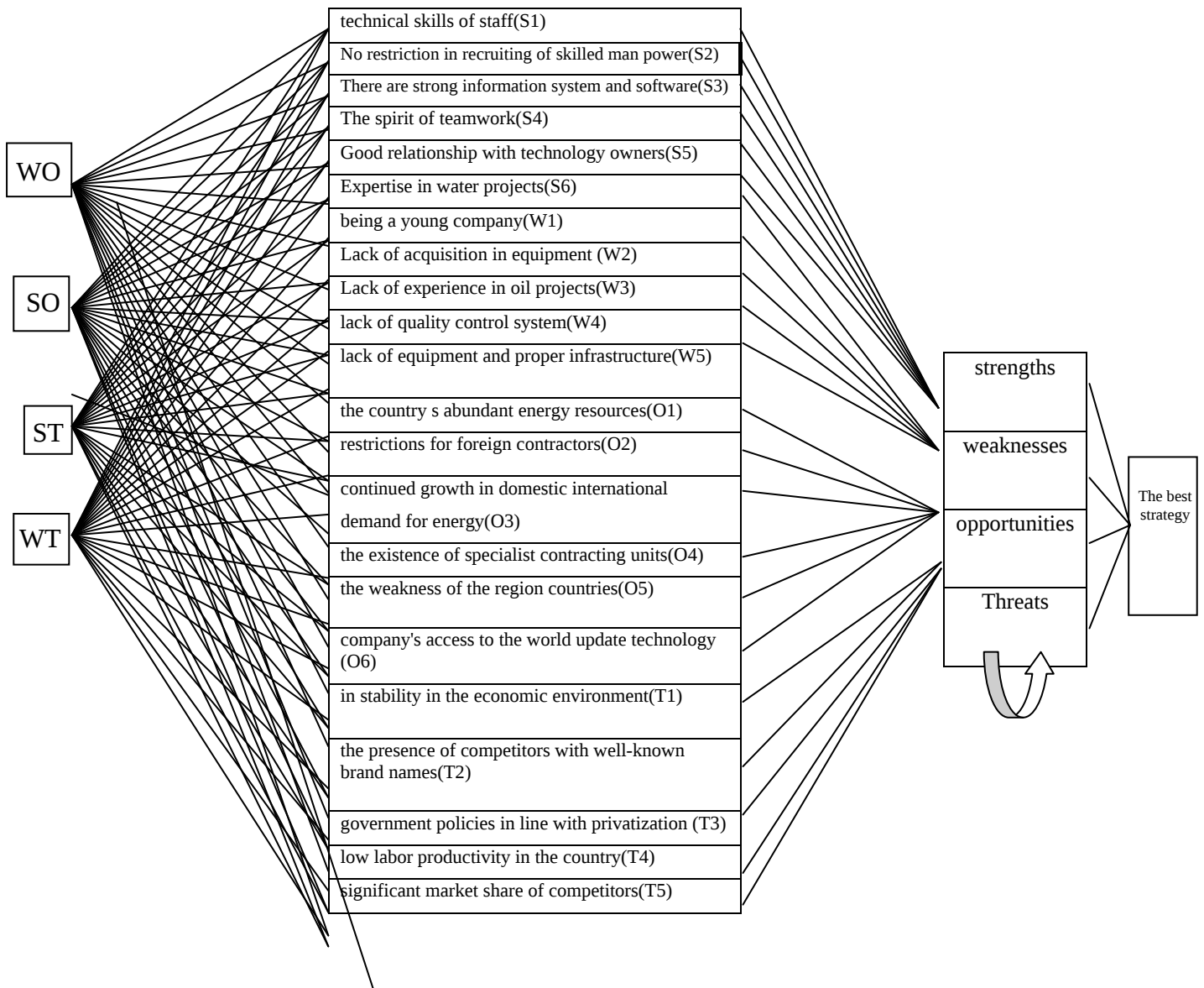


Figure 5 : Analytic network process model for SWOT matrix

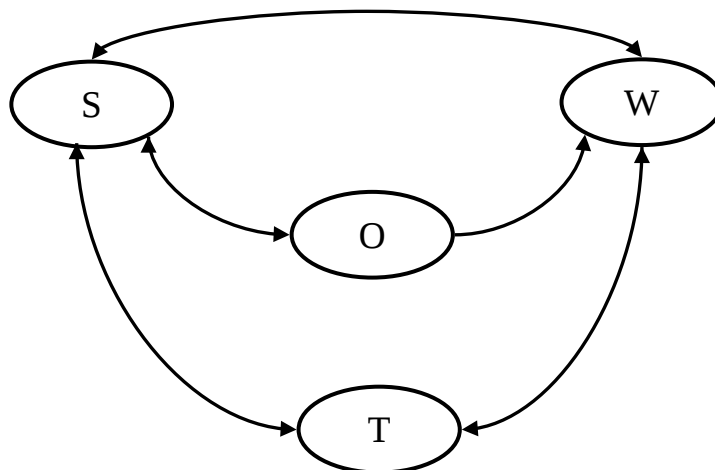


Figure 6 : The inner dependence among SWOT factors

Table 1 : Verbal scale for assessing the relative importance

Verbal scale of relative importance	Triangular fuzzy scale	Triangular fuzzy scale in the other side
Same	(1,1,1)	(1,1,1)
Equal importance	(1/2,1,3/2)	(2/3,1,2)
Relatively more important	(1,3/2,2)	(1/2,2/3,1)
More important	(3/2,2,5/2)	(2/5,1/2,2/3)
Very important	(2,5/2,3)	(1/3,2/5,1/2)
Exactly very important	(5/2,3,7/2)	(2/7,1/3,2/5)

Weaknesses(W) -Being a young company (W1) -lack of acquisition in equipment and certain machinery(W2) -lack of experience in oil projects (W3) -lack of quality control system(W4) -lack of equipment and proper infrastructure(W5)	strength (S) -staff professional skills (s1) -no restriction in recruiting of skilled manpower(S2) -there are strong information system and software (S3) -the spirit of team work(S4) - good relationships with technology owners(S5) -Expertise in water project (S6)	Internal factor External factor
WO strategy -professional reinforcing of manpower and infrastructure in the area of thermal power plants	SO strategy -market development-the foreign goal market	Opportunities(o) -the country's abundant energy resources(O1) -restrictions for foreign contractors(O2) -continued growth in domestic international demand for energy(O3) -the existence of specialist contracting units(O4) - the weakness of the region countries(O5) - company's access to the world update technology (O6)
WT strategy -cooperation and strategic partnership	ST strategy -development and implementing of new technology	Threat(T) - instability in the economic environment(T1) - the presence of competitors with well-known brand names(T2) - government policies in line with privatization (T3) -low labor productivity in the country(T4) -significant market share of competitors(T5)

Table 2 : SWOT Matrix

Table 3 : Pair wise comparisons matrix of SWOT factors with no dependence of SWOT factors

W_j	T	O	W	S	SWOT factors
0.382	(1,1.42,1.88)	(0.73,0.96,1.29)	(1.88,2.38,2.88)	(1,1,1)	Strength (S)
0.108	(0.75,1.17,1.63)	(0.43,0.54,0.75)	(1,1,1)	(0.35,0.42,0.53)	Weakness (W)
0.401	(1.63,2.13,3.26)	(1,1,1)	(1.33,1.85,2.35)	(0.77,1.04,0.38)	Opportunities (O)
0.109	(1,1,1)	(0.38,0.47,0.62)	(0.62,0.86,1.33)	(0.53,0.71,1)	Threat (T)

Table 4 : The inner dependence matrix of SWOT factors with regard to the strengths

W_j	T	O	W	Strengths
0.267	(1.25,1.67,2.13)	(0.41,0.52,0.71)	(1,1,1)	Weakness (W)
0.733	(1.75,2.25,2.75)	(1,1,1)	(1.41,1.94,2.45)	Opportunity (O)
0	(1,1,1)	(0.36,0.44,0.57)	(0.47,0.6,0.8)	Threats (T)

Table 5 : The inner dependence matrix of SWOT factors with regard to the weaknesses

W_j	T	S	Weakness
0.881	(1.21,1.60,2)	(1,1,1)	Strengths (S)
0.119	(1,1,1)	(0.50,0.63,0.83)	Threats (T)

Table 6 : The inner dependence matrix of SWOT factors with regard to the opportunities

W_j	W	S	Opportunity
0.759	(1.1,1.5,1.92)	(1,1,1)	Strengths (S)
0.241	(1,1,1)	(0.52,0.67,0.91)	Weakness (W)

Table 7 : The inner dependence matrix of SWOT factors with regard to the threats

W_i	W	S	Threats
1	(1.32,1.71,2.1)	(1,1,1)	Strengths (S)
0	(1,1,1)	(0.48,0.59,0.76)	Weakness (W)

Table 8 : Relative importance degree of the strengths

Strengths (S)	S1	S2	S3	S4	S5	S6	W_j
Technical skills of the staff(S1)	(1,1,1)	(1.2,1.7,2.2)	(1,1.43,1.9)	(0.43,0.68,0.97)	(0.68,0.97,1.33)	(0.8,1.3,1.8)	0.191
No restriction in recruiting of skilled manpower(S2)	(0.45,0.59,0.83)	(1,1,1)	(1.08,1.5,1.93)	(0.46,0.67,0.97)	(0.78,1.13,1.53)	(0.86,1.13,1.47)	0.163
There are strong information system and software(S3)	(0.53,0.70,1)	(0.52,0.67,0.93)	(1,1,1)	(0.73,0.91,1.17)	(0.46,0.83,1.1)	(0.46,0.83,1.1)	0.128
The spirit of team work(S4)	(1.03,1.47,2.34)	(1.03,1.5,2.17)	(0.86,1.09,1.38)	(1,1,1)	(0.65,0.98,1.33)	(0.66,1,1.37)	0.189
Good relationships with the technology owners(S5)	(0.75,1.03,1.47)	(0.65,0.88,1.28)	(0.91,1.20,1.56)	(0.75,1.02,1.55)	(1,1,1)	(0.9,1.4,1.9)	0.177
Expertise in water projects(S6)	(0.56,0.77,1.25)	(0.67,0.88,1.16)	(0.91,1.2,1.56)	(0.73,1,1.52)	(0.53,0.71,1.11)	(1,1,1)	1.52

Table 9 : Relative importance degree of the weaknesses

Weaknesses (W)	W1	W2	W3	W4	W5	W_j
Being a young company (W1)	(1,1,1)	(1.05,1.31,1.63)	(0.75,1.08,1.43)	(1.5,2,2.5)	(1.38,1.8,2.23)	0.298
Lack of a question in equipment and certain machinery (W2)	(0.61,0.76,0.96)	(1,1,1)	(0.64,0.9,1.21)	(1,1.43,1.9)	(0.68,1.1,1.53)	0.197
Lack of experience in oil projects (W3)	(0.7,0.93,1.34)	(0.82,1.11,1.57)	(1,1,1)	(1.1,1.6,2.1)	(1.5,1.93,2.4)	0.271
Lack of quality control system (W4)	(0.4,0.5,0.67)	(0.53,0.7,1)	(0.48,0.63,0.91)	(1,1,1)	(0.55,0.81,1.13)	0.09
Lack of equipment and proper infrastructure (W5)	(0.45,0.56,0.72)	(0.65,0.91,1.47)	(0.42,0.52,0.67)	(0.88,1.23,1.83)	(1,1,1)	0.1444

Table 10 : Relative importance degree of the opportunities

Opportunities	O1	O2	O3	O4	O5	O6	W_j
The country s abundant energy resources and reserves(O1)	(1,1,1)	(1.38,1.73,2.13)	(1.2,1.63,2..1)	(1.1,1.6,2..1)	(1.2,1.7,2.2)	(0.78,1.2,1.63)	0.245
Restrictions for foreign contractors (O2)	(0.47,0.58,0.72)	(1,1,1)	(0.47,0.57,1.1)	(0.86,1.13,1.47)	(1.2,1.63,2.1)	(0.87,1.28,1.7)	0.167
Continued growth in domestic and international demand for energy(O3)	(0.48,0.61,0.83)	(0.91,1.34,2.14)	(1,1,1)	(1.1,1.6,2.1)	(1.3,1.8,2.3)	(1,1.43,1.9)	0.216
The existence of specialist contracting unit(O4)	(0.48,0.63,0.91)	(0.68,0.88,1.16)	(0.48,0.63,0.91)	(1,1,1)	(1.4, 1.9, 2.4))	(0.6,1.03,1.5)	0.158
The weakness of the region countries (O5)	(0.45,0.59,0.83)	(0.48,0.61,0.83)	(0.43,0.56,0.77)	(0.42,0.53,0.71)	(1,1,1)	(0.96,1.23,1.58)	0.085
Company s access to the world update technology (O6)	(0.61,0.83,1.28)	(0.59,0.78,1.15)	(0.53,0.7,1)	(0.67,0.97,1.67)	(0.63,0.81,1.04)	(1,1,1)	0.129

Table 11 : Relative importance degree of the threats

Threats	T1	T2	T3	T4	T5	W_j
Instability in the economic environment (T1)	(1,1,1)	(1.6,2.1,2.6)	(1.3,1.8,2.3)	(1.6,2.03,2.5)	(1.3,1.8,2.3)	0.431
The presence of competitors with well-known brand names (T2)	(0.38,0.48,0.63)	(1,1,1)	(1.37,1.78,2.2)	(1.27,1.68,2.1)	(0.88,1.3,1.73)	0.269
government policies in line with privatization (T3)	(0.43,0.56,0.77)	(0.45,0.56,0.73)	(1,1,1)	(1.3,1.67,2.1)	(1.2,1.57,2)	0.196
Low labor productivity in the country(T4)	(0.4,0.49,0.63)	(0.48,0.6,0.79)	(0.48,0.6,0.77)	(1,1,1)	(0.68,1.03,1.43)	0.026
Significant market share of competitors (T5)	(0.43,0.56,0.77)	(0.58,0.77,1.14)	(0.5,0.64,0.83)	(0.7,0.97,1.47)	(1,1,1)	0.078

Table 12 : General priority of SWOT factors sub branches

SWOT factor	Factors weights	SWOT sub factors	Sub factors weight	Weights and general priority of sub factors	
Strengths(S) 0.445		Technical skills of the staff (S1)	0.191	0.085	1
		No restriction in recruiting of skilled manpower(S2)	0.163	0.072	6
		There are strong information systems and software(S3)	0.128	0.057	8
		The spirit of team work (S4)	0.189	0.084	2
		Good relationships with the technology owners(S5)	0.177	0.079	4
		Expertise in water projects(S6)	0.152	0.068	7
Weaknesses (W) 0.152		Being a young company (W1)	0.298	0.046	10
		Lack of a question in equipment and certain machinery (W2)	0.197	0.030	13
		Lack of experience in oil projects (W3)	0.271	0.042	12
		Lack of quality control system (W4)	0.090	0.014	18
		Lack of equipment and proper infrastructure (W5)	0.144	0.022	16
Opportunities (O) 0.342		The country' s abundant energy resources and reserves(O1)	0.245	0.083	3
		Restrictions for foreign contractors (O2)	0.167	0.057	8
		Continued growth in domestic and international demand for energy(O3)	0.216	0.074	5
		The existence of specialist contracting unit(O4)	0.158	0.054	9
		The weakness of the region countries (O5)	0.085	0.029	14
		Company s access to the world update technology (O6)	0.128	0.044	11
Threats 0.061		Instability in the economic environment (T1)	0.431	0.026	15
		The presence of competitors with well-known brand names (T2)	0.269	0.016	17
		government policies in line with privatization (T3)	0.196	0.012	19
		Low labor productivity in the country(T4)	0.026	0.002	21
		Significant market share of competitors (T5)	0.078	0.005	20

Table 13 : The importance degree of strategy options with regard to the professional skills of employees

Professional skills of employees (S1)	SO	WO	ST	WT	W _j
Market development- the foreign goal market(SO)	(1,1,1)	(1.36,1.77,2.18)	(1.08,1.43,1.83)	(0.88,3.1,1.73)	0.354
Professional reinforcing of manpower and infrastructure in the area of thermal power plants (WO)	(0.46, 0.57,0.74)	(1,1,1)	(1.2,1.7,2.2)	(1.1,1.53,2)	0.301
Development and implementing of new technologies (ST)	(0.55,0.7,0.93)	(0.45,0.59,0.83)	(1,1,1)	(1.1,1.53,2)	0.211
Cooperation and strategic partnership (WT)	(0.58,0.77,0.14)	(0.5,0.65,0.91)	(0.5,0.65,0.91)	(1,1,1)	0.134

Table 14 : The importance degree of strategy options with regard to the significant market share of competitors

Significant market share of competitors (T5)	SO	WO	ST	WT	W_j
Market development- the foreign goal market (SO)	(1,1,1)	(1.34,1.67,2.01)	(0.78,1.13,1.53)	(1.18,1.53,1.93)	0.351
Professional reinforcing of manpower and infrastructure in the area of thermal man plants (WO)	(0.5,0.6,0.75)	(1,1,1)	(0.68,1.03,1.43)	(1.2,1.63,2.1)	0.26
Development and implementing of new technologies (ST)	(0.65,0.88,1.28)	(0.7,0.97,1.47)	(1,1,1)	(1.5,2,2.5)	0.316
Cooperation and strategic partnership (WT)	(0.52,0.65,0.85)	(0.48,0.61,0.83)	(0.4,0.5,0.67)	(1,1,1)	0.073

Table 15 : Strategies weight and priorities in FANP and FAHP

	SO	WO	ST	WT
Weights in FAHP	0.274	0.316	0.286	0.124
Rank in FAHP	3	1	2	4
Weights in FANP	0.282	0.317	0.278	0.123
Rank in FANP	2	1	3	4

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20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.



27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.



Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

- Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

- Use standard writing style including articles ("a", "the," etc.)
- Keep on paying attention on the research topic of the paper
- Use paragraphs to split each significant point (excluding for the abstract)
- Align the primary line of each section
- Present your points in sound order
- Use present tense to report well accepted
- Use past tense to describe specific results
- Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives
- Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.



Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript-- must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.



- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently. You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.



Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.



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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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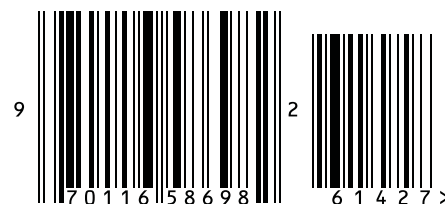


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ISSN 9754350

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