International Conference on Leadership, Technology, and Innovation Management

Innovative Green Technology in Turkey: Electric Vehicles’ Future and Forecasting Market Share

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Abstract

The demand for oil is ever increasing due to the adaptation of developing countries to the global economy; as a result, market prices are constantly fluctuating because of the basic economic law of demand. In 2007, oil prices in the market reached approximately 150 USD per barrel. Subsequently, with the global financial crises, the price dropped to approximately 40 USD per barrel. The volatility in the oil and energy costs forces governments and industries to seek new solutions. Price volatility is not the only reason to transform markets to green technologies. Other motives include the negative impact on the environment and the consequent social movements to protect nature. The environmental issues and consumer sensitivity to these issues have impact on corporations’ production processes. Green technologies appear to be a major future tendency. Corporations – especially the MNCs (Multinational Corporations) – invest in innovative technologies and R&D (Research and Development), which is already greatly focused on green technologies. There are many environmental issues modern societies have to deal with, such as climate change, global warming, industrial waste, and heavy air pollution. In order to control and reduce the effects of these on the environment, one of the most significant change factors that need to be considered is green and renewable energy. Electric vehicles (EVs) emerge with strong potential to remove a substantial part of these effects by introducing green energy. Furthermore, its technology can contribute significantly to global innovation. Along with developed countries, Turkey, (as a developing country) did take a leading role in adopting this new innovative green technology and intends to become the main manufacturer of the EVs for Europe and global markets. In this paper, EV’s expected consumer demand, the market share, and the contribution to the foreign trade volume of Turkey for the near future are studied.

Keywords: Innovation, Green Technologies, Electric Vehicle, Electric Vehicles Potential Demand in Turkey

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Electronic copy available at: https://ssrn.com/abstract=3340337
1. Introduction

The world has become a global village, as the popular saying goes, and the expansion of globalization is an irreversible phenomenon. One of the most important consequences of globalization on the world economy is intense competition in international and domestic markets. Today, intense competition in international markets works in favor of consumers by increasing the favorable aspects of trade, such as cheaper prices of tangible and intangible goods. Consequently, corporations face difficulties associated with this competition, such as operating in markets with standards in product quality, production technology, technological developments, and marketing, to name a few. Specifically, corporations that aim to expand their businesses in global markets are forced to rely on more efficient and less costly means of production than domestic manufacturers. Therefore, the result is a more intense competitive atmosphere for international corporations than for domestic corporations [1].

Today, there is another challenge companies—especially multinationals—must face, and that is the environmental repercussions caused by manufacturing. Current studies forecast that under a laissez-faire system, Greenhouse Gas Emissions (GHG) would rise by 45% by 2030. As a result, there is an expected rise in the global average temperature of up to 6%. What this spells out for the economy is global GDP losses equivalent to 5–10%, and more than 10% losses in the GDP of poor countries, rendering them to be at the greatest loss [2].

Consumers' predilection for green technologies is increasing because of the negative climate changes caused mostly by MNCs especially in the last decades. The corporations are considering eco-efficiency and green alternatives as a major source of strategic change and planning [3]. Wider ranges of industries—from agriculture to automotive—have started to invest in these areas. Globally, fuels derived from oil power constitute more than 90% of the transportation sector. But this is not the case with diesel and oil consumption since these energy sources are linked to issues such as the lack of security in oil supplies, oil costs, and GHG [4], [5]. In addition, concerns about climate change and energy security also stimulated this demand (for green technologies) and provoked a renewed interest in EVs lately [6]. There are many examples in the recent past of failed new technologies in the market such as laser disks and satellite phones. It would not be wrong to assume the EV, which appeared in the market first time around 1890, might join this list. The first EV was “La Jamais Contente;” it was capable of 100 km/h [7]. Since then, there has been significant development made. They reappeared in the market from time to time and occasionally, become one of the most popular matters of discussion, especially during high volatility in oil prices. However, EVs have never been able to dominate the market. In fact, EVs still receive little interest and low demand from the consumers: of 3.8 million new cars were registered in Germany in 2009, only 162 of them were EVs [8]. Despite these circumstances, the EV is one of the leading elements of green technology. Although it has remained a matter of discussion for 120 years, the EV is still very new in global markets and has many disadvantages such as: limited cruising range, lack of charging stations, and a longer recharging time requirement for the battery compared to the internal combustion engine (ICE). On the other hand, their most significant advantage includes low cost energy consumption and lower carbon dioxide emissions. The United States Department of Energy estimated that a typical EV can run for 43 miles on a dollar's worth of electricity.

Many countries in the world, including developed and developing ones, have started to implement new policies for green technologies. The sustainable innovations could play an important role for the economic and technological development of transportation [9]. For example, in the United States, the Obama administration has set a goal of one million plug-in vehicles on the road by 2015 and has introduced laws and policies supporting this goal [6]. Turkey is a developing country whose government has tried to implement similar policies across the country as well. In 2011, the government passed a regulation for the registration of EVs. Additionally, some car manufacturers in
Turkey is planning to introduce new EV models to the domestic market in 2012. Turkey’s Ministry of Industry and Trade has been studying the trend towards electric and hybrid-powered vehicles and aims to make the country a leading EV manufacturer. Incentives will be granted by the government for EV manufacturers and investments will be made in R&D[10]. Charging stations will be introduced, while agreements and special arrangements will be made with electric distributors and oil stations.

2. Literature Review And Hypotheses

2.1. Green Technology and Electric Vehicles

The term ‘green technology’ has become very popular in the last decade. The motive behind it was the rising public awareness of pressing environmental issues. Green technology is characterized by the preservation of the environment, and supporting renewable products and energy usage [11]. ‘Green’ was included simply because it is a color associated with the foliage of nature. Specifically, ‘green technology’ is used to describe energy production such as solar energy and wind energy. Green has also come to mean “renewable.” Renewable energy’s main source is the sun, which provides unlimited energy without any harm to nature. The question of just how ‘green’ green technology really is often raised. The fact of the matter is that it is practically harmless to nature. It reduces air pollution by supporting consumer use of ‘greener’ alternatives such as the EVs. Consequently, the demand for nuclear plants will be replaced increasingly by that of electricity. Another question that arises is: “Is it possible to completely recycle a vehicle’s whole parts, specifically its battery?” The answer is that it is not; unfortunately, there is no technology which does not harm nature even a little. Corporations’ interest in green technologies is based on several factors. First, there is government focus on environmental issues and incentives for green technology usage. Second is consumer demand and preference for green technology products. Therefore, it is expected that consumer preference in the near future will be products of green technology. One such product - the EV - has a very simple structure. The vehicle consists of a battery that provides energy for an electric motor that drives the wheels, and a controller which regulates energy flow to the motor [12]. Furthermore, the EV design is not limited to cars: it can be implanted in things such as electric trains and elevators.

2.2. Innovation and Its Impact on Economic Growth

It is a well-known fact that unlike domestic competitors, international companies face extra costs, including, but not limited to, taxation, transportation costs, marketing, customs, as well as cultural and social differences which usually work in favor of domestic companies[1]. As a result, in order to maximize efficiency in global markets, MNCs must invest in manufacturing technologies and innovation as well. The consumer’s increasing sensitivity to environmental issues forces corporations to focus on advancement of green technologies. MNCs particularly need this in order to compete in the global market – otherwise they will be forced to withdraw from the market by competitors after relatively shorter period of time[13].

The modern theories of innovation and economic growth were inspired by Schumpeter’s works in early 20th century[14]. Schumpeter formulated innovation in all kinds of profit-making motives and activities based on technological advances in all thinking and things[15], [16]. According to Fisher, innovation is one or all parts new thinking: new ways of doing things to produce and test related economic and social activities[17]. Schumpeter’s work (1942) predicted that the innovative activities of the entrepreneurs feed a ‘creative destruction’ process. Economic growth is a process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, and incessantly creating a new one[15]. The corporations that disregard innovation during production process, transportation, etc. will be eliminated from markets and
becomemnants of the past. Theory states that thenaturalincreaseofentrepreneurswillaccelerateeconomicgrowth. The recent theoretical studies done by Solow(1956)and Romer(1986), and the empiricalaccountsbyMansfield(1972)andNadiri(1993) related technological innovation to economicgrowth. These theories have been well established in economic literature[16,19,20,21,22]. A large body of empirical studies focused on technological progress and innovation of firms. These studies have established that the level of the technological innovation of a company contributed to its economic performance and increasing market share[16]. Nadiri (1993) applied the Cobb-Douglas production function and related innovation to final output and productivity[22]. In the long-run, growth, output, and a firm’s performance depend on the growth rate of inventions[16].

Aconsiderable number of studies on green technologies with regard to corporations’ implemented strategies started in late 1980s. Most of these studies discussed corporations’ management and shareholders as a priority over environmental issues. Today, however, their concerns are now focused on expected changes in environmental regulation requirements in the near future and consumers demand changes[3]. Therefore, corporations mainly focus on how they can make these changes without negatively affecting profitability. This is an understandable concept regarding actors in profit motivated free-market economies. The growing public awareness of environmental issues is inevitable. Bower and Christensen (1995) concluded that when first entering the market, the new disruptive technologies usually do not outperform the current technology on established performance parameters, but generate breakthrough performance on new value parameters[23]. Moore’s (1991) study pointed out that the innovative entrance in the marketstresses the importance of building specific dynamics for identifications to the consumers for adaptation of the product to market, and dominantly replacement of the old technology with the new, innovative one[7],[24]. It is predicted that environmental sustainability will create an enormous global market for innovative sustainability technologies. It will be a major market surpassing other key sectors such as that of the automotive or machinery. Forecasts of the global market show a 5-8% average annual growth rate of demand for technology in the fields of energy supply, energy efficiency, transportation, and water over the next ten years[9]. The focus and implementation of green technologies will prove to be economically beneficial for developing countries.

2.3. Development of Hypotheses

The ongoing shift towards a new renewable energy source has led many countries to change their trade policies. The new technology used in the EV has spread in many countries. European Union (EU) countries adopted the technology, and promoted research on the technical subjects. Turkey has signed an agreement with Renault to be the main base for manufacturing EV. Estimated market demands are forecasted to be about 30,000 EVs by end of the 2015. As a result, the potential of this new innovative opportunity raised new questions. In this paper, we focused on three main points:

H1: Expected market share of EVs in Turkey will not dominate domestic market in the near future.

H2: EVs export contribution on Turkey’s trade deficit would not have high impact on near future.

3. Methodology

3.1. Research Goal
In this paper, we aim to study the forecast of consumer demand for electric vehicles in Turkey and their dominance in the Turkish automotive industry, as well as the impact of the import of electric vehicles on Turkey’s trade deficit.

3.2. Sample and Data Collection

We have benefited from the studies focusing on selected EU countries, such as Germany and England, regarding these issues due to demographic similarities to Turkey in the markets. Furthermore, when forecasting the consumer demand, current official records regarding the infrastructures of the EV, (i.e., service providers, models, and charge types,) have been employed. In this paper, we aim to study the forecast of consumer demand for EVs in Turkey, the feasibility of manufacturing them there, and the impact of EV export on the country’s foreign trade volume. When investigating the forecasted costs and cost comparison with the current conventional vehicle technology, data from the websites of Turkstat, TEDAS and Turkish Treasury Secretary were utilized. Also, since the EV is an innovative technology and very new to the market, as well as the lack of data, we have made several assumptions.

4. Analyses and Results

H1: Expected market share of EVs in Turkey will not dominate the domestic market in the near future.

EVs – the latest innovative technologies in the transportation sector – bring about a new shift in the automotive industry in terms of policies, economy, and energy usage [8]. For a new product, its function, cost, and performance will determine the consumer demand for it. Consumer demand’s predictive factors may include price, cruise range, performance, environmental impact, durability, and convenience criteria. As expected, in Turkey, total costs is the key factor to all types of consumers since government levies a very high tax rate (approx. 55% of the total price) on the automobiles. For commuters who use their cars on a daily basis, the biggest concern is the cruising range as confirmed by a survey conducted in Germany showed [8]. EVs come with a strong promise to increase the vehicles’ performance, reduce CO₂ emissions, and lower energy costs especially when taking into account the crude oil prices in Turkey.

EVs contribution, however, can only be understood when there is substantial consumer uptake of the vehicles. In terms of consumer convenience, the accessibility and reliability of recharging the battery is one of the most crucial issues. The nature of the technology allows providing a full charge of the car within 6-8 hours and this favors the overnight charging as the best option whereas the conventional vehicles do not have a serious refueling issue because of widespread gas stations[25].

One of the most common methods of understanding the consumer attitude towards an innovative automotive technology is by surveying the consumer after conducting a test drive. After collecting the data from a well-distributed sample and using the correlation method to evaluate the results, researchers observed the customer behavior towards the product with satisfactory results. The general customer consensus is that EVs have environmental benefits because they emit less amount of carbon dioxide than conventional vehicles; this makes them a plausible alternative. Furthermore, contrary to expectations, recharging the car overnight was not perceived as a downside of EVs, but rather a fairly acceptable feature. Charging the EVs while it is parked at work or overnight at home are the most convenient methods of recharging. The availability of various recharging spots or stations such as supermarkets, roadsides, and petrol stations are perceived as very good means of ‘refueling’ [26]. Other than functioning as a less polluting renewable energy, the EV offers another very innovative feature: very silent cruising.
This is a surprising element given the EV’s higher performance over conventional vehicles. Another advantage that appeals to most customers is the smooth cruising. Based on these ratings, it can be concluded that electric cars will have a significant customer demand. Densely populated cities such as Istanbul, Ankara, Izmir, and Bursa would especially benefit from EV technology since it would reduce the air and noise pollution to satisfactory levels. Also in these cities, EV technology would be fairly easily implemented due to high number of potential charging spots. (Examples of these locations include malls, plazas, and parks.)

As a starting point, one of the current service providers in Turkey, Esarj, has installed recharging stations in several locations near big cities. Considering the time required to get a fully charged battery, the company suggested the utilization of cell phones and GPS systems to make reservations for recharging. Although current EV technology law is not in effect, many service providers are ready to embrace the new technology. EV manufacturer, Renault, announced the current five stations in Istanbul will be increased to twenty by the end of 2011 [27]. The worldwide service provider for EV, Better Places Inc., announced there will be 100 stations to be installed throughout Europe by the end of 2011. This will increase EV’s marketability and will help it spread rapidly [28].

Current data indicate that EV technologies have great advantages over conventional vehicles, and an expected increase in consumer demand. Lower costs, less noise, comfort, and more environmentally friendly features give EVs a head start before its actual penetration in the market. The similarity of the demographics between EU countries and Turkey allows us to benefit from the surveys conducted in EU countries.

Throughout the world, 90% of the transportation sector is driven by oil-derived fuel. Nevertheless, oil based fuel consumption is considered problematic due to its costs, environmental issues (e.g., GHG,) and the lack of resources. EVs are the hopeful alternative to conventional vehicles because in addition to their high performance, they are less costly and more environmentally safer.

The current taxation on conventional vehicles is approximately 55% on a brand new vehicle in Turkey. According to a cabinet decision, the planned taxation on the EVs would be applied based on three categories. For vehicles under 85 kV motor power, the tax will be 3%; for the vehicles between 85-120 kV motor power, 7%, and vehicles over 120 kV motor power will be taxed 15%. The lower taxes to foster EV growth in the Turkish automotive industry leads to a 30% price drop[25]. In terms of fuel costs, the EV has a substantial advantage over conventional vehicles. In 2011, Turkey witnessed oil based conventional vehicles costs of approximately 30 TL in 100 km cruise range, and the diesel based conventional vehicle costs of approximately 20 TL. In comparison, the EVs cost 3 TL for a nightly charge, and 4 TL for a daytime charge based on the current electricity prices (Efacec, 2011). Assuming a conventional vehicle travels 15000 km, fuel costs total 3300 TL even for diesel-run conventional vehicles. EVs, on the other hand, will spend only 600 TL [25].

Renault, (the current EV provider,) announced that they will introduce the domestic automotive market with 3 EV models: the Fluence, Kangoo, and Twizy. These will be introduced consecutively, and carry a featured cruising range of 170-185km. The determined price for the most promising model, Fluence, in EU countries is 21300 EUR. Considering the battery rent of 79 EUR per month, this model is expected to compete with first use automobiles [25]. Moreover, the reduced 3% sales tax will also add to the competitive edge over the conventional vehicles in the domestic market.

Despite the advantages of EV technology stated above, EVs are not expected to dominate the automotive market in the near future. The current downsides of this technology such as the low cruise range, lack of recharging stations, difficult implementation in apartment-block residential establishments, and charge time hinder the dominance of the EVs over conventional cars. It can be easily inferred from the low figures in initial production plans that manufacturers do not expect the EVs to
drastically substitute conventional vehicles. However, by eliminating the current constraints of the new EV technology by, for example, decreasing the recharge time, and increasing the battery capacity, cruising range, and availability of recharging stations throughout the country, the EV will presumably take a vital role in the automotive industry.

**H2: EVs export contribution on Turkey’s trade deficit would not have high impact on near future.**

One of the major problems in Turkey’s economy is its trade deficit. According to Turkish Treasury Secretary the trade deficit in 2010 was approximately 49 billion USD [29]. Over 50% of the trade deficit, (30 billion USD,) was caused by oil and oil derived products. The EV technology will reduce the dependency on foreign sources by lowering oil imports. Furthermore, it is possible to infer that even the first 50,000 EVs will reduce the impact of the oil and oil derived products by approximately 1 billion USD [25]. By 2015, it is forecasted that 30,000 EVs will be launched into domestic market. Also noteworthy is that the service provider, Efacec, announced that according to the Copenhagen Criteria, launching a single EV saves 8500 EUR in environmental investments[25].

Although theoretically it is viewed that the EV penetration might have a positive contribution in reducing the trade deficit,(for reasons mentioned,) we do not have sufficient data to make an accurate forecast. Nevertheless, since the automotive sector occupies the greatest segment of Turkey’s exports, a substantial increase in this export item would make a substantial contribution. Although the manufacturers’ production plans for the future (i.e. 30,000 EVs by end of the 2015) are relatively insignificant when compared to current production, EVs are expected to have a slightly positive change in the export figures. However, since the number of production units is very small, a significant change in country’s trade deficit is not expected.

5. Conclusion

In this paper, authors aimed to study the forecasted consumer demand for EVs in Turkey, whether or not they will be dominant in Turkish automotive market, and their export impact on Turkey’s foreign trade volume.

Current data and survey results indicate that EV technology has great advantages over conventional vehicles and that a high customer demand for it can be expected. Less costs, quieter motor, comfort, and environmental-friendly features give the EVs a head start before its actual penetration into market. The demographic similarity between selected EU countries and Turkey allows us to benefit from the surveys conducted in those countries. In this context, EVs are expected to have a high customer demand in the near future. Despite the advantages of EV technology, the current downsides of this technology such as low cruise range, lack of recharging stations, difficult implementation in apartment-block residential establishments, and charge time hinder the dominance of the EVs over conventional cars. Therefore, it can be inferred from manufacturers’ production plans that EVs are not expected to substantially dominate over conventional vehicles. Although theoretically, the EV penetration might have a positive contribution in reducing the trade deficit which is mostly caused by oil import,(by minimizing the foreign-source dependency and slightly increasing the automotive export,) authors do not have sufficient data to make an accurate forecast on impact of Turkey’s foreign trade volume. Although Turkey’s most important export item is the automobile and its subsectors, EV penetration in the market is not expected to substantially alter the foreign trade deficit upon very low demand in near future.
Acknowledgment

Authors would like to thank to Rubaa Saleh, Selim Demez and Mehmet Alptekin Kösem for their helpful comments and contribution to this paper.

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