IJAMRR

International Journal of Advanced Multidisciplinary Research and Review

ISSN 2330-1201

Volume: 5
Number: 8
Year: 2017
2017 Winter

ISSN 2330-1201

International Journal of Advanced Multidisciplinary Research and Review
ISSN 2330-1201

International Journal of Advanced Multidisciplinary Research and Review (IJAMRR)

ISSN 2330-1201

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International Journal of Advanced Multidisciplinary Research and Review (IJAMRR)

ISSN 2330-1201

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International Journal of Advanced Multidisciplinary Research and Review (IJAMRR)

2013

ISSN 2330-1201

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International Journal of Advanced Multidisciplinary Research and Review
ISSN 2330-1201

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The Relationships between Motivation and Self-Efficacy

Raphael Gomel[1]

Self-efficacy is percived as a main factor that shapes motivation to perform tasks. The relationships between self-efficacy and motivation were examined in a recent experimental prosedure presented here, conducted between managers and workers. The findings suggests different connections between these variables. A quantitative research was conducted in a college for adult studies (Gomel, 2016). 207 participants of courses in the college were required to estimate their ability to successfully complete an hypothetical task, Their self-efficacy, motivation and willingness to perform were measured. Their motivation was manipulated and changes in variables were measured. Pearson correlation coefficient and Spearman correlation coefficient were used to examine the relationships between variables. In addition, linear regression tests were done, to test the effect of interactions between motivation and specific self-efficacy on willingness to perform of the participants. It was found that motivation participates in determining self-efficacy and in forming the relationship between self-efficacy and willingness to perform. It was also found that motivation has a more crucial role than specific self-efficacy in predicting willingness to perform.

Key words: self-efficacy, motivation, willingness to perform

Introduction

One of the issues that concern many researchers is how to motivate people to achieve best performances, and how current experience affects future behavior. according to Bandura's theory, one's Self-efficacy affects his motivation for completing the task and the later affect

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performance. Self-efficacy has been defined as the level of an individual's belief in his or her own ability to succeed in performing and achieve wanted results (Bandura, 1977, 1980). A wide body of knowledge supports the claims of the theory, however, other evidence were found recently, suggesting different connections between the variables: A research recently conducted, following Bandura's theory, tested for a positive direct connection between self-efficacy and performance and between self-efficacy and motivation amongst nursing students. it was found in some cases that motivation had a central effect, and without it, the effect of self-efficacy on the level of success was not found (Hadid, 2013). These findings dispute Bandura's claim about the importance of motivation, and raise a question about the exclusiveness of self-efficacy in determining the level of success. Following these results, in the current research we examind wether motivation affect self-efficacy and the later affect willingness to perform

The role of Self-efficacy

Self-efficacy refers to people's beliefs about their ability to monitor and manage events that affect their environment and their lives so they could satisfy their needs, and their ability to summon the motivation, the cognitive resources and the actions (skills) required to succeed in the tasks they chose. Self-efficacy is defined as "people's judgment of their capability to organize and execute courses of action required to achieve selected types of performance" (Bandura, 1986, p391). In other words; A person's assessment of his ability to use the necessary skills and behave in a specific way, in order to deal with different situations. Self-efficacy is what a person believes he can do with his abilities under given conditions (whether realistic or not). This belief is related to the expectations to get results: whether the individual expects his performance to produce successful results – or failure. Self-efficacy is based on the assumption that people avoid performing tasks which are perceived as too hard for their abilities and choose to complete tasks that match their perceived ability. These directions were supported in many researches (Lunenburg, 2011).

The relationships between Self-Efficacy and motivation

According to Bandura, Self-efficacy influences action through motivational, cognitive and emotional processes. It affects the choice of tasks to be performed, determines the degree of effort investment and time of persistence's invested while dealing with obstacles. A person who believes he could perform a task, his self-efficacy will be high as well as his motivation to perform it. In contrast, a person who believes he could not complete the task successfully, will have lower self-efficacy, and will avoid the task (Snyder & Lopez, 2007). People are drawn to activities where they have high self-efficacy and less drawn to activities for which they have low self-efficacy (Van der Bijl & Shortridge-Baggett, 2002). Different researches that have found a positive connection between motivation and self-efficacy have presented findings supporting this claim, such as Eccles and others (Eccles, 2007, 2009), Agbarieh (2013), Steyn and Mashaba (2014). Williams and Williams (2010) reinforced this, indicating that people with high self-efficacy treat difficult tasks as challenges rather than threats they should avoidAdditional researches also found positive connections between efficacy and performance (O'Neil et al,. 2013; Ramchunder & Martins, 2014). Similar findings have been reported by Lane et al. (2003).

It seems that there is a lot of evidence reinforcing Bandura's main arguments that self-efficacy shapes motivation and motivation affects performance and achievements. However, research findings, although generally support the theory, are not uniform and there are also opposing evidence: Kendall (2006) found that self-efficacy is negatively related to motivation and performance, LaForge-MacKenzie et al., (2014)

found that self-efficacy was not a significant predictor of performance. Additionally, there are indications that motivation is not directly related to performance. Hadid, (2013) found that motivation has a role in strengthening the connection between self-efficacy and success. In some cases motivation was found to have a central influence, without which the effect of the self-efficacy on the level of success was not present (Hadid, 2013, p40).The current research, conducted following Bandura's theory (1986) and Hadid's findings (2013) tested for a positive

direct connection between motivation, self-efficacy and willingness to perform amongst 207 participants in management courses.

Method

Objectives

The current research attempted to examine relationships between motivation, self-efficacy and willingness to perform

Design and participants

A quantitative research was conducted, including an experiment group and a control group. The data collected was gathered via questionnaires from 207 participants in management courses. 62 of them were managers and 144 workers, 32% were women and 68% men. 147 participants were young people between the ages of 21–30 and 60 participants were over the age of 30.

Material and procedure

A hypothetical situation was presented to the participants in which they were required to estimate their ability to successfully walk through a long pathway of hot coals, barefoot. A hypothetical reward of a A little sum of money was promised to those that succeed in completing the task. Following Kirsch's distinction, we distinct between general perceived self-efficacy and a perceived specific self-efficacy regarding a particular task that one intend to performe (Kirsch, 1986). At the first stage The participants were asked to fill out questionnaire to measure their motivation, their specific self-efficacy and their level of willingness to complete the task. At the second stage, the participants' motivation was manipulated: The participants were presented with a change in the described situation, according to which, those who succeed in completing the task in the story win a large sum of money. The rest of this stage was identical to the first stage: the participants were asked once again to complete the questionnaires to measure motivation, specific self-efficacy and level of willingness to complete the task.

Tools and indicators

Measurements of the Independent Variables: General Self-Efficacy was tested by a 10 item questionnaire, based on the General Self-efficacy questionnaire that was used at (Hurter,2008) with necessary adjustments for our research

Motivation for Task Performance was measured in two ways: Indicator A: The participants filled out a questionnaire including four items in which they were requested to rate, on Likert scales (Norman, 2010). Indicator B: The participants were asked to rate on Likert scale their level of motivation for performing the task on a five option scale.

Measurement of the Dependent Variables:Specific Self-Efficacy: The participants were reqwested to estimate the level of success they would achieve had they tried to do a hypothetical task on 5 options Likert scale.

The willingness to perform the task: The participants were reqwested to estimate the chances that they would perform the task in the hypotheticals ituation described to them

The statistical data analysis was done using Pearson and Spearman tests and linear regression analysis.

Results

The Relationship between Motivation and General Efficacy

Significant relationships were found between motivation and general efficacy only among managers before the manipulation ($r=0.302$, $p<0.05$) and in the younger group of participants ($r=0.180^*$, $p<0.05$)

The relationships between Motivation and Specific Efficacy

The relationship between motivation and specific efficacy was found to be positive, strong and significant. The relationships were stronger among workers than among managers. After the manipulation of motivation stronger relationships were found in both motivation indicators.Testing the relationships according to age distribution has not shown any significant differences between younger people and older people

Table 1: The Relationship between Motivation and Specific Efficacy before and after the Manipulation, with Distribution by Role Groups

	Specific efficacy			
	Before		after	
	worker	manager	worker	manager
Motivation indicator A	0.716**	0.487**	0.775**	0.688**
Motivation indicator B	0.576**	0.307**	0.777**	0.639**

**p<0.01

The Effect of Motivation and Specific Efficacy on the Willingness to Perform:

In order to test the effect of motivation and specific efficacy on the willingness to perform, linear regressions were used. The results of the regression Before manipulation show effects of specific efficacy and motivation on the willingness to perform. This effects are stronger for workers than for managers.

Table 2: The Results of the Linear Regression to Predict the Willingness to Perform by Motivation A and the Specific Efficacy before the Manipulation among workers and managers

	variable	B	β	T	p
worker	constant	0.099		0.784	0.434
	Specific efficacy	0.158	0.165	2.372	0.019
	Motivation indicator A	0.630	0.698	10.008	0.000
manager	constant	0.480		2.364	0.021
	Specific efficacy	0.148	0.204	1.809	.0075
	Motivation indicator A	0.376	0.498	4.418	0.000

Segmenting the participants according to role after the manipulation shows that the effect of specific efficacy on the willingness to perform is stronger for workers than for managers.

However, the effect of motivation on the willingness to perform is stronger for managers than for workers.

Table 3: The Results of the Linear Regression to Predict the Willingness to Perform by Motivation A and the Specific Efficacy after the Manipulation among workers and managers

	variable	B	β	T	p
worker	constant	0.235		1.470	0.144
	Specific efficacy	0.306	0.285	4.075	0.000
	Motivation indicator A	0.605	0.625	8.937	0.000
manager	constant	0.407		1.531	0.131
	Specific efficacy	0.214	0.211	2.156	0.035
	Motivation indicator A	0.654	0.666	6.806	0.00

The segmentation of participants according to age groups before the manipulation shows that the effect of specific efficacy on the willingness to perform is only significant for younger people. However, the effect of motivation on the willingness to perform is stronger for older people than it is for younger people. Moreover, after the manipulation, the effect of specific efficacy on the willingness to perform was found to be stronger among the older group of people in comparison to the younger group, while the effect of motivation on the willingness to perform is much stronger among younger people.

Conclusions

In the current research, we have attempted to examine whether motivation participate in forming the self-efficacy. The examination of these relationship was done on two levels: first, we tested for a relationship between the research participants' motivation and their specific and general self-efficacy. This kind of relationship has indeed been found. Second, we tested the question whether increasing motivation by an experimental manipulation affects the strength of the relationship. Evidence was found to the strength of the relationship changing with the manipulation of the motivation of the research participants; With the increased

average level of motivation, there was also an increase in the level of self-efficacy of the participants. That is, in certain situations, the motivation can affect one's perceived self-efficacy, contrary to the perception that it is the efficacy that determines the level of motivation.

The findings of the research shows that the relationship between general efficacy and motivation does not always exist. there might be other factors causing the relationship between self-efficacy and motivation to be different between different groups of people. The relationships may differ for different ages or among workers as opposed to managers; and also for the same people in different situations. These findings fit the social learning theory, which claims that a person's motivation is affected by behavioral factors, personal factors and environmental factors that participate in forming it (Wood & Bandura, 1989). The findings of the research shows that the workers' willingness to perform is mainly affected by motivation, while the role of self-efficacy is significantly smaller. The manipulation has moderated this trend in a way that after the manipulation, self-efficacy had a slightly greater effect on performance while motivation had a slightly lower effect. Among younger people as well, the willingness to perform is affected much more clearly by motivation than self-efficacy, however, the effect of the manipulation on younger people is stronger and causes a significant increase in the effect of motivation on the willingness to perform and a decrease in the effect of self-efficacy on willingness to perform. It seems that older workers respond differently than younger workers to the promised rewards for a successful performance, and give different importance to their perceived self-efficacy: older people have higher regard to their self-efficacy than younger people. One possible explanation to this trend may be that it may have been caused by the younger people's tendency to take more risks than older people, and maybe they were more tempted by the high reward that was promised to the people who succeed in the task in this experiment.

Among managers, the manipulation had a different effect: it appears that the higher the motivation, the more tempted the managers are to strive and receive the reward promised to those who succeed in the task, even despite their lack of faith in their ability to complete the task.

Summary

The claim that motivation can have an important role in forming self-efficacy and in affecting willingness to perform through self-efficacy does not have much empirical evidence as found at the current research according to which motivation participates in determining self-efficacy and in forming the relationship between self-efficacy and willingness to perform. It appears from the findings of the current research that motivation has a more crucial role than specific self-efficacy in predicting willingness to perform. The practical significance is that managers can influence the level of workers' motivation and so affect their perceived self-efficacy and improve workers' performance In addition, the fact that different relationships were found between motivation, efficacy and performance among different groups of participants has meaning regarding differences necessary to the ways of motivating different workers of an organization. thus a greater chance of success is promised rather than an attempt to motivate all workers with an identical program.

* Gomel, Raphael. *The relationships between motivation, specific self-efficacy and performance amongst adults - managers and workers.* A dissertation submitted in partial fulfillment on the requirements of Varna Free University for the degree of Doctor of Psychology 2016. A dissertation that has not been approved yet.

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International Journal of Advanced Multidisciplinary Research and Review
ISSN 2330-1201

International Journal of Advanced Multidisciplinary Research and Review
Volume 5, No.:8, 2017 Winter

An Outlook to the Social Media Strategies for Automotive Industry in Turkey[1]

Zeki Yuksekbilgili[2]

Mehmet Bagkur

In today's world, traditional media models are withering and social media started to affect the several industries. The automotive industry is one of the industries, which affected and influenced by social media up to a significant amount. Turkish Automotive consumers' attention have quickly transitioned to social media as well. Thus, the Turkish Automotive brands have recognize this new phenomenon and adopt their strategies accordingly. This study discuss the effectiveness of social media and Facebook strategies of Turkish Automotive brands for the brands with considering the automotive social media audience' behaviors. The study also propose insights and a model for the automotive brands to increase their performance within social media platform.

Keywords: Social media, Turkey Automotive Industry, Marketing, E-Marketing

INTRODUCTION

Social media is the one of the emerging trends in the today's world; it turned into a dynamic for entertainment, recommendations, discovery and interaction. There are more than 2.307 billion active social media accounts by January 2016 (Kemp, 2016) and the number of social accounts have a growth about %12 per year since 2011. This popularity make social media a platform where people share what they like, discover new things and make recommendations.

[1] An earlier version of this study was presented at INTERNATIONAL SOCIAL RESEARCH CONGRESS (USAK 2017), 20-22 April 2017, Istanbul / Turkey

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In today's world consumers require on-demand and immediate access to data at their own convenience at anytime. (Rashtchy et al., 2007). Consumers interests turning away from marketing tools like television, newspaper and magazines and consistently demand more control over their media consumption (Volmer & Precourt, 2008). The brands adopt this change as well and many of the brands use social media as a tool to directly communicate with their consumers and cherish their loyalty.

Social media, not only make brands to communicate with their consumers but also enabling customers to talk to one another, which is an extension of traditional word-of-mouth communication (Ramsey, 2016). As Vincent Ferrari mensioned 'instead of telling a few friends, consumers now have the ability to tell hundreds or thousands of other peoplewith a few keystrokes!' (Mangold & Faulds, 2008). At this point, brands must be very consistent on every single action on social media to leverage their brand's value (Ramsey, 2016).

The human behaviour within social media have the same popularity in Turkey 46.28 million social media accounts in Turkey, which is %49 of the population (Kemp, 2016). Turkish people have different interest within social media where the top five popular areas are as below:

This usage and popularity of social media makes it one of the best tools for customer engagements and lead generation (Hendricks, 2015) as well which also increase the importance of social media sites like Facebook, a very important marketing tool for the industries.

Overall, it is long been acknowledged in marketing management that a successful social media strategy is necessary for a successful marketing strategy. Marketing management are agree that social media is necessary to clearly reflect the values articulated in an organization's mission statement and contribute to the fulfillment of the organization's performance goals (Mangold & Faulds, 2008). This study focus on social media usage for Turkish Automotive sector and their social media strategies and targets to propose a model for an effective social media strategy.

An Outlook to the Automotive Industry

For about 125 years, auto industry is evolving the new trends of the changing world. Years ago, in the start of the digitalization, it was enough to have a website and connect with the consumers but in today's world, the trend is the social media platforms like Facebook (Lempert, 2008). Today, many auto manufacturers have already in era of transforming to the digital and huge amount of resources already allocated within the businesses (Vollmer & Precourt, 2008). Social media have a big portion in the digitalisation process as consumers spent most of their time in social media. It is clear that the companies who do not adopt to this new epoch will be outstripped within the market as the will be behind their competitors.

In conclusion, social media and social data already become an important tool for car producers and the research shows that the importance and the benefits of the social media for the OEM's will continuously increase in the next 10 years.

AIM AND METHODOLOGY

In today's world the traditional advertising methods are crushing as they are neither cheap nor gets consumers high attention as consumers attention have migrated to the digital platforms where they can get information more quickly at anywhere (Rashtchy et al., 2007; Vollmer & Precourt, 2008).

This paper aims to show how effective Turkish automotive brands are in their social media strategy, the automotive audience in Turkey and advise a transformed vision on social media strategy for automotive brands

In this study, the research started with gathering social data for the Automotive Facebook users in Turkey. 38 Turkish Automotive Brands' official Facebook pages for the dates January-July 2016. In order to normalise the data set brands with less than 1 million fans were excluded.

During the study, analysis are completed in 3 sections

1. Automotive Social Index in Turkey: Focus on 5 key factors for Automotive brands to see how their strategy performs

2. Audience and Automotive Brand Relation: Focus on how the Brands communicate with the audience within their social media strategy

3. Automotive audience : Focus on the audience, age, sex, activity, professions of automotive audience in social media to include demographics into strategy.

Data Collection Method

Social intelligence techniques used to gather the data from internet and brand's Facebook pages.Facebook Graph API and Facebook Query Language, which provided by Facebook Developer's platform on Facebook and Google Visualisation API Query language, which is provided by Google on Google Analytics platform, had been used.

Facebook Query Language is a query language that allows querying Facebook user data by using a SQL-style interface, avoiding the need to use the Facebook Platform Graph API. Data returned from an FQL query is in JSON format by default. Data returned from an FQL query is in JSON format by default.

Unfortunately, the Facebook Query Language is not supported by Facebook after 7 August 2016 so the data belongs after of 7 August is gathered by Graph API, which is provided by Facebook as well.

The Facebook Graph API is a low-level HTTP-based API that you can use to query data, post new stories, manage ads, upload photos and a variety of other tasks that an app might need to do (https://developers.Facebook.com/docs/graph-api/overview [Access date:20-09-2016]).

Data related with Automotive companies are gathered from brands official Facebook pages and monitor the number of likes, comments, shares of brands from their Facebook pages which allows to calculate brands' posts 'People talking about this rate' and 'Post engagement Rate's.

The biggest limitation of the data gathering is the limited time for the data and the permissions of Facebook. Another limitation about the study is the Volkswagen Facebook page due Volkswagen Turkey is using the global Facebook page so the Volkswagen Turkey Facebook page is not included at all.

In conclusion, Facebook API platform is the muchly used tool in this study to gather data from Facebook where all the data gathered from official page's for different times. At the points, where data restriction stop to get data from official pages, the data has been derived from Facebook IQ platform on industry base.

AUTOMOTIVE SOCIAL INDEX IN TURKEY

Explanation of social index in detail

Social index can measured with number of parameters but in this study select: Applause rate of the content, likes, the number of people the post reached and how the content echoes with the audience.

In this study, we track and monitor the number of likes, comments, shares of brands from their Facebook pages and also calculate their posts 'People talking about this rate' and 'Post engagement Rate's' which gives us a mature result for social index of the Facebook pages.

Five specific attributes selected to calculate the social media index of automotive brands in Turkey.

Number of fans: Shows the number of communications OEM's started from Facebook

Growth: Shows the growth of the followers of the OEM' Facebook page. The growth rates shown in this study is the average weekly rate for the last 2 years

People talking about this rate: Shows all the interactions about the Facebook fan page within Facebook

Social Engagement Rate: Shows the interactions done by the fans the engagement rate calculated with the formula below:

Engagement Rate = (Likes Comments+ Shares on give day/Own Posts on given day) X (100/fans)

Automotive Social Index in Turkey

Automotive industry have an increasing trend on the Facebook since 2011 and it is in the top 10 industries in in the average Facebook fans.

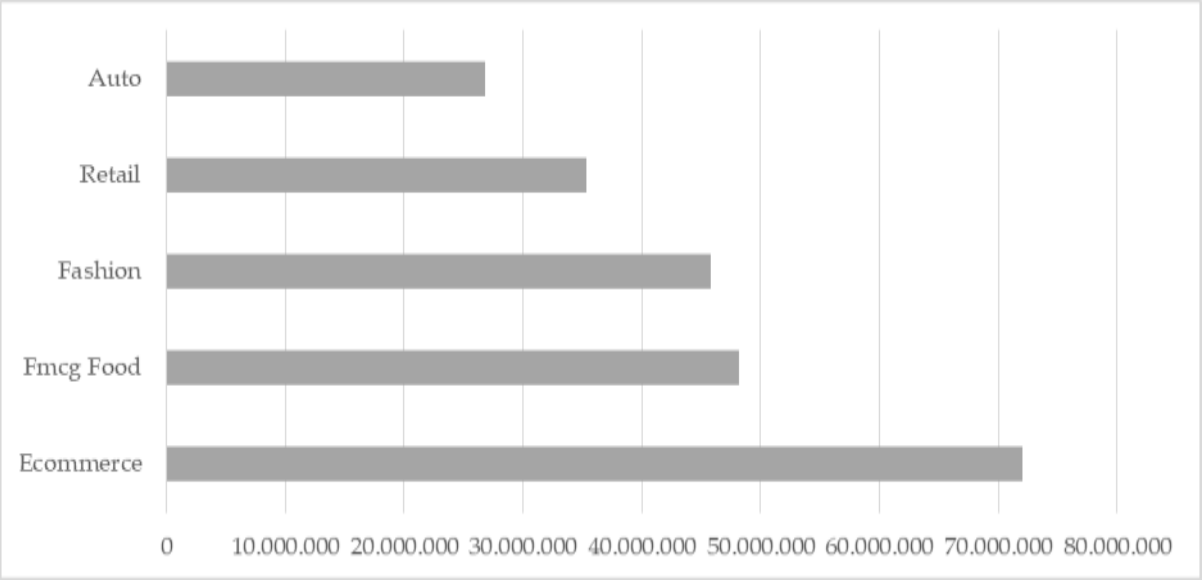

Figure 1. Top social media industries in Turkey

The number of fans of automotive industry showed an increased trend since 2011 and in 2016, there are about 25 million social media accounts who are at least fan of a page, which operates in automotive industry. The automotive brands in Turkey, started to open Facebook pages years ago and nowadays exactly all the brands have their own Facebook fan pages.

In this chapter, in order to evaluate the automotive social index in Turkey, data gathered and analysed from 32 brand's Facebook pages across four attributes for August 2016. It is also important to mentioned that the data is belongs to median values.

Table 1. Automotive Brand's Turkey Social Index Attributes (data shows average rates between May-August 2016, Excluding VW)

BRAND	Fans	PTAT	WG	ER (%)
Renault Turkey	2.071.792	62.483	-0,03%	0,86%
Mercedes-Benz Turkey	1.836.153	75.624	0,81%	0,39%
Hyundai Turkey	1.264.056	55.918	0,65%	1,46%
Honda Turkey	1.247.835	46.465	1,21%	0,71%
BMW Turkey	1.157.163	43.379	0,07%	0,53%
Audi Turkey	1.124.825	28.429	0,38%	1,87%
FIAT Turkey	1.036.402	11.927	-0,07%	0,33%
Dacia Turkey	742.726	1.138	-0,17%	0,13%
KIA Turkey	738.212	30.153	0,59%	1,05%
Ford Turkey	636.885	35.078	-0,01%	0,13%
Mercedes-Benz Light Commercial	620.836	7.268	0,21%	0,81%
Skoda Turkey	426.551	6.835	-0,03%	0,15%
SEAT Turkey	358.306	6.532	0,55%	0,40%
Toyota Turkey	321.108	5.262	0,62%	0,06%
Mondial	254.871	6.281	1,91%	0,24%
Ford Trucks	240.605	3.197	0,12%	0,35%
BMW Motorrad Turkey	230.063	6.238	1,69%	0,88%
Volvo Car Turkey	196.795	3.444	2,43%	0,20%
FIAT Commercial	161.973	2.046	0,95%	0,73%
Alfa Romeo Turkey	154.234	1.990	0,86%	0,79%
TVS Turkey	152.293	955	0,79%	0,06%
Mazda Turkey	151.442	2.875	3,17%	2,25%
Scania Turkey	151.171	9.755	0,10%	0,44%
SsangYong Turkey – Şahsuvaroğlu	148.304	5.178	0,08%	0,60%
Yamaha Motor Turkey	141.088	38.661	0,52%	0,52%
Borusan Otomotiv	136.674	1.684	-0,11%	0,91%
Jeep Turkey	116.602	3.085	-0,15%	0,33%
Mitsubishi Motors Turkey	106.757	3.386	0,28%	0,05%
Avek Otomotiv	100.724	5.391	-0,03%	0,39%
Porsche Turkey	97.042	3.482	0,07%	1,40%
SuzukiTürkiye	89.342	966	2,93%	0,23%
Maserati Turkey	88.251	1.184	5,54%	1,94%
Otomol	87.846	1.133	1,42%	0,04%
Otokoç	80.225	344	0,92%	0,08%
Medos Fiat	74.741	280	-0,08%	0,35%

It is clear that the brands who operates more for passenger car's seems to be more popular and the top five companies in the above table have more than a million fans which clearly

shows that they have a better social media strategy compared to others and investing within social media.

According to the Table 1 , Renault is the leading brand with more than 2 million fans on the Facebook which shows that they have more than double fans compared to its competitors(except 4 brands). On the other hand, when we look at the sales numbers in 2016, the Renault has the highest sales as well compared to its competitors and again its sales numbers are about double of lots of its competitors.

Mercedes Benz Turkey have the highest "People talking about this rate"(PTAT) across all of the other companies with 75.624 interactions which clearly shows that people like to talk about Mercedes which shows that people in Turkey have more interest to the brand in the first quarter of 2016. On the other hand, Mercedes Benz Turkey have a lower score on the engagement rate compared to the other brands in August. This shows us that Mercedes Benz Turkey fan page tremendously growth in June compared to the previous months. This growth rate shows about 80.000 people started to follow Mercedes Benz Turkey fan page and this increase effects the PTAT rate as well which can related with the new E- Series advertisements on social media. On the other hand, the engagement rate of Mercedes Benz Turkey is 0.39% in July, which is an average rate within other companies. This infographic shows us that people are interesting in the Mercedes Benz Turkey more than other brands but not interested in the posts by shared by Mercedes Benz.

Honda Turkey has a %1.21 weekly growth rate and %0.71 growth rate in the first half of the 2016. When we look to the growth numbers, we can see that the number of fans following Honda Turkey Facebook page have increased from 900.000 is to 1.2 million in 6 months. This increase shows that Honda's social media strategy altered within last few years and nominated by the automotive consumers. This strategical change also consistent with the sales numbers as well, where the number of sales made by Honda has a growth about %19.45 compared to the 2015 first half (Automotive Distributers Association, 2016).

We can clearly see from Table 1 that the companies like Ford, Toyota Turkey, Opel Turkey, Dacia Turkey who are in the top 10 for the sales in 2015 and first half of 2016, do not have the same performance in the Facebook and in their social media strategy. Especially Ford

Turkey had sold about 60,000 vehicles in the first half of the year, which is about 3 times bigger than the Mercedes Benz Turkey sold vehicles, but the Mercedes Benz Turkey fans have increased the number of fans 3 times more than Ford on Facebook. On the other hand, when we look at the passenger car sales in the first half, Mercedes Benz Turkey have a growth about %6.74 where Ford sales decreased about %16 compared to the previous year. This performance in the sales cannot be %100 related with social media but can say that it has a big effect.

Overall, Renault Turkey have the highest number of fans within the social and Honda have the highest growth trend in the first half. In addition, Audi and Hyundai have the one of the highest engagement rates within the industry, which shows that they are good at their social media posts strategy. Mercedes Benz Turkey have the highest PTAT rate across the others as well, which makes it the most popular brand within the Facebook but on the other hand Mercedes Benz Turkey not able to show this performance in engagement. Instead of BMW TURKEY, has one of the highest fans between its competitors, has a very low growth rate in 2016 which is also consistent with sales as well where decreased about %11 compared to 2015.

In conclusion, the top 6 companies in the table 3.1 seems to have a more mature social media strategy compared to others with more than a million fans. It is clear that they are able to leverage their social media with their sales operation, as especially the fan growth numbers are proportional to growth in sales. On the other hand, the companies with highest sales like Toyota Turkey, Ford Turkey, Kia Turkey, and Dacia Turkey do not have a mature social media strategy compared to their competitors.

BRAND AUDIENCE RELATIONSHIP

The biggest difference between social media and traditional media is that, in social media, the publisher receives positive and negative reactions from their audience. This makes brands every single action on social media to focus on to make the audience to interact on the posts on brands page. This makes Facebook a platform where the brands can directly communicate with their consumers and cherish their loyalty and build more strong reputation on their

audiences thus , the manufacturer's must be reliable with the posts and the responses . In addition, the social media strategy with the posts will affect the reach and the loyalty of consumers but to do so the sales as well.

In this chapter , the brands with more than million Facebook pages fans are analysed in detail to evaluate how they shape their social media strategy in communicating with their audience's.

Brand Activities on Facebook

As the Facebook turned into a platform where the brands interconnect with their customers, their activities on their Facebook page will directly effects the company's reputation among their fans but to do so , brands must have a solid social media strategy and also related actions accordingly. The activities on the Facebook page makes a big part of the company's social media strategy and directly effects the numbers of people and success in communicating audiences. The communication way in Facebook based on the posts and brands can reach all of their fans with a post they made from their Facebook page.

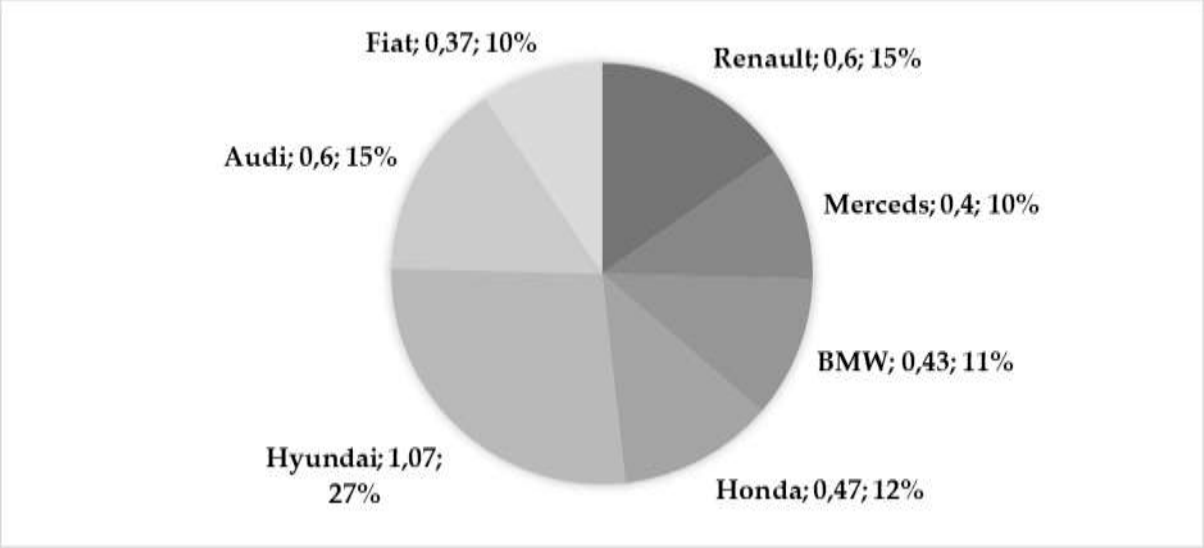

Figure 2. Average posts per day (data belongs to dates between 21.7.2016 – 21.8.2016)

Renault has the highest number of posts within Facebook with 1.07 posts per day followed by Hyundai, Audi and Fiat has the lowest post where shares a post once in 3 days.

The industry average for posts is about 0.5, which shows that Renault has double posts compared to the other companies and have something to say its audience everyday through Facebook.

Engagement rate is the one of the best metrics, which shows the performance of the posts and the audience's interactions.

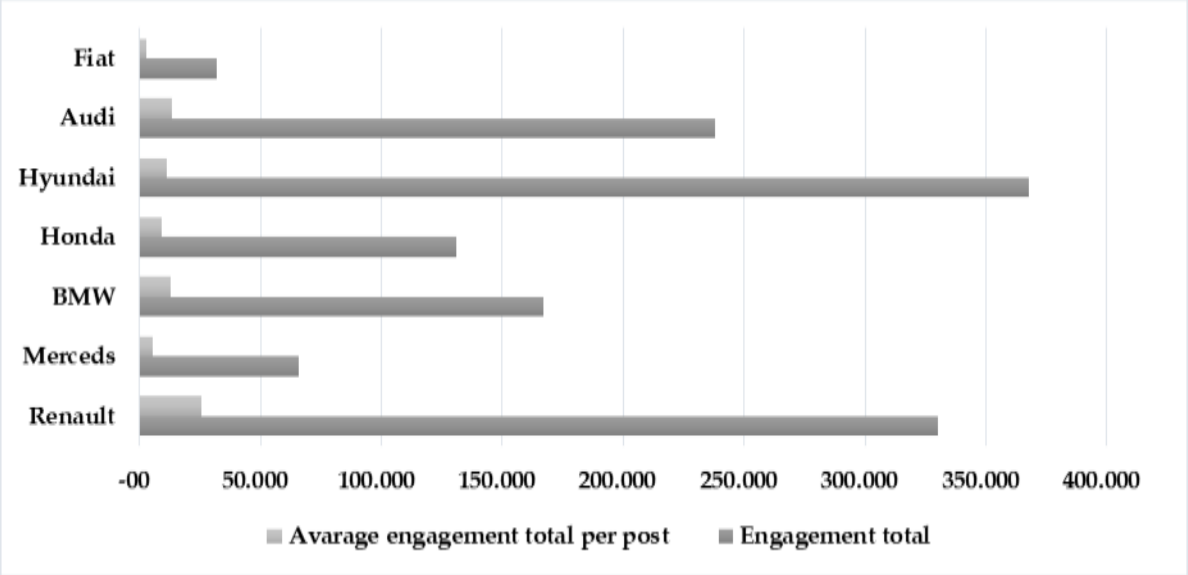

Figure 3. Engagement rate per company (data belongs to 21.7.2016- 21.8.2016)

The above graph, summarise the average engagement rate and total engagements for post between 21.7.2016 to 21.8.2016 dates. Hyundai is the brand which able to engage highest number of people and able to communicate with highest numbers of audience on Facebook. Hyundai is followed by Renault, which has the highest number of fans and still able to communicate with big percentage of audience in the mentioned period with highest engagement rate (%1.23)

Mercedes Benz Turkey, which has highest PTAT, has a low engagement rate compared to its competitors. This shows that some of the posts shared by Mercedes Benz Turkey have high attraction and some get very little attraction by fans, which shows that Mercedes Benz Turkey posts are differentiate from each other with either content or type.

In conclusion, Hyundai and Renault is vastly effective in engaging with their consumers where Fiat is lacking with engaging with its customers through Facebook. BMW TURKEY, Honda and Audi are above industry averages with engagement and Mercedes is lacking a smooth performance where some of the posts are lacking engagement with audience's instead some are effective.

Timing of the Manufacturer's and Audiences

It is accepted by lots of business leaders that timing is very important in business even sometimes, it is more important than the content. Same as the business, in the social media, the timing is very important as well. Being active on the times when the audience are online, increase the chance to noticed and responded. In addition to that , timing of the responses is very important as well where brands will have the opportunity to show their customers that they are always available and in contact with them.

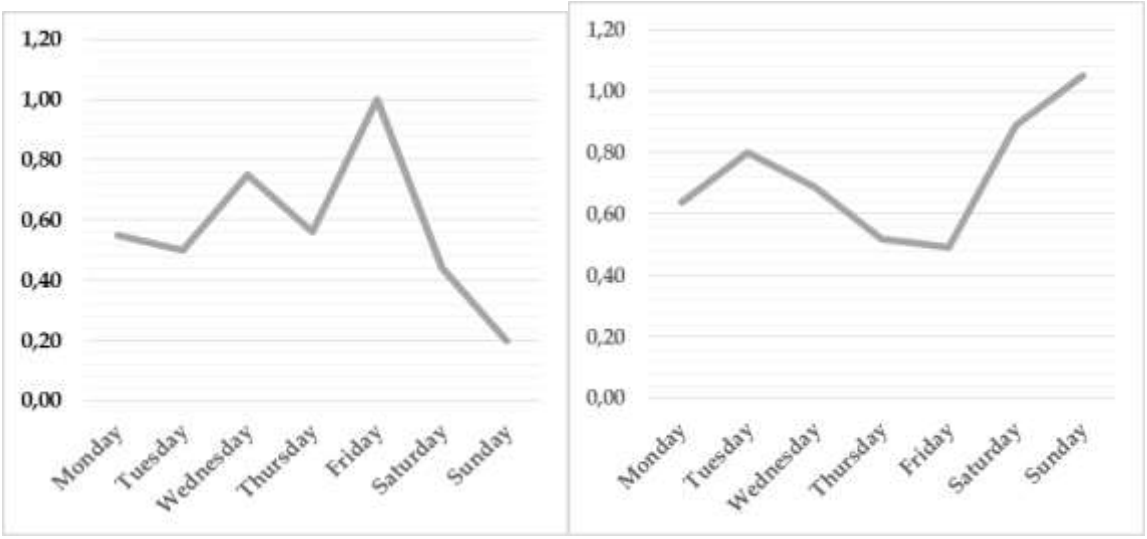

Figure 4. Average activity and average engagement rate on daily basis: data belongs (data belongs to 1.1.2016 – 31.6.2016)

Initially, the brand's activity on the Facebook shows a slight decrease at start of the week and shows an increase in the middle of the week. The brand's posts reach a peak point on Fridays and dramatically decreases within the weekends and we can say that only few brands are slightly active in the weekends.

When we look to the engagement rates for the audiences with the brand's post, we can easily see that there is a tremendous increase after Friday and the highest engagement is on Sundays, which means that the audiences are much more action on the brand's post in the weekends especially on Sundays

Overall, it will be clever for the brands to have posts on the days, which the audience engagement rates are high; however just few of the brands have posts in the weekends where the engagement rates are highest.

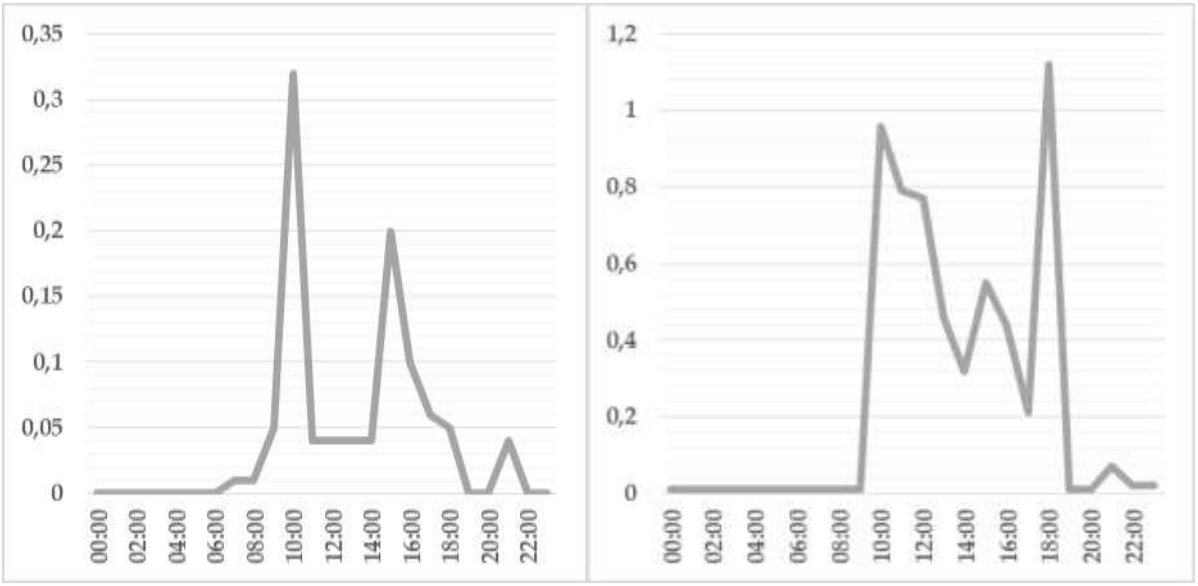

Figure 5. Average activity and average engagement rate on hourly basis (data belongs to 1.1.2016 – 31.6.2016)

When we look at the hourly activity of the brands and the audiences, there is a two peak points for the engagement of the audiences, which are at 09:00 and 19:00, which is out of working hours. In the morning session, the brands have their posts where the activity is the

highest but there are fewer posts by brands around 20:00, which can be accepted as most suitable time.

The data also shows that, Hyundai takes in account the timing in their social media strategy and have postings during the weekends and outside of the working hours but oppositely Mercedes Benz Turkey is lacking to have any posts during the weekends and around 20:00 in weekdays where the engagement rate is the highest. We can also see the effect of the timings in audience engagement when we look at to the average engagement rate and surely, Hyundai's perfect makes them to get better engagement.

Consequently, automotive brands in turkey are not take into account the timing enough within their strategy. It is important for the brands to recognise that having posts outside the working hours will help them to reach and engage with more audience and brands may loss leads if not have Facebook posts are reply to customer questions during weekends where it will be a good strategy to have social teams working on weekends and outside working hours.

Brand's Content on Facebook

The content of the Facebook posts makes a big part of the brands social media strategy and brands should use true content to present their brand's services, products and the brand's reputation in social arena.

Design, style and performance are three most important factors for the automotive industry as the elegance and the performance have a %14 affect during the car purchasing processes

(Mangold & Faulds, 2008). The presentation of the products within the social media is very important as well as the posts seen in the social media can affect the customers decisions and interests. Another point is that , social applause can affect people .Social effect have a high influence on purchase decisions as lots of people would like to buy cars which have social influence on others.

Lots of the companies social media strategies are much more operated by the photos where %75 of the content shared by the top 6 brands are consistent of the photos where the high quality photos are a good way to present the design and the style of the products.

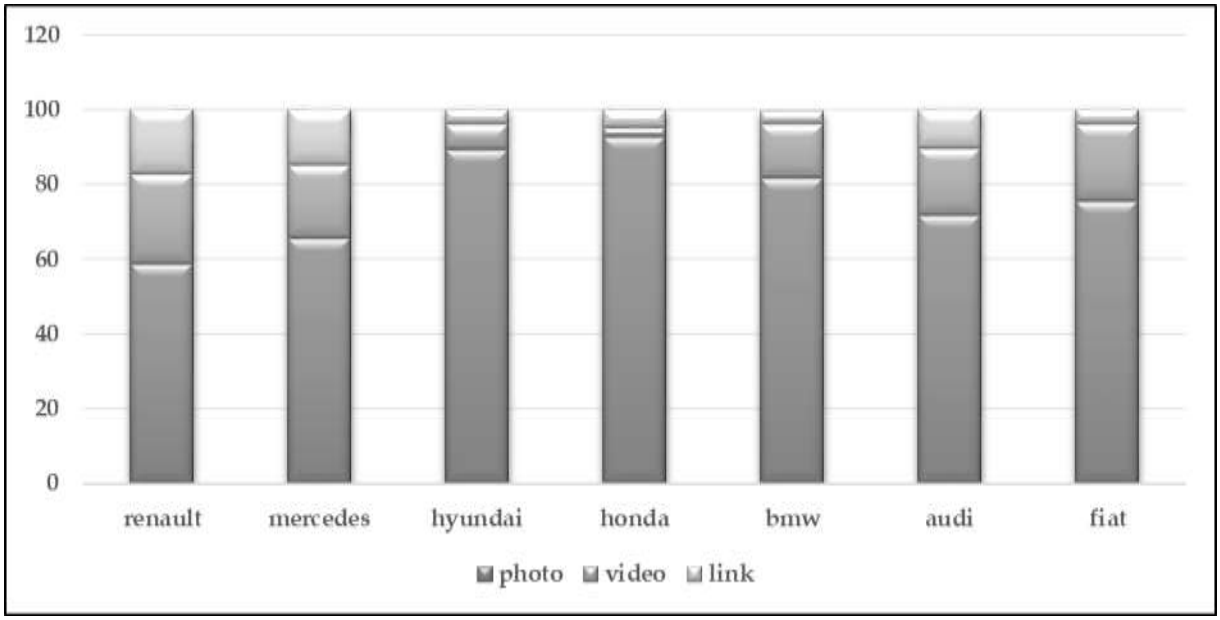

Figure 6. Post type percentages (data belongs to 1.1.2016 – 31.6.2016)

Other than the photo's the six brands have also used video's and links where video's has about %18 average and links have a %6 percent average.

Table 2. Post Types and Average Engagement Rate

Post Type	**Posts per Day per Company**	**Engagement Rate / Post**
Photo	0.44	0.86%
Video	0.13	0.10%

When we look into the engagement rate's we see the strategy that the companies using for post types is correct as the photo's engagement rates are a lot more than the video's and automotive companies absolutely prefer to post photos

AUTOMOTIVE AUDIENCE IN TURKEY

Facebook is the most popular social platform and totally, there is 1,481,914,040 users over world (Kemp, 2016). Compared to the country population, Turkey is the third country, which

has the highest Facebook usage in the world. This makes Facebook a more important platform for the Turkish market.

Table 3. Top 10 Countries Who Has Highest Facebook Usage Percentage

Country	Population Percentage
ABD	62.69
United Kingdom	61.53
Turkey	57.84
Thailand	57.51
Mexico	54.76
Brazil	51.70
Philippines	50.05
Vietnam	39.65
Indonesia	33.23
India	11,37

The Facebook audience in Turkey has interest in different sectors and automotive sector is in the top five Facebook sectors with rank five. According to the Facebook Insights data, there are about 15 million active users who are either interested in Automotive Sector or Automobiles. This audience is exactly the target audience of the automotive brands and sure big part of it is automotive consumers. In this part of this study, we will focus on 10-15 million audience in Turkey and their details.

Demographics of Automotive Audience in Turkey

The brands must know the demographics of their audience in social media and act accordingly as the demographics is a great tool to help us to understand the interest, social behaviour of the targeted audience.

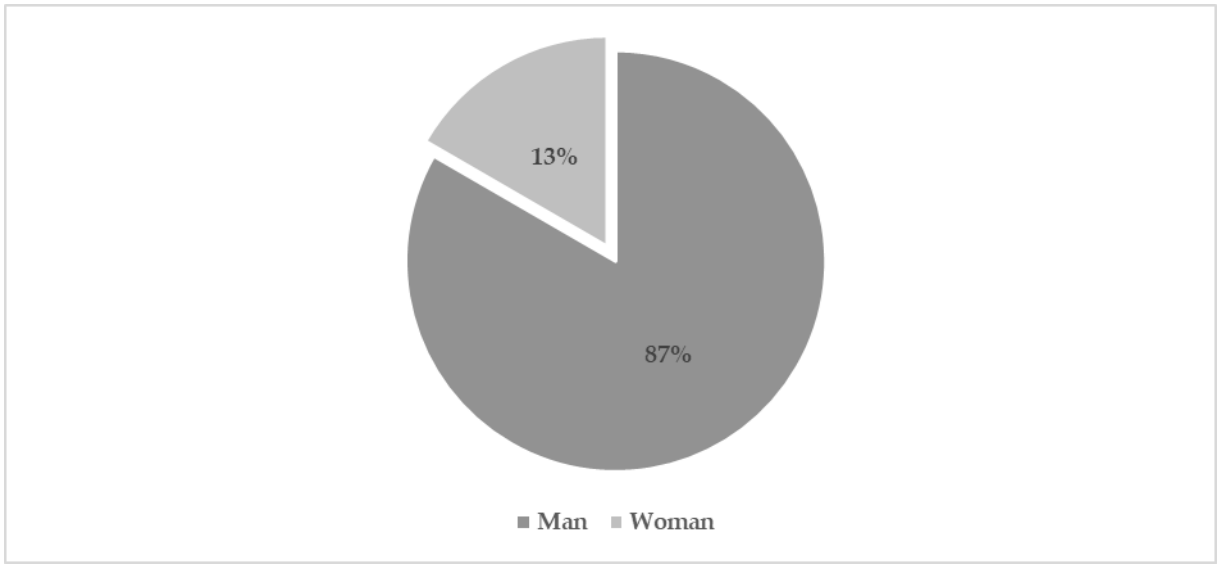

Figure 7. Gender distribution of automotive audience in Facebook

Men dominates the social audience of the Facebook for social media audience with %85 and women are not interested in automotive in social media. Mercedes Benz Turkey has very limited interest from the woman as only %9 of the page fans are women. Renault and Fiat is leading two brands in women interest in social media as %18 of their fans are woman.

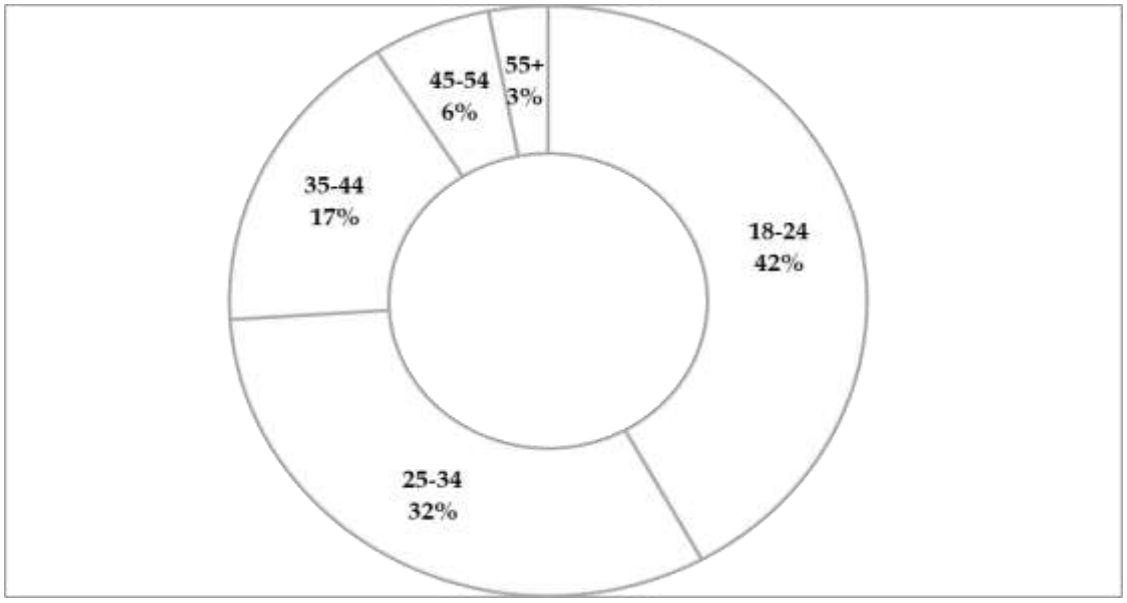

Figure 8. Age distribution of automotive Facebook audience

The age is another important demographics and the automotive audience nominated by young people who are between 18-34 years old with a percentage of 74%.

The demographics of the audience is very important in an effective social media strategy as brands able to know their targets and spent their effort accordingly. For example, a social media campaign for retired people on Facebook will not be a good social media strategy as only %10 of the audience may be retired but on the other hand a campaign that target the young professionals will have a great fit into the Facebook

Job and Profession Analysis

In today's world, many people spent about %33 of their time at their work and naturally, this makes a big effect in their social life and so as in social media. The audience's profession is very important for the automotive brand's social media strategy and this will help them to design both their products and social media strategy accordingly.

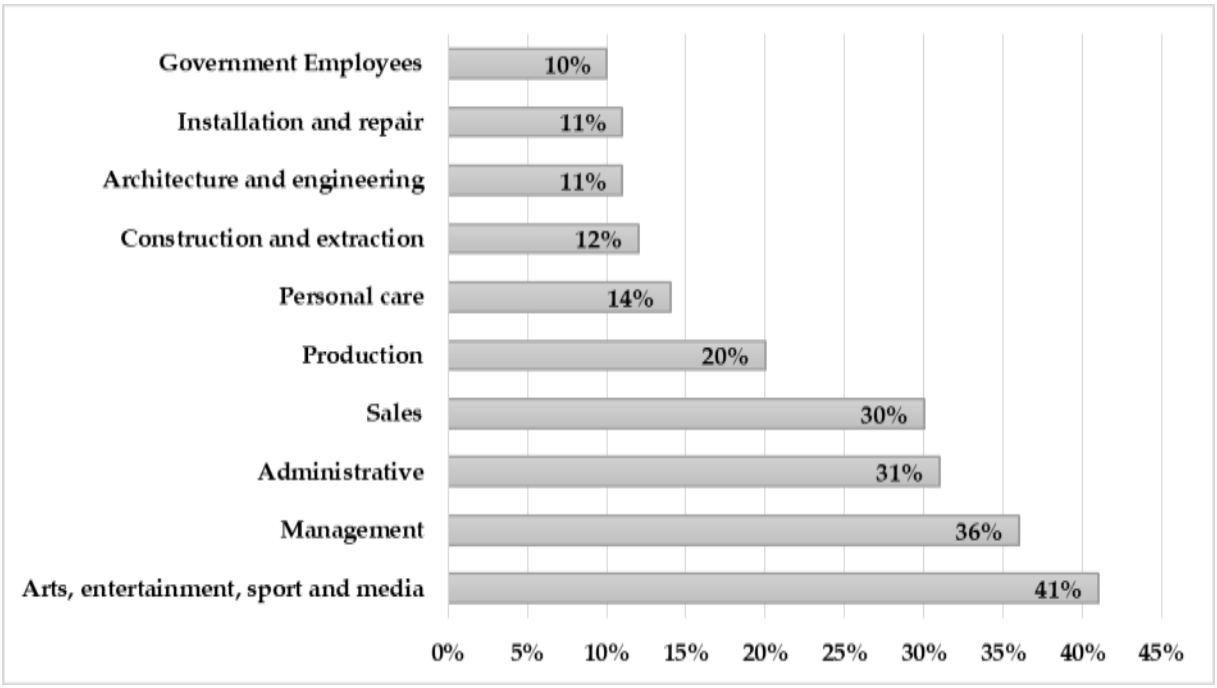

Figure 9. Top job areas of automotive audience in Facebook

A big part of the automotive audience in Facebook belongs to Arts and Entertainments sector and followed by people who are doing management jobs. People who are working at government has the least interest within the automotive brands in social media. People who are working in construction and repair have a limited interest on Automotive sector as well where this seems a big gap in Truck and Van selling Brands as people who work in those sectors use the vans and trucks to operate their jobs.

Interest Analysis

The audience other interests are also very important as not only shapes the social media strategy but also the product strategy as well. In addition, being aware of the other popular pages, which audience interested in social media, can used to create effective cross-functional sales and campaigns within social media.

Table 4. Top Interest Areas of Automotive Audience In Facebook

Category	**Facebook Page**
Arts/Entertainment/Nightlife	Cadde Hikayeleri
Transport/Freight	Mercedes-Benz Kamyon
Vitamins/Supplements	HARDLINE
Company	OPET- pirelli
Cars	Mercedes-Benz Türkiye,Honda Türkiye,Renault Türkiye,Hyundai Turkey
Public Figure	Sedat Peker,Köksal Baba
Sports League	UEFA Champions League,UEFA Europa League, Lig Tv
News Personality	Ertem Şener
Website	Tesbihane, Otomobil Dünyam, sahibinden.com, Küfür Sokakta
Computers/Internet	Nesine.com

The top categories who are in the automotive audience is more interested in social media defined in the above table. When linked to the job analysis, it is clear that the art and entertainment sector has a big cross with the automotive industry as people who are working

in arts nominating the audience as well. In addition, those infographics can be used as a good tool for the advertisements for example an advertisement film with Ertem Şener or an advertisement for a Europe League match can be preferred to get more interest by audience.

Key Findings

As outlined in previous chapters, the current car owners and future customers from different interests and profession are using Facebook effectively to get information about cars, voice their ideas and their concerns. On the other hand, automotive brands are using Facebook as well to get in touch with their consumers and achieve their marketing targets.

Especially, Facebook pages with more than a million fans act in social media according to a strategy and able engaged hundred thousands of people weekly. However, the posting times, contents and average engagement rates shows that all the brands have gaps with knowing their audience and shape their content and strategy accordingly.

The brands Toyota Turkey and Opel Turkey who sells about 100 000 vehicles in a year period, have a very limited popularity in Facebook which shows even the car owners of these brands do not a fan of their cars Facebook Page.

In conclusion, there is a huge audience for automotive industry and the brands must alter their social media strategies accordingly, which effect their performance. This study shows that the posting times, content and audience demographics effect the way that brands communicate with their audience and must considered during designing social media strategy

The analyses during this study divided into 3 sections so the findings defined in 3 sections as well.

Automotive Social Index in Turkey

Many of the automotive brands in Turkey increase the number of their fans in Facebook on a consistent basis week to week, which also shows that Facebook is a matured platform for automotive industry. The growth and popularity of the fan pages especially increased on the

times when a new product's posts shared by brand. The increase in the growth and PTAT rate followed by an increase in the sales numbers in the analysed cases. It is also find out that, a mature social media strategy really make sense in social media as this supported by the brands Ford and Toyota Turkey instead of they have the highest car owners in Turkey, they have very limited fans on Facebook.

Renault Turkey has the highest number of fans within the Facebook where Mercedes Benz Turkey is the most popular brand within the Facebook Platform. The growth rate and popularity rate of Mercedes Benz Turkey, Honda Turkey and Hyundai Turkey is remarkable and above the Turkey averages which can be achieved with a solid social media strategy.

Brand Audience Relationship

Automotive Facebook pages get about half million interactions in a week by automotive audience. The audience is more likely to "like" the posts instead of comment or share and %85 of the interactions are likes. The automotive audience is more active at 10:00 am in the mornings and 20:00 pm at nights and weekends are the times where they reach their pike for their interactions in social media.

Brands have average one post in every two days where posting daily performing better. Photos are the most common posts in automotive social media strategies of all brands where brands frequently prefer to post photo's more than other post type. Renault Turkey and Mercedes Turkey are the two brands who also prefer to use videos in their posts more than other brands where the videos more likely to be remembered compared to the photos.

Renault Turkey is the leader of the engagement among all other its competitors and have a great average engagement rate through its all posts. Hyundai Turkey, BMW TURKEY, and Audi are the other brands who follow Renault Turkey in the engagement rate. BMW TURKEY, Renault and Audi are the most consistent brands in the average engagement rate and have a steady engagement rate for all of their posts. As mentioned above Mercedes Benz Turkey is the most popular automotive brand however, the average engagement rate is low compared to others which shows us that Mercedes Benz Turkey not able to get the same interest by users in their all posts where some of them are engaged very well and some

poorly. Mercedes Benz Turkey is not the only brand and many of the companies are lacking with having a consistent engagement rate for different posts.

The posts with low engagement rate shared repeatedly with the same content, which shows that the brands are not analyse their post engagement rate effectively. Lacking of content analyse make brands to not alter their posts according to the audience interests and share the content which is not popular often. For example, Mercedes Benz Turkey is using Kitesurf content in their posts, which has a very lower engagement rate than average however the Kitesurf content is still in use by brand in every week.

Interestingly, the brands Toyota and Opel Turkey who sells about 100 000 vehicles in a year period, have a very limited popularity in Facebook when compared the sales numbers.

Automotive Audience

The males nominate automotive Audience in Facebook where the Male's forms % 87 of the audience. Renault and Fiat have the highest female ratio in automotive brands. The most common profession within the audience is art, entertainment and sports where the people who work for government have least interest to auto industry in Facebook. The young people who are aged between 18-35 forms big part of the audience.

Overall, it is find out that the future car customers make big portion of the automotive dealers and art, sports and media are the sectors, which interested by the automotive audience.

INSIGHTS AND PROPOSED MODEL FOR A SUCCESSFUL SOCIAL MEDIA STRATEGY

As discussed within the study, social media and marketing is very important for the automotive brands to leverage their marketing and sales target. The contribution of social media strategy in brands awareness and intention to purchase discussed in previous chapters. In this chapter, we will provide some insights for a better social media strategy for Turkish Automotive Market and propose a model for automotive brands in Turkey in the light of the findings of the study.

The study has shown that the social media will help the brands to increase their brand awareness, customer loyalty and the sales. In this section, a model proposed for the automotive brands for their social media strategy.

The insights and proposed model will focus on to increase the brand awareness and customer loyalty with the social media and by this way increase the sales.

Brand Loyalty and reputation is very important for brands as they are two important parameters to increase the number of sales and the prices. The brand awareness directly effects the demand and this turns into a higher equilibrium price in supply demand chart.

Insights and proposed model, in order to increase the brand awareness and loyalty we focus on fan growth rates and engagement rates.

Insights for Turkish Automotive Brands

The insights advised by this study are based on the findings in chapter seven and especially focus on to improve the social media strategy of the Turkish Automotive Brands. According to the findings, the following insights expected to increase the social media performance of the brands in Turkish automotive sector

• Share the Posts when the automotive audience is most active which is at 10-12 and 20.00 in the weekdays and make sure to post in the weekends around 10:00

• Regularly analyse the content and engagement rates of the post and find which content the audience most interested.

• Target to post contents where the people engage more and be sure that do not share the content that is not interested by audience repeatedly. Turkish audience is engaged mostly with the future products and content with performance

• Prefer to publish mostly photo’s which have highest engagement rate in Turkish market

• Boost the audience to action on the posts with not only likes but also with the shares which targets to increase the fan growth. Turkish audience is highly like to share the posts for new products

• Work with the social influencers and post the contents they engaged. Ertem Şener is very popular within automotive audience in Turkey and will be a good choice for automotive brands in Turkey to work with

• Make sure that to reply all of the questions, nominations and complaints of audiences as quickly as possible and make audiences to feel you are always in touch with them.

• Never reply audience with an advise to find their answers in the website

Proposed Model for an Effective Social Media Strategy

An effective social media strategy requires an effective model. According to the research made a social media, process model and steps defined in this study. The defined model is consist of six steps.

Figure 10. Proposed social media strategy road map

1- Create a social purpose attached to business strategy

Every marketing manager accepts that every marketing strategy requires a purpose. Social media is a marketing tool as well and in order to have a strong social media strategy, you must have a purpose.

The social media purpose must aligned with the business targets and aims. In order to define a strong purpose, the model advise to follow the steps below:

- Define your limitations as not all the objectives can be achieved with social media
- Define your audience
- Define your targets
- Define your purpose

In conclusion, the model advise to define your limitations, audience and targets in detail before creating your purpose for social media strategy.

2- Define a marketing voice on social media

The social media voice will be the road to the destination and the tone used will be the car you travel to the destination. Before starting to your journey, it is very important to build the road and decide on the car.

The social media voice will be the tool, which will define the brands personality, relation with the audience and the audience ideas about the brand. When defining your voice you should be stick with your purpose

In the end of this step, adjectives should defined that describes the voice of the brand. Consider that the voice is the road and the tone is car

3- Define your posting strategy and engaging content

Posts are the biggest tool that can be used to engage with customers. There are three important parameters related with the posts:

- Content
- Timing
- Frequency

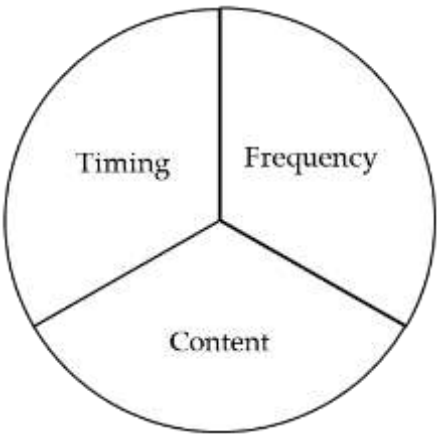

Figure 11. Posting strategy

The model does not advise any strict rules for posting strategy as it differs for different audiences and different voices. The proposed strategy here is to "Just give it a try" to see what is the most effective

4- Analyse the social data, test and being agile

As defined in the third step, posting in social media is something individual and there is not any formula for that. The way to find the best recipe is to try. The model advise to analyse the social data on a post basis. The statistics will provide us a view and insights for the best content, timing and frequency.

Figure 12. Iterative process to define posting strategy

The model advise the steps below to analyse the posts and achieve to the best results

• Define the post content , timing and frequency

• Set a target

• Try it!

• Analyse the statistics

• Define insights

• Iterate

6- Streamline and automate your process

The last part of the proposed model advise to have a streamline process for the social media.

The model advise to have a dynamic queue, which includes the posts that will be shared. Every singly post in the queue expected to have a priority and a scheduled post-date. By this way, the postings in social media will automated and become better as times goes by.

On the other hand, it is also very important to know that the social media is a 2-way communication platform so it is not possible to automate your process %100. The model strictly advise to reply to the audience immediately when they talk to you through social media.

CONCLUSION

Automotive industry will definitely undertake important changes in the following years driven by new technologies and digitalisation. This changes will affect the design, engineering and business models as well as the way brands communicate with their audiences. Changes will portend the existing strategies but on the other hand will provide new opportunities for the ones who adopt the changes.

As mentioned in the study, today's car buyers are regularly track the automotive brands from social media and voice their concerns, expectations and experiences about cars from social media as well. Thus, automotive brands must adopt the social media in to their business models and must have a solid social media strategy to understand their customers changing needs, and built strong relations with customers.

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International Journal of Advanced Multidisciplinary Research and Review
ISSN 2330-1201

International Journal of Advanced Multidisciplinary Research and Review
Volume 5, No.:8, 2017 Winter

Choosing Intelligent Elevator Control System by Using Analytic Hierarchy Process in High-Rise Buildings

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ABSTRACT

In the last decades, improvements on the technology leads great improvements on the elevator sector and building sector. High-rise buildings have become more common and elevator systems have been improved relatively with the needs of the people who live or work in high-rise buildings. Finding the optimal intelligent elevator control system according to the needs of the building is not an easy problem to solve for the administration of the high-rise buildings. In this paper eight criteria have been determined by the decision-makers in high-rise buildings. The most important criteria has been determined as being able to call for the elevator by using specified cards which enables specialize the use of the elevators with the weight of 0,294 and the least important criteria has been determined as having an option for guidance of the elevators to the pre-determined floor in an emergency situation with the weight of 0,019. As alternativse, three different intelligent elevator control system have been determined and Analytic Hierarchy Process (AHP) method has been used to determine the weights of the criteria and to choose the optimal intelligent elevator control system alternative.

KEYWORDS: Multi-Criteria Decision Making (MCDM), Analytic Hierarchy Process (AHP), Elevator Systems.

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INTRODUCTION

With the raise on the number of the high-rise buildings, needs and demands of the high-rise buildings are being changed. One of the most complex problem in high-rise buildings is to make the transportation between floors better. In high-rise buildings, the most important transportation tools are elevators and the goal of the elevator control system should be maximizing the capability of transportation and improve the service quality (Jamaludin, Rahim, & Hew, 2009). To improve the elevator performance, the most direct way is adding cabins to the elevator systems or enlarge the cabins to make capacity higher or to make shorter transportation time, speed of the cabins can be accelerated. However, chance of these approaches to happen is very low, because of the limited space, higher costs and other reasons.

Hence, Intelligent Elevator Control Systems have been developed and studied by many researchers (Chan, So, & Lam, 1996) (Inamoto, Tamaki, Murao, & Kitamura, 2003). These systems can be described as, systems that based on the principle of taking the passengers that are going to same floor in the same cabin and nowadays working principle that involved into minimizing elevator waiting time for the passengers and minimum waiting time in the cabin for passengers with the better algorithms, which systems that include multiple elevators. To accomplish this goal, in every floor specialized buttons to enter the floor number which passenger want to go are placed. This is called “hall call system”. Apart from this buttons, cards, fingerprint readers and iris readers can be used for personalized access authorities. The base point is to make it possible for people to travel from the same or similar floors to the destination floors in the same cabin.

Today, to improve the elevators’ performances, systems with destination hall call registration have been developed. With these systems, the information about destination floors of passengers are being utilized by the control systems and because of that number of the each elevator cabin’s stops become less. To make it clear with an example it can be assumed that six passengers are waiting at the entrance floor for the elevator which consists two cabins. Passengers can be called P1, P2, P3, P4, P5 and P6 and the floors that passengers aim to go are 3, 3, 3, 4, 4 and 4, respectively. Their destination floors are not known in the ordinary systems and elevator controller put the passengers into the cabins randomly. So, in this

situation, it can happen that P2, P3 and P4 can be put in one cabin and P1, P5 and P6 can be put in the other cabin which causes each cabin to stop twice. But, in the destination hall call registration system, elevator controller knows the destination floors so put P1, P2 and P3 into one cabin and put P4, P5 and P6 in the other cabin to make both cabins stop once. This leads to reduce the time and effects overall performance of the elevator system positively.

Hence, it can bee seen that the best traffic scenario for the users of building is taking the passengers who will go to nearby floors into the same cabin and use this cabin with full capacity. Intelligent Elevator Control Systems are being used based on this principle.

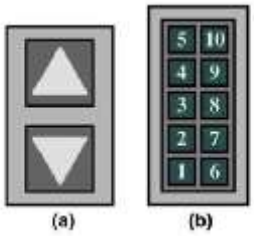

Figure 1: Two types of hall call buttons (a) the conventional system, (b) the destination entry system (Tanaka, Uraguchi, & Araki, 2005)

Nowadays, there are several models of destination entry Systems and several brands which produce them. Intelligent Elevator Control Systems. It is a complex decision making problem for the high-rise building managements to decide which model and which brand will be used. This paper concerns with the efficiency of the full configured Destination Entry Systems compared to the conventional old system and not full configured Destination Entry System by using one of the Multi Criteria Decision Making method, called Analytic Hierarchy Process.

Literature Review

Analytic Hierarchy Process has been used widely in the literature. Other than finance sector (Steuer & Na, 2003), AHP has been used in many different sectors such as logistics, manufacturing, business, environment. In logistics sector, application areas of AHP are transportation route selection (Chan & Chung, Multi-criteria genetic optimization for distribution network problems, 2004) (Chan & Chung, 2005) (Chan, Chung, & Choy,

2006),supplier selection (Korpela, Lehmusvaara, & Tuominen, 2001) (Tyagi & Das, 1997), facility location selection (Chuang, 2001) (Partovi, 2006) (Badri, 1999).

With the improvements on the technology, intelligent elevator control systems also took attention of the researchers. Sensor systems of the elevators in high-rise buildings (Marchesi, Hamdy, & Kunz, 2001), scheduling problem is considered as another topic for minimizing the waiting time for passengers (Hirasawa, Kuzuniki, Iwasaka, Kaneko, & Kawatake, 1979), predicting the traffic flows is another complex problem that determined in the elevators of high-rise buildings (Koehler & Ottiger, 2002). To solve these complex problems, authors developed mathematical methods.

In this paper, to solve the problem of choosing intelligent elevator system between the alternatives, AHP which is one of the Multi-Criteria Decision Making methods has been used.

Methodology

Analytic Hierarch Process is another Multi Criteria Decision Making Methods and one of the widely used methods in the literature. Analytic Hierarchy Process is developed in 1972 (Saaty T., 1972).

Analytic Hierarchy Process has been used in various sectors in the literature such as sustainable and renewable energy (Singh & Nachtnebel, 2016), agriculture (Abdollahzadeh, Damalas, Sharifzadeh, & Ahmadi-Gorgi, 2016), health (Nguyen & Nahavandi, 2016), nuclear power (Erdoğan & Kaya, 2016).

In this paper, Analytic Hierarchy Process have been used to making the decision of choosing the best elevator passenger routing alternative. Application of Analytic Hierarchy Process is shown step by step (Karaman & Akman, 2017).

Step 1: Starting process of the application of Analytic Hierarchy Process is determining the hierarchy model that can be seen as Figure 1. Option number is being shown as m and criterion number is being shown as n.

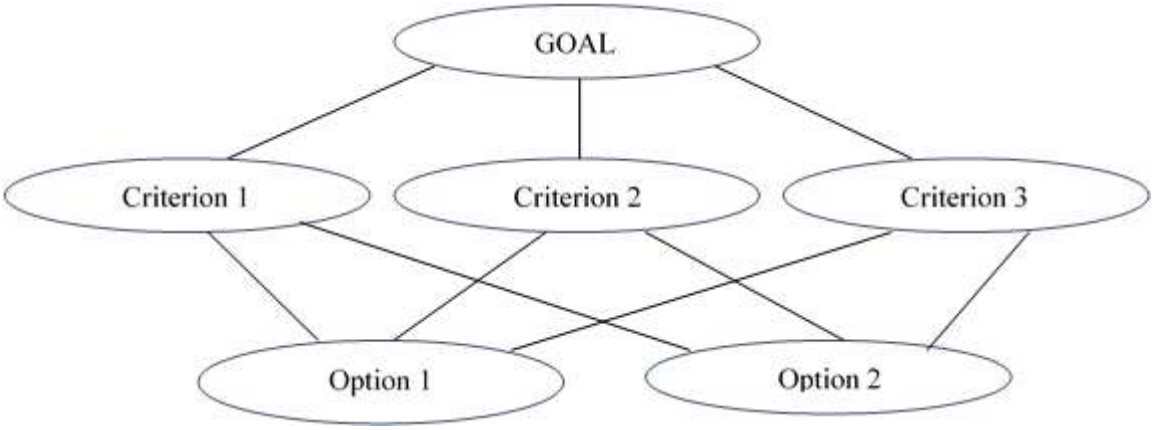

Figure 2 AHP Hierarchy Model

Step 2: Then, pairwise comparison matrix for each criterion is being determined, by the comparing each option by pairs for each factor. This matrix size is being shown as $n \times n$. When pairs are being compared linear scale is being used which can be seen in the table 2. The pairwise comparison matrix can be seen as:

$$A = \begin{bmatrix} a_{11} & a_{12} \dots & a_{1n} \\ a_{21} & a_{22} \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} \dots & a_{nn} \end{bmatrix}$$

Because of the linear comparison, $a_{ij} = \frac{1}{a_{ji}}$. For example, if a is 7 times important than b, which means that a alternative has very strong importance over b alternative, then, b is 1/7 times important than a.

Table 1 Linear Scale (Saaty T. , 1972)

Intensity of Importance	Definition	Explanation
1	Equally strong	Two activities contribute equally to the objective
3	Marginally strong	Experience and judgment strongly favor one activity over another
5	Strong	Experience and judgement strongly favor one activity over another
7	Very strong	An activity is strongly favored and its dominance demonstrated in practice
9	Extremely strong	The evidence favoring one activity over another is of tile highest possible order of affirmation
2,4,6,8	Intermediate Values	When compromise is needed

Step 3: Factors' weights are being determined in this step. To determine the weights, column vectors of the pairwise comparison matrix are being used. At the end, n numbered B column vector is being determined. B column vector has n number of components. This B column vector can be seen as:

$$B_i = \begin{bmatrix} b_{11} \\ b_{12} \\ b_{13} \\ \dots \\ b_{1n} \end{bmatrix}$$

The formula that being used to calculate the column vectors can be seen as:

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}$$

After, n number of B columns are obtained, these columns are being gathered for determining the C matrix.

$$C = \begin{bmatrix} c_{11} & c_{12} & c_{13} \dots & c_{1n} \\ c_{21} & c_{22} & c_{23} \dots & c_{2n} \\ c_{31} & c_{31} & c_{33} \dots & c_{3n} \\ \dots & \dots & \dots & \dots & \dots \\ c_{n1} & c_{n2} & c_{n3} \dots & c_{nn} \end{bmatrix}$$

Where;

$$c_{11} = b_{11}$$

$$c_{n1} = b_{n1}$$

$$c_{1n} = b_{1n}$$

$$c_{nn} = b_{nn}$$

Then, for the determining weights, w column vector is being determined which means arithmetic average of the values of lines of C matrix. It can be formulated as:

$$w_i = \frac{\sum_{j=1}^{n} c_{ij}}{n}$$

Weights vector is determined by using the w values.

$$W = \begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ \dots \\ w_n \end{bmatrix}$$

Step 4: Consistency Ratio is being calculate in this step. Analytic Hierarchy Process is based on the comparison of decision maker and to apply the method successfully, comparisons should be consistent. Consistency ratio is based on the comparison between the number of factors and a coefficient called basic value which shown as λ. To calculate the λ, D vector column should be calculated by multiplying the A comparison matrix and W weights vector. It can be formulated as:

$$D = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ \dots \\ w_n \end{bmatrix}$$

Then, by using the D vector column, E values are determined with the formula:

$$E_i = \frac{d_i}{w_i}$$

After that, arithmetic average of the E values gives the value of λ and can be formulated as:

$$\lambda = \frac{\sum_{i=1}^{n} E_i}{n}$$

After λ is calculated, Consistency Indicator (CI) can be calculated by the formula:

$$CI = \frac{\lambda - \mathrm{n}}{n - 1}$$

Then, Consistency Ratio (CR) is calculated by dividing Consistency Indicator (CI) to Random Indicator (RI). Random Indicator values are already determined and can be seen in Table 2.

Table 2 Random Indicator Values (Saaty R. W., 1987)

Number of n	RI
1	0
2	0
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49
11	1.51

International Journal of Advanced Multidisciplinary Research and Review
Volume 5, No.:8, 2017 Winter
Pages: 40 - 53

Consistency Ratio should be equal to or less than 0.10, to be the consistent, otherwise means that the comparisons are inconsistent and all the calculations are invalid.

Step 6: By doing the same steps for each factor to the options, standardized decision matrix is calculated. Standardized decision matrix can be seen as K matrix where s_{ij} represents the standardized value of decision point:

$$K = \begin{bmatrix} s_{11} & s_{12} & s_{13} & \cdots & s_{1n} \\ s_{21} & s_{22} & s_{23} & \cdots & s_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ s_{m1} & s_{m2} & s_{m3} & \cdots & s_{mn} \end{bmatrix}$$

Step 7: Multiplying the K matrix with W weights column vector, L column vector is being gathered. L column vector represents the scores of the options and can be formulated as:

$$L = \begin{bmatrix} s_{11} & s_{12} & s_{13} & \cdots & s_{1n} \\ s_{21} & s_{22} & s_{23} & \cdots & s_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ s_{m1} & s_{m2} & s_{m3} & \cdots & s_{mn} \end{bmatrix} \times \begin{bmatrix} w_1 \\ w_2 \\ w_3 \\ \cdots \\ w_n \end{bmatrix} = \begin{bmatrix} w_1 s_{11} + w_2 s_{12} + w_3 s_{13} + \cdots + w_n s_{1n} \\ w_1 s_{21} + w_2 s_{22} + w_3 s_{23} + \cdots + w_n s_{2n} \\ \cdots \\ w_1 s_{m1} + w_2 s_{m2} + w_3 s_{m3} + \cdots + w_n s_{mn} \end{bmatrix}$$

The option has the highest score overall, is the best option to choose. There are some sofwares that are developed for application of Analytic Hierarchy Process, to make easier use.

Application

In this paper, AHP will be used for determining the passenger guidance system of a new building between 3 alternative systems. Elevator system will be assumed to have 4 cabins and 20 stops. Stops would be numbered as 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19. Elevator system would be at the 2.5 meters per second and car capacity at 1200 kg. In the European standards a passenger would be calculated as 75 kg so the passenger capacity of an elavtor cabin would be 16 persons. 8 criteria are determined for the decision, by the decision maker:

1) Elevator Guidance in the lobby: This criterion enables the passengers that make call for elevator in the lobby to see which cabin is coming for them.

2) Calling for the elevator by using card: Apart from the standard passengers, in the necessary times,

by using card elevator could be called.

3) Having an Elevator to floor option: In an emergency situation, pre-determined cabins could be guided to the floor that the elevator called.

4) Energy Saving Mode: At the low-traffic times, some of the cabins could stand in the parking mode for saving energy.

5) Giving a Call From Turnstile: This criteria enables the passengers that are using the elevator daily, to call the elevator when the user makes an entrance to the building automatically and save time.

6) Generating a Traffic Scenario: Elevator system should enable to direct the elevators, according to traffic, only upwards or downwards.

7) Being Trackable: This criteria eables to get report from the floors call buttons, and enables to analyze the traffic.

8) Having an Encodable Option: It is the option that gives the managers to encode some floors. For example, only authorized persons could enter the 15th floor and managers could write a special code for make the elevator go to the 15th floor.

The purpose is choosing the best option between 3 options according to these 8 criteria.

Elevator System Options are:

- 1) Advanced Conventional call system with card reader support
- 2) Full Configured Elevator Passenger Dispatching System
- 3) Lobby Supported Elevator Passenger Dispatching System

First of all weights of the criteria are determined by using an MS Excel Spreadsheet developed by Klaus D. Goepel. Pairwised comparisons can be seen in Figure 3.

		Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Criterion 6	Criterion 7	Criterion 8
Criterion 1	1	1	1/5	6	1	2	4	1/2	3
Criterion 2	2	5	1	8	2	2	7	1	6
Criterion 3	3	1/6	1/8	1	1/9	1/9	1/4	1/5	1/5
Criterion 4	4	1	1/2	9	1	2	2	1/2	3
Criterion 5	5	1/2	1/2	9	1/2	1	5	1/2	1
Criterion 6	6	1/4	1/7	4	1/2	1/5	1	1/2	1/4
Criterion 7	7	2	1	5	2	2	2	1	2
Criterion 8	8	1/3	1/6	5	1/3	1	4	1/2	1

Figure 3 Pairwise Comparison

According to the comparisons, calculated weights can be seen in Table 3.

Table 3 Weights of the Criteria

Criterion	Weight
Elevator Guidance in the lobby	13,3%
Calling for the elevator by using card	29,4%
Having Elevator to Floor option	1,9%
Energy Saving Mode	14,0%
Calling From Turnstile	10,9%
Generating a Traffic Scenario	4,5%
Being Trackable	18,0%
Having an Encodable Option	7,9%
Total	100%
Consistency Ratio	8,1%

It can be seen that, consistency ratio is 0,081 which is below 0,01 which shows that the comparisons of the decision maker is consistent. Also it can be seen that for the decision maker, “Calling for the elevator by using card” criterion is the most important criterion with

29,4% weight and “Having Elevator to Floor Option” criterion is the least important criterion with 1,9% weight.

After this step, alternatives are compared by pairs for each criterion. And overall values of the alternatives can be seen in Table 4.

Table 4 Values of Alternatives

Criteria	Alternatives			Weight of Criterion
	Alternative 1	Alternative 2	Alternative 3	
Elevator Guidance in the lobby	0,443	0,443	0,114	0,133
Calling for the elevator by using card	0,429	0,429	0,143	0,294
Having Elevator to Floor option	0,200	0,260	0,106	0,019
Energy Saving Mode	0,633	0,260	0,106	0,140
Calling From Turnstile	0,388	0,388	0,224	0,109
Generating a Traffic Scenario	0,229	0,563	0,280	0,045
Being Trackable	0,098	0,532	0,370	0,180
Having an Encodable Option	0,388	0,388	0,224	0,079
Overall Values of The Alternatives	0,378	0,420	0,195	

Based on the calculation, Alternative 2 which is Full Configured Elevator Passenger Dispatching System is the best option for the decision maker.

Conclusion

With the improvements on the building sector, buildings are becoming higher. One of the higher buildings’ basic needs is, high-speed elevator systems. Elevator systems will be more improved and changed. These two sectors are connected with the improvements on each other.

With this paper, a model has been prepared for making selection between 3 elevator systems for which one is better to use according to the 8 criterias. As a result, it has been shown that Full Configured Elevator Passenger Dispatching System is better than the other alternatives based on the 8 criterias that determined by the decision maker.

Also, it has been proved that, Analytic Hierarchy Process can be used for making decision about the elevator passenger guidance system.

In the future, with the improvements on the elevator sector and building sector, new criteria would be developed and introduced, but by using the same model, it would be still possible to make a rational decision. Also, AHP can be used in different perspectives of the elevator sector, such as choosing the supplier of the elevator systems, raw material supplier etc.

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