# An analysis with a Meta- Synthesis approach on the development policy of Electric vehicles in Iran

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**ABSTRACT:**

The purpose of this research is to analyze the development policy of electric vehicles in Iran. Therefore, this research aims at a comprehensive analysis of the development of electric vehicles in Iran, considering that the review of previous research shows the lack of a comprehensive discussion and review in the policy field of the development of electric vehicles in Iran.

The research method in this study is a hybrid method. First, the studied factors were obtained by reviewing the research literature, and then the validity and reliability between them was determined through the opinion of 18 experts who formed the decision team and through the Kappa coefficient.

According to the results of the research, there is a close relationship between the factors of improving the economic situation, productivity, focus on a healthy environment, sustainable development, pragmatism, innovation and change, optimal strategy and policy, budget and livelihood, and comprehensiveness with the main category of the research, i.e. policy development of electric vehicles in Iran. It is based on the necessary strategies and policies and the implementation of appropriate policies, which leads to consequences such as: productivity, sustainable development, etc.

Environmental problems caused by the extensive use of fossil fuels prompted car manufacturers to change their approach towards optimizing the existing engines with the least cost and changes in order to achieve maximum efficiency, and on the other hand, the concern of endangering Due to their limited resources and their non-renewability, their supply led the major consumers of oil and gas to search for alternative and renewable sources of energy.

## 1. Introduction

Previous studies have focused on industrial policies or only science and technology policies, but key decision makers have explicitly mentioned industrial policies and science and technology policies as two complementary pillars to achieve technological progress (Howell 2017; Zhi and Pearson, 2017). This synergy between conventional industrial policies and science and technology policies can be an important pillar in the rapid technological progress of the country (Mao et al., 2021).

In addition to supporting nascent industries to compete effectively, technology policies also update the industrial structure and help poor economies catch up with more robust economies (Liu et al., 2020). But the main problem is that government organizations that develop industrial policies face information constraints and incentive problems (Tian, 2020). Emerging industry policies should create a new operational framework for industrial policy in which government, market and research and development can work together in a political system for the innovative development of emerging industry. Emerging industries always face fundamental challenges and must be protected against the competitive advantages of more mature industries (Hemphill, 2020). Therefore, support for emerging industries through industrial policies is widely carried out around the world. Therefore, industrial policies should focus on expanding industrial capacities in the future as well as supporting the development of technologies in order to create a comparative advantage and increase competitiveness in emerging industries (Liu et al., 2020). Therefore, one of the goals of promoting technologies in strategic emerging industries is to transform these industries into a leading sector in the national economy (Liu et al., 2020). Thus, it is necessary to develop strong policies to promote technological innovations in emerging industries (Dang and Liu , 2020; Liu et al., 2020). In the vision of 2050, on the one hand, due to mass production, technological innovations, as well as due to the effects of the learning curve, the production costs of hybrid electric vehicles and fuel cell vehicles will decrease significantly, and on the other hand, due to The increase in fuel prices and the imposition of $CO_2$-based taxes will dramatically increase energy costs (Ajanovic, 2015).

Therefore, in order to limit the use of fossil fuels the world, today is moving in the transportation sector by changing the paradigm towards the use of renewable, sustainable and affordable energy sources such as electric mobility. Investing in new energy vehicle(NEVs) technology provides an opportunity to keep pace with the global automotive industry. Compared to the conventional car industry, this emerging strategic industry offers promising positive options, so by formulating development policies in the field of electric cars, it is possible to help the country's economic development and achieve rapid and significant progress (Liu et al., 2020).

Electric vehicles are an emerging, strategic and promising automotive technology, and since today, the world is facing serious environmental threats, including the permanent ever-increasing global warming and the depletion of the ozone layer, dependence on the use of limited resources of non-renewable fossil fuels and its reduction for the transportation industry and the power generation sector, in terms of the emission of greenhouse gases over time, creates serious concerns, the phenomenon of global warming has a negative impact on both the environment and the quality of life. (Khan et al., 2020).

Changing the paradigm towards electric cars is a step towards this goal (Matulka, 2014). Electric mobility is both environmentally compatible and economically favorable compared to conventional mobility (Faria et al., 2012). Electric mobility brings sustainable transportation, of course, electric mobility should be adopted along with policy recommendations on how to adapt it to achieve a sustainable mode of transportation (Srikanth, 2018; Khan et al., 2020). Electric cars are attractive due to positive economic benefits, reduction of greenhouse gas emissions, improvement of citizens' well-being and improved security. Positive economic benefits are economic growth and recovery, job creation and increased competition in the industry. Improvements in citizen well-being were attributed to reductions in air and noise pollution and overall health benefits. Security was recognized as a political concern (dependence on imported oil), an economic one (the cost of importing oil) and an important issue (related to the concept of security of energy supply). According to the mentioned cases, the development of electric vehicles in the country is not in a favorable situation. The necessity of compiling an effective analysis is necessary for the development of electric vehicles in Iran, but the review of past studies shows that there is no structured study in this regard. Therefore, according to the importance of policy making in this sector due to its role in the development of the country and the weakness of existing studies in this field, the present study seeks an effective analysis for the policy making of the development of electric vehicles in Iran.

## 2.Theoretical foundations and research background

### 2-1. Sustainable Development

Sustainable development includes the three main areas of economic, environmental and social development. A sustainable economic system is able to produce goods or services that reduce the government's external debt and prevent imbalance between different economic sectors, and at the same time Now it protects agricultural and industrial products from any damage. According to the environmental perspective, organizations and the environment must work together as a team.

Organizations play an important role in exploring environmental issues and contributing to technological solutions to solve them, while the environment plays an important role in creating job opportunities and employment (Yacob et al., 2019).

A sustainable economic system is able to produce goods or services that reduce the government's foreign debt and prevent imbalances between different economic sectors, while protecting agricultural and industrial production from any damage (Sohrab et al., 2016). Another point of view is the environmental point of view. In general, companies and the environment are constantly placed on two opposing fronts, so that all business activities lead to environmental risks and concerns and are perceived as a threat to business expansion. However, this conflict gradually decreased with the development and implementation of sustainable green practices in recent years. Organizations and the environment must work together as a team. Organizations play an important role in exploring environmental issues and contributing to technological solutions to solve them, while the environment plays an important role in creating job opportunities and employment (Yacob et al., 2019).

### 2-2. Smart Urban Mobility

Smart urban mobility is part of a smart city, which is defined as a combination of sustainability and innovation. As an innovative technology, electric vehicles lead to sustainable urban mobility. Wang et al.'s research (2019) showed that road priority (access to bus lanes and High occupancy vehicle), charging density (the number of chargers corrected for population), fuel price are positive and statistically significant for predicting electric vehicle market share. Unexpectedly, road preference is the most important factor while direct subsidy is not the reason for the large difference in EVs between different countries. Although tax exemptions, fee exemptions, reduction/exemption of electricity supply and national per capita income have a positive and significant relationship with the market share of electric vehicles, based on the results obtained from this research, the first duty of governments to promote electric vehicles It will provide road priority for electric vehicles and expand the scale of charging infrastructure. Governments are not good at controlling fuel prices, but they can raise fuel taxes. In addition, tax exemptions, fee exemptions (such as parking, tolls and ferries) and reductions in electricity supply for electric vehicles should be maintained if direct subsidies are abolished. It is worth noting that for the main market of electric vehicles, it is better for governments to consider financial incentives to cultivate the market (Wang et al., 2019).

## 2-3. Transformation of the transportation sector

The transformation of the transportation sector is a big challenge in terms of reducing the domestic demand for fossil fuels (and consequently its imports), increasing energy security, curbing local air pollution and reducing greenhouse gas emissions in line with the goals of sustainable development and the Paris Agreement 2015 (Zimm, 2021).

In 2019, global transport emissions increased by just under 5% (compared to the previous annual increase of 1.9% since 2000). This increase can be attributed to efficiency improvements, electrification and greater use of biofuels (International Energy Agency, 2020). The transition to sustainable development of the transport sector, although challenging, is vital. In this sector, decarbonization should take place quickly to remain in the Paris agreement to maintain global temperature (Rogelj et al., 2018; Zimm, 2021).

Electric vehicles, which have been widely promoted over the past decade, are now dominating new personal transportation options. For example, favorable electric vehicle policies in Norway have resulted in the highest share of electric vehicles in the world at over 9% in 2019 (Government of Norway, 2019). The evolution of electric personal motorized transport vehicles is therefore an outstanding example of transformative development that brings technology and policy interventions into the wider emerging transport system. Electric vehicles have been around for a long time and require other supporting infrastructure than internal combustion engine vehicles. Electrification of energy and transportation systems based on renewable energy will significantly reduce overall energy demand (Global Energy Assessment, 2012; Zimm, 2021).

## 2-4. Research background

Wang et al., (2017) investigated the effectiveness of several potential policy incentives in China by conducting a discrete-choice experiment involving 247 respondents. Da Silva et al. (2018) found that gasoline prices and financial incentives have the greatest influence on the payback period for the purchase of battery electric vehicles in Brazil.

Mersky et al. (2016) investigated the effects of demographics and policy incentives in Norway on EV sales and found that the number of public charging stations had the greatest effect. A preference survey reported by Langbroek et al. (2016) in Sweden changed free parking or access to bus lines as alternatives to expensive subsidies. Studies conducted by (Lieven, 2015) in 20 countries from 5 continents show that installing a charging network on free-ways is absolutely necessary. But these surveys focused on incentive policies without considering other socio-economic factors. Sierzchula et al., (2014) analyzed the financial incentives and other factors

related to the promotion of electric vehicles. However, their focus was on financial incentives and traffic regulation policies were ignored.

As previously mentioned, financial incentives will be abolished in the future, then traffic regulation policy may become an important driving force for the development of electric vehicles. Wang et al. (2019) by examining the national electric vehicle market share in 2015, concluded that the density of chargers, fuel price and road priority are significant positive factors that are correlated to the electric vehicle market share of a country. Nevertheless, financial incentives are no longer the reason for the huge differences in EV promotion among countries. Zhang et al. (2018) found that prioritizing the development of urban public transportation can effectively promote sustainable urban development. Barton and Schütte (2017) also confirmed this hypothesis using a comparative qualitative analysis among Norway, California, Germany, New Zealand, Australia and France. (Wang et al., 2019).

Amelia Mutter (2021) examined the interplay between future perspectives and de-fossil fuel policy on Swedish roads, results from research on the energy efficiency of electric vehicles as an important step to reduce dependence on fossil fuels by reducing the overall energy demand in the transport sector And the quote also emphasizes electric vehicles for a clean and quiet urban environment, where replacing combustion engines with clean and quiet alternatives can have the greatest impact. Feroz Khan.et al. (2020) in Pakistan, by researching the move towards hybrid technology, came to the conclusion that the government should create the necessary relaxation in terms of customs duties and encourage auto manufacturers to set up local industries of such cars in the country.

## 3. Methodology

### 3-1. Meta-synthesis method

The method of this research is qualitative which was done using meta-synthesis. Meta-synthesis is one of the types of meta-study methods. In connection with the meta-study method, Bench & Die conclude that the meta-study consists of four main parts as follows:

**Meta-theory**: Analysis of past research theories;

**Meta- Method**: Methodological analysis of past researches;

**Meta-synthesis**: Qualitative analysis of past research findings;

**Meta-analysis**: Quantitative analysis of past research findings (Salehnejad et al., 2017).

Meta-synthesis is a type of qualitative study that examines the information and findings extracted from other qualitative studies with a related and similar topic. As a result, the intended sample for meta-synthesis consists of selected qualitative studies based on their relationship with

the research question. Meta-synthesis, an integrated qualitative literature review is not the desired topic. Also, the analysis of secondary data and primary data is not one of the selected studies, but the analysis of the findings of these studies. In other words, meta-synthesis is the combination of the interpretations of the main data interpretations of the selected studies. Meta-synthesis focuses on qualitative studies that do not necessarily include extensive theoretical foundations and instead of providing a comprehensive summary of findings, creates an interpretive synthesis of findings. By providing a systematic approach for researchers through the combination of different qualitative researches, meta-synthesis explores new and basic topics and metaphors, and with this method, it improves the current knowledge and creates a comprehensive and broad view of the issues. Meta-synthesis requires that the researcher conduct a detailed, in-depth review and combine the findings of related qualitative research. By examining the findings of the main research sources, researchers reveal and create words that show a more comprehensive representation of the phenomenon under investigation. Similar to the systematic approach, the use of meta- compilation achieves a result that is greater than the sum of its parts (Sohrabi et al., 2010). The steps of this research are based on the seven-step method of Sandelowski and Barroso (2007) in meta- synthesis, which are shown in the figure below:
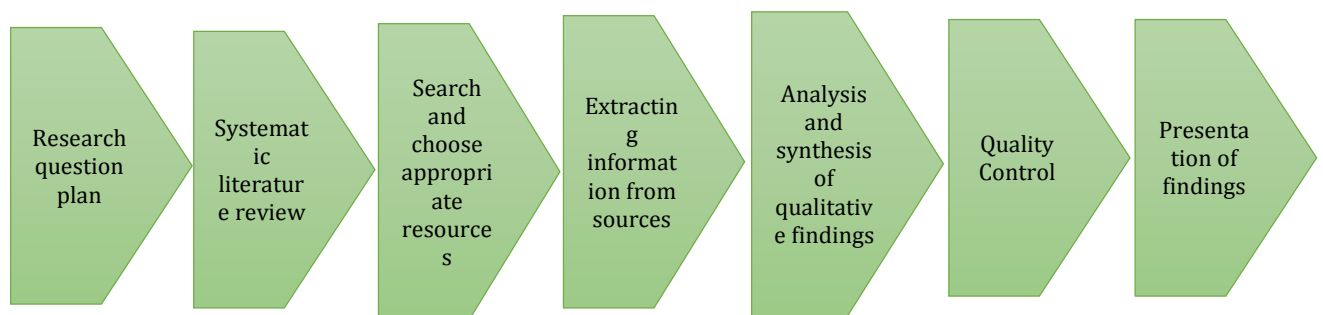


*Figure 1.* **Meta-synthesis steps based on the seven-step method (Sandelowski and Barroso, 2007)**

In this research, the meta- synthesis method and the approach of Barroso and Sandelowski (2007) have been used to review the research literature.

The first stage includes creating the research objective and collecting articles from databases. This step allows us to identify the literature related to learning from health policy. We included both theoretical and conceptual sources in our literature review process. The main goal of this research is to learn from the policy in line with health and health affairs, which is to discover possible ways of integrating learning-based solutions in academic research; In Figure 2, the revision model of the meta- synthesis process according to the approach of Barosi and Sandelowski is presented for this method of analysis.
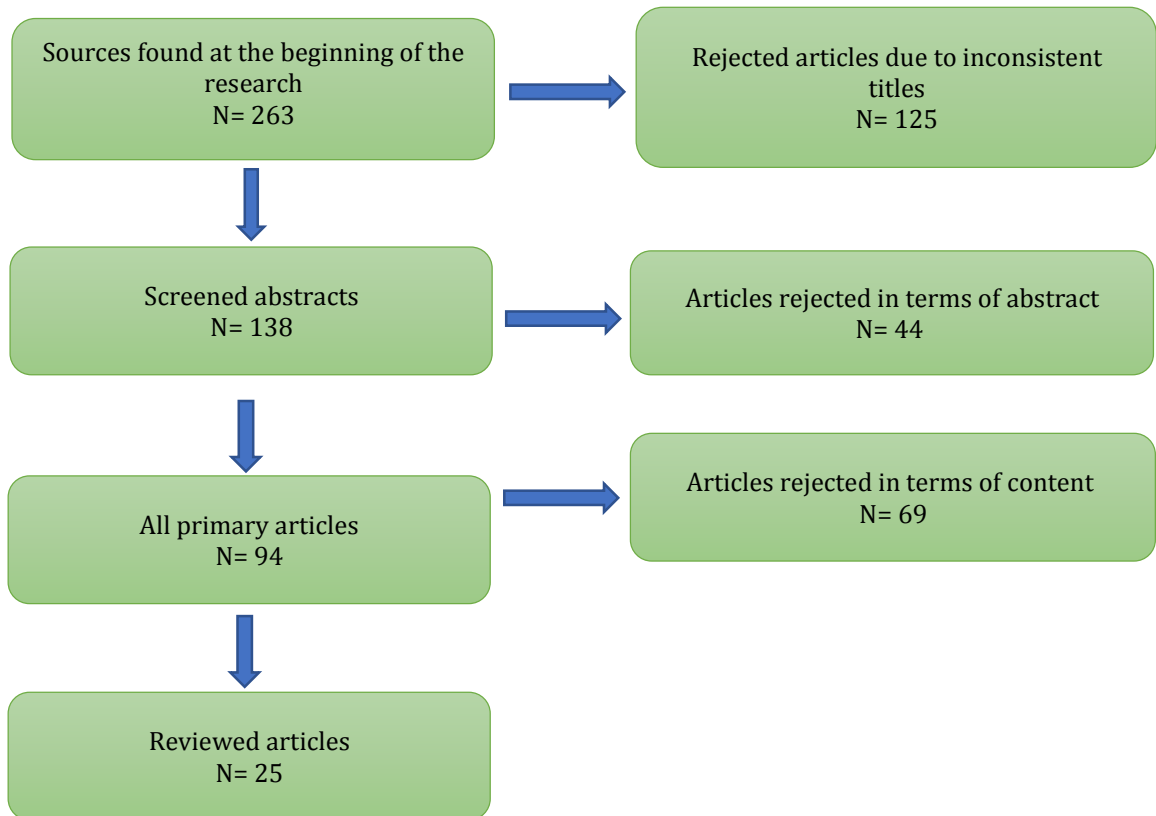
*Figure 2*. **Revision model of meta--synthesis process according to the approach of Barroso an  Sandelowski**

### 3-2. First step: Setting research questions

The first step of meta- synthesis is setting research questions. The first question to start with was: "What is the use of electric vehicle development?" You can also ask questions with the theme of what application is used in the development of electric vehicle? And what are the main indicators of the development of electric vehicle? What are the indicators of the studied category? What are the indicators of the studied category related to each other? Table 1 shows the basic criteria for searching for sources based on the research questions.

*Table 1*. **Basic search criteria**

| Indicators | Acceptance criteria | Non-acceptance criteria |
|---|---|---|
| Subject of study | Investigating the application of electric vehicle development | Things other than the application of electric vehicle development |
| Research time | Studies published since 2000 | Research before 2000 |
| The language of research | English | Non english |
| Geographic Area | All countries | -------------------- |
| Study method | Quantitative, qualitative and experimental methods | Review and library |
| The studied community | Countries using electric vehicle | Countries where electric vehicle are not Used |
| Type of Document | Published articles and reports | Invalid content |

### 3-3.*Step two: Systematic review of texts*

At this stage, the researcher systematically searched for articles published in foreign and domestic authoritative articles with the aim of determining valid, reliable and relevant documents in the appropriate time frame. First, relevant keywords were selected. Therefore, several keywords were used in the database, including the development of electric vehicles, environment, sustainable development. In Table 2, the investigated databases are shown, and in Table 3, the investigated keywords are stated.

*Table 2*. **Search databases for research resources**

| Row | Name of the base | Address |
|---|---|---|
| 1 | Google Scholar | Scholar.google.com |
| 2 | Wiley Publications | Wiley.com |
| 3 | Science Direct database | Sciencedirect.com |
| 4 | Scopus | Scopus.com |
| 5 | Research base of university researches | Iefpedia.com |

*Table 3*. **Keywords used in research**

| Row | Keywords |
|---|---|
| 1 | Electric vehicles |
| 2 | Sustainable Development |
| 3 | Smart urban mobility |
| 4 | Transformation of transportation |
| 5 | Strategic emerging industries |

### 3-4. Step three: Search and review related articles

After identifying the key words of the research, the collection of articles containing the key words was identified. Science Direct, Scopus, Wiley, and Google Scholar databases were used for the literature search process. These articles were screened based on things such as title, abstract, content and research method, and the final articles were extracted. The initial search resulted in the collection of 263 articles.Every study that is conducted must have acceptable validity, reliability and objectivity Qualitative study and systematic review are not exempt from this. In systematic review studies, a comprehensive search will lead to finding many related studies, but since all of these studies are not of sufficient quality, after reviewing the studies again and extracting the results of each of them, each study before entering into the combination with Appropriate tools are evaluated according to the defined criteria and only the ones with good quality are included in the analysis. In this research, a checklist was used that includes various criteria to evaluate the high, low, and average quality of each of the primary studies. The purpose of scoring each study is to increase the validity of the study with the appropriate tool of the checklist and to exclude low-quality studies from the synthesis process. At this stage, the first articles found were equal to 263 articles. Then articles with unrelated titles were removed, which was 125 articles. In the next step, articles with irrelevant abstracts were removed. At this stage, 44 articles were removed. In the third step of the third step, articles with unrelated content were removed, and in this step, 69 articles were removed and finally 25 articles were determined.

*Table 4*. Quality control output of articles

| No. | Author | Type of Document | Clarity of research objectives and methods | Clear statement of findings | Appropriate justification of the research result | Consistency between the guiding paradigms of the research project with the chosen methods | Total points |
|---|---|---|---|---|---|---|---|
| 1 | Liu et al. 2020 | Article | 1 | 1 | 4 | 3 | 9 |
| 2 | Tian 2020 | Article | 4 | 5 | 1 | 2 | 12 |
| 3 | Ajanovic 2015 | Article | 1 | 1 | 5 | 3 | 10 |
| 4 | Ortar & Ryghaug 2019 | Article | 3 | 4 | 2 | 5 | 14 |
| 5 | Pelegov & Pontes 2018 | Article | 3 | 3 | 4 | 3 | 13 |
| 6 | Li et al. 2019 | Article | 4 | 4 | 1 | 3 | 12 |
| 7 | Fraunhofer 2018 | Article | 3 | 4 | 4 | 5 | 16 |
| 8 | Pourvaziri et al. 2020 | Article | 4 | 5 | 5 | 5 | 19 |
| 9 | Doğu & Aras 2019 | Article | 1 | 1 | 2 | 1 | 5 |
| 10 | Morunova et al. 2018 | Article | 2 | 1 | 5 | 1 | 9 |

| No. | Author | Type of Document | Clarity of research objectives and methods | Clear statement of findings | Appropriate justification of the research result | Consistency between the guiding paradigms of the research project with the chosen methods | Total points |
|---|---|---|---|---|---|---|---|
| 11 | Wang et al. 2019 | Article | 3 | 5 | 3 | 1 | 12 |
| 12 | Saikawa 2010 | Article | 3 | 5 | 2 | 4 | 14 |
| 13 | Lopez-Carreiro & Monzon 2018 | Article | 2 | 2 | 3 | 3 | 10 |
| 14 | Rietmann & Lieven 2019 | Article | 2 | 1 | 5 | 2 | 10 |
| 15 | Zimm 2021 | Article | 2 | 2 | 3 | 3 | 10 |
| 16 | Schuitema & Bergstad 2018 | Article | 2 | 2 | 5 | 4 | 13 |
| 17 | Huang 2019 | Article | 2 | 1 | 3 | 1 | 7 |
| 18 | Münzel et al. 2019; Santos & Davies 2020 | Article | 1 | 2 | 2 | 3 | 8 |
| 19 | Zimm 2021 | Article | 4 | 2 | 5 | 1 | 12 |
| 20 | Bocken et al. 2019 | Article | 1 | 2 | 1 | 3 | 7 |
| 21 | Hardeman 2019; Rietmann & Lieven 2019 | Article | 1 | 2 | 4 | 4 | 11 |
| 22 | Tummers 2019 | Article | 2 | 4 | 1 | 5 | 12 |
| 23 | Howell 2017; Zhi and Pearson 2017 | Article | 1 | 1 | 4 | 3 | 9 |
| 24 | Sierzchula et al. 2014 | Article | 1 | 1 | 2 | 1 | 5 |
| 25 | Yacob et al. 2019 | Article | 3 | 4 | 2 | 5 | 14 |

### 3-5. Step four: extracting information from the articles

At this stage, the content of the articles was carefully studied and the basic indicators were extracted. Screening criteria were determined to identify articles related to the content analysis process. The publication limit of articles related to the development of electric vehicles was considered. At this stage, a review protocol proposed by Krippendorff (2013) was applied to analyze the suitability of the selected documents for content analysis. Documents published before 2013 were not selected for the content analysis process. Also, the citation score of all documents was checked to find the reliability of the findings presented through the literature review process. Applying these inclusion and exclusion criteria resulted in the selection of 23 documents that met all the requirements set by the review protocol.

**Table 5**. Articles extracted from databases

| No. | Author | Type of Document | Code |
|-----|--------|------------------|------|
| 1 | Liu et al. 2020 | Article | Fin01 |
| 2 | Tian 2020 | Article | Fin02 |
| 3 | Ajanovic 2015 | Article | Fin03 |
| 4 | Ortar & Ryghaug 2019 | Article | Fin04 |
| 5 | Pelegov & Pontes 2018 | Article | Fin05 |
| 6 | Li et al. 2019 | Article | Fin06 |
| 7 | Fraunhofer 2018 | Article | Fin07 |
| 8 | Pourvaziri et al. 2020 | Article | Fin08 |
| 9 | Doğu & Aras 2019 | Article | Fin09 |
| 10 | Morunova et al. 2018 | Article | Fin10 |
| 11 | Wang et al. 2019 | Article | Fin11 |
| 12 | Saikawa 2010 | Article | Fin12 |
| 13 | Lopez-Carreiro & Monzon 2018 | Article | Fin13 |
| 14 | Rietmann & Lieven 2019 | Article | Fin14 |
| 15 | Zimm 2021 | Article | Fin15 |
| 16 | Schuitema & Bergstad 2018 | Article | Fin16 |
| 17 | Huang 2019 | Article | Fin17 |
| 18 | Münzel et al. 2019;  Santos  & Davies 2020 | Article | Fin18 |
| 19 | Zimm 2021 | Article | Fin19 |
| 20 | Bocken et al. 2019 | Article | Fin20 |
| 21 | Hardeman 2019; Rietmann  & Lieven 2019 | Article | Fin21 |
| 22 | Tummers 2019 | Article | Fin22 |
| 23 | Howell 2017; Zhi and Pearson 2017 | Article | Fin23 |
| 24 | Sierzchula et al. 2014 | Article | Fin23 |
| 25 | Yacob et al. 2019 | Article | Fin23 |

### 3-6. Step five: analysis and synthesis of qualitative findings

To identify the main applications, first 63 sub-applications were identified and these sub-applications were placed in 17 main categories, and then these 17 applications were divided into 7 types of predictive, prescriptive, diagnostic, automation, tracking, and monitoring analytical applications according to their analysis type and have been placed as a warning.

*Table 6*. **Basic themes and open/descriptive codes from text studies**

| Row | Open/descriptive codes | Basic themes | Pundits |
|---|---|---|---|
| 1 | Policies promote industrial development by improving economic strength and enable countries to alignment or even surpass the economies of other countries. | Improving economic strength<br>Promotion of industrial development<br>Economic alignment<br>Overtaking competitors | Liu et al. 2020 |
| 2 | The main problem is that government agencies that formulate industrial policies face information constraints and motivational problems. | Information constraints<br>Motivational problems | Tian 2020 |
| 3 | Politicians of different countries have recognized electric vehicles as a promising technological alternative to fossil fuel vehicles in the fight against global warming and pollutants due to global commitments to reduce greenhouse gas emissions and good prospects. They have formulated and implemented a wide range of policies in the market. | Technological alternative<br>Development and implementation of policies | Ajanovic 2015 |
| 4 | Electric vehicles can improve the efficiency, affordability and sustainability of the transportation system. | Efficiency<br>Affordability<br>Improving the stability of the transportation system | Ortar & Ryghaug 2019 |
| 5 | These vehicles are seen as a symbol of the evolution towards sustainability and an environmentally friendly society. | Transformation towards sustainability<br>Environmentally friendly society | Pelegov & Pontes 2018 |
| 6 | Electric vehicles are popular among academics, automakers, and government agencies due to their environmental benefits and high energy efficiency. | Environmental benefits<br>High energy efficiency | Li et al. 2019 |
| 7 | Alarming levels of carbon dioxide emissions require urgent socio-ecological transformations in transportation systems. These levels require political, socio-economic and cultural changes, including significant reductions in passenger cars, | Urgent socio-ecological transformations<br>Political changes and... | Fraunhofer 2018 |

| Row | Open/descriptive codes | Basic themes | Pundits |
|---|---|---|---|
| | upgrades to public transport and related infrastructure, new mobility services and alternative employment schemes to prevent large-scale job losses. | | |
| 8 | The main reason for global environmental destruction, especially in industrialized countries, is the unsustainable pattern of production and consumption. | The unsustainable pattern of production and consumption | Pourvaziri et al. 2020 |
| 9 | A definition of sustainable development that is agreed upon by the majority includes the three main areas of economic, environmental and social development, and the characteristics of each of these areas are examined. | Sustainable development and sustainability | Doğu & Aras 2019 |
| 10 | The economic perspective is one of the dimensions of the sustainable development model. Sustainable development is one of the paths of economic development in the future of any country. | Economic development in the future ** sustainable development | Morunova et al. 2018 |
| 11 | In the main market of electric cars, it is better for governments to consider financial incentives to grow the market. | Financial incentives | Wang et al. 2019 |
| 12 | Dispersive policies have led to technological advances and reduced environmental impacts around the world, but more is needed. | More work | Saikawa 2010 |
| 13 | Smart urban mobility, motivated by long-term targets to mitigate climate change and reduce petroleum use, is needed as a combination of sustainability and innovation. | A combination of sustainability and innovation / Smart urban mobility | Lopez-Carreiro & Monzon 2018 |
| 14 | Electric vehicles rely on policy support to compete with internal combustion engine vehicles. | Policy support | Rietmann & Lieven 2019 |
| 15 | The transformation of the transportation sector is a major challenge in terms of reducing the domestic demand for fossil fuels (and therefore its imports), increasing energy security, curbing local air pollution and reducing greenhouse gas emissions in line | Major challenge / The transformation of transportation sector | Zimm 2021 |

| Row | Open/descriptive codes | Basic themes | Pundits |
|---|---|---|---|
| | with the goals of sustainable development and the Paris Agreement 2015. | | |
| 16 | It is very necessary for policymakers to pay attention to public support for the political feasibility of policy interventions. | | Schuitema & Bergstad 2018 |
| 17 | Much of the industrial policy and related reforms prevent the market from playing a decisive role, thus exacerbating the misallocation of resources. | Lack of market role<br>Improper policies**optimal policies<br>Misallocation of resources | Huang 2019 |
| 18 | At the beginning of the technology, the difference in the national promotion of electric vehicles can be attributed to the existing policy support, mainly financial incentives. | Political support<br>Financial incentives | Münzel et al. 2019; Santos & Davies 2020 |
| 19 | Some relate the adoption of technology to the conditions that guarantee its promotion. | Conditions guaranteeing promotion | Zimm 2021 |
| 20 | Reaching the highest levels of sustainability is possible when future research focuses on all aspects of models designed in this field. | Focus on all aspects | Bocken et al. 2019 |
| 21 | Current electric vehicles adoption rates are typically weak or low in countries with no policy intervention and higher in countries with strong policies. | Political intervention | Hardeman 2019; Rietmann & Lieven 2019 |
| 22 | Policy interventions can help change behavior. | Policy interventions<br>Behavior change | Tummers 2019 |
| 23 | Key decision makers have explicitly mentioned industrial policies and science and technology policies as two complementary pillars to achieve technological progress. | Industrial policies and science and technology policies | Howell 2017; Zhi and Pearson 2017 |
| 24 | Government intervention is usually justified with the aim of promoting technological innovation and reducing negative environmental impacts (such as the emissions of conventional automobiles). | Government intervention | Sierzchula et al. 2014 |
| 25 | The environment plays an important role in occupational opportunities and employment. | The importance of the environment | Yacob et al. 2019 |

*Table 7*. **Organizing themes consisting of basic themes**

| Basic themes | Organizing themes |
| --- | --- |
| Improving economic strength | |
| Promotion of industrial development | |
| Economic alignment | Improving the economic situation |
| Overtaking competitors | |
| Motivational problems | |
| High energy efficiency | |
| Efficiency | Efficiency |
| Affordability | |
| Environmentally friendly society | |
| Environmental benefits | |
| The importance of the environment | The focus of a healthy environment |
| Urgent socio-ecological transformations | |
| A combination of sustainability and innovation | |
| The unsustainable pattern of production and consumption | |
| Sustainable development and sustainability | Sustainable Development |
| Improving the stability of the transportation system | |
| Economic development in the future | |
| Major challenge | |
| Smart urban mobility | Pragmatism |
| More work | |
| The transformation of transportation sector | |
| Behavior change | |
| Technological alternative | Innovation and change |
| Transformation towards sustainability | |
| Improper policies | |
| Policy support | |
| Political changes | |
| Development and implementation of policies | Optimal strategy and policy |
| Political support | |
| Political intervention | |
| Government intervention | |
| Misallocation of resources | |
| Lack of market role | Budget and livelihood |
| Financial incentives | |
| Focus on all aspects | |
| Industrial policies and science and technology policies | |
| Information constraints | Holistic |
| Conditions guaranteeing promotion | |

### *3-7.Step six: Reliability and validity of the model*

Every study that is conducted must have acceptable validity; Qualitative study and meta-synthesis analysis are not excluded from this. In qualitative research, validity refers to concepts including defensibility, believability, verifiability and even reflectivity of the results. One of the reliability indicators of qualitative research is the evaluation of two or more documents in terms of reference to a specific indicator. The percentage of agreement between two observers is often important in evaluating the quality of their observations of the results. Their degree of agreement is strongly influenced by the fact that even if two observers use completely different criteria for judging subjects as positive or negative, we expect them to agree at least about some participants (and only because Luck and Iqbal), agree with each other. What we really want to know is how much their consensus rate is greater than the rate that results from luck.

Answering this question will probably tell us to what extent, for example, the training and education of the observers has improved the quality of their readings, so that the percentage of agreement between them exceeds the amount of agreement that results from mere luck.

In the topics of inferential statistics, there is a concept called agreement measurement, which examines and evaluates the relationship between two quantities. The difference between this concept and other concepts of statistical communication is the separate measurement of the sizes of these two quantities by two people, phenomena or two sources of decision making. The size of agreement is measured by a coefficient called Cohen's kappa coefficient. What we are looking for in Cohen's kappa coefficient is to assess the extent of agreement between the extracted codes, each of which separately measured our two main quantities.

In order to understand the concept of kappa, we need to ask two questions. First, to what extent is the agreement between readings of different codes greater than what would be expected by chance alone? This can be calculated by subtracting the observed percent consensus from the percent consensus expected by chance alone. This value is the form of Kappa deduction:

**(% agreement expected by chance alone) - (% observed agreement)**

The second question is, "What is the maximum amount that two observers can increase their consensus, compared to the consensus expected by chance alone?" It is clear that their maximum agreement is 100% (complete consensus - two observers are in complete agreement). Therefore, the maximum amount that they can expect to increase their consensus is equal to:

**(% consensus expected by chance alone) - 100%**

The above value is the denominator of the kappa fraction. Kappa expresses the extent to which the observed consensus is greater than that expected by chance alone (i.e. the percentage of

observed agreement minus the percentage of consensus expected by chance alone, or the same as subtraction). relative to the largest amount that codes can hope to increase their consensus (100% minus the consensus expected by chance alone; the denominator of the fraction). Therefore, kappa, in terms of a numerical value, shows how much the consensus obtained between the codes is greater than the consensus expected by chance alone, and it is expressed as a ratio of the maximum increase that is possible with respect to It states that consensus occurs only by chance. Kappa statistical index can be defined by the following equation:

$$K = \frac{P_{agree} - P_{chance}}{1 - P_{chance}}$$

$P_{agree} =$ Proportion of trials in which judges agree

$P_{chance} =$ Proportion of trials in which agreement would be expected due to chance

Based on the obtained articles, the Kappa index equal to 0.76 was obtained, which indicated the validity of the extracted codes, which is shown in Table 8.

*Table 8*. **Kappa coefficient of agreement**

| Description | | Value | Standard deviation | T – Test Approximation | Significance level |
|---|---|---|---|---|---|
| Agreement scale | Kappa | 0.762 | | | |
| | Valid items | 71 | 0.256 | 2.330 | 0.04 |

### 3-8.Seventh step: presentation of findings

According to the public relations report of the Islamic Council Research Center, the energy, industry and mining studies office of this center announced: The research results have shown that electric vehicle are the most desirable and ideal cars among all types of cars due to the absence of polluting gases. Examining the experiences of most advanced countries with automobile industry shows that these countries have a serious and documented plan for the development and mass production of electric vehicle, and since 2009, most of the governments of advanced countries have developed a significant tendency towards electric vehicle, which may be this. Iqbal is not unrelated to the rapid growth of global petroleum prices. Another thing that can be learned from

these programs is that the years between 2015 and 2020 are the start of mass production of electric vehicle for most countries.

Considering this trend and especially the aggravation of the pollution crisis in big cities including Tehran, it seems that the government, Automobile manufacturers and parts manufacturers of our country should put the necessary planning for the introduction and spread of electric vehicle technology on the agenda. But despite the challenges in the production and use of this car in the country, the production of electric vehicle, like other advanced countries in the world, needs serious support from the government. In short, the requirements for the production and use of electric vehicle in the country are due to the payment of research and development subsidies for automobile companies; paying subsidies to the users of these cars; Creating suitable infrastructure at the level of cities for the use of these cars; reducing the import tariff of electric vehicle parts; Creating infrastructure for the development and production of electric vehicle engines; Creating incentives for the use of electric vehicles.

Also, the challenges of production and use of electric vehicle in the country are: increase in city electricity consumption in case of mass use of these cars - short life of motor parts compared to motor parts of existing combustion cars - unaffordability of creating battery charging stations - capacity Carrying less cargo and passengers for urban and suburban use compared to the cost of these cars.

## 4.Results

Although the invention of electric vehicle was almost simultaneous with the invention of internal combustion cars, due to the very cheap rate of fossil fuels and the weakness of electric vehicle in the past, it was these internal combustion cars that were welcomed. In the report of the Research Center of the Islamic Council, it is stated in this connection: "The electric vehicle was invented in 1834 AD. During the last decade of the 19th century, companies were established as electric vehicle manufacturers in America, Britain and France, but due to battery limitations and the rapid development of internal combustion engine vehicles, since 1931 approaches towards the use of combustion vehicles He was pushed." But in the last decade, the use of electric vehicle has expanded a lot, and both automobile manufacturers and consumers have shown favor to it.

According to reports, some factors seem to have had a serious impact on the increase in the production and purchase of electric vehicle. The first reason for this increase is the investment of some reputable companies in this industry and as a result, the production of batteries is much cheaper than in the past. In this way, the final price of electric vehicle is greatly reduced and more

people are able to buy electric vehicle. As a result, the electric vehicle industry has been able to compete with the internal combustion vehicle industry.

Another factor influencing the expansion of electric vehicle production is the continuous fluctuations in fuel prices and its price increase compared to the previous decades. Especially when in 2008, the price of each gallon of gasoline in the United States reached 4 dollars, the discussion about electric cars and their use was proposed again. Now in many countries, especially countries that do not have huge petroleum and gas resources, the price of gasoline is significant, and due to the reduction of petroleum resources in the coming decades, it seems that the price of gasoline for end consumers may increase even more. find At the same time, due to the wide-ranging inventions and innovations in the field of electricity production, especially in clean ways and using renewable sources, the final price of electricity for consumers will be lower, and as a result, the use of an electric vehicle will cost much less than The car will have internal combustion.

The third factor affecting this industry is the increase in environmental concerns among different communities. Electric vehicle are clean cars and have little pollution compared to internal combustion cars, especially gasoline and diesel cars. As a result, it can be predicted that both governments and their citizens prefer to use electric vehicle instead of internal combustion cars.

"Bloomberg Institute" as one of the institutions that analyze and examine the prospects of new industries, draws the future of the automobile industry in its annual reports. In the latest report of this institute about the electric vehicle industry and its outlook in the world, we read: "Electric vehicle sales have increased from a few thousand units in 2010 to more than 2 million units, and there is no sign of this trend slowing down." We predict that the annual sales of electric vehicles will reach 10 million units in 2025, 28 million units in 2030, and 56 million units by 2040. According to this forecast, in 2040, the share of electric vehicle in the global car market will reach more than 50% and will exceed the share of internal combustion cars.

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