

# An Analysis of New Energy Automobile: From the Perspective of R&D Expenditure

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## ABSTRACT

In the market of new energy vehicles, Research and Development (R&D) intensity is an important indicator to measure whether an enterprise can develop rapidly and occupy market share. This paper will analyze the relationship between enterprise R&D intensity and enterprises' risk to measure the advantages and disadvantages of excessive R&D investment. Through the data collection and analysis, we find that R&D investment has two sides. In terms of advantages, high R&D intensity means more high-tech output, and people are more willing to experience new things, which makes products of those companies with high R&D intensity more popular and seize the market faster. In terms of disadvantages, R&D investment accounts for too much of the operating income, which will make the enterprise have no excess cash reserve. It is a great risk in the face of some difficulties, so the enterprise needs to allocate R&D investment reasonably. To sum up, we summarize some rules about the relationship between R&D investment and risk sharing. Some technology-led enterprises can adjust their R&D ratio by these rules to avoid some risks.

**Keywords:** Electric Vehicle, Marketing, Researching and Developing, New Energy.

## 1. INTRODUCTION

From the current circumstance, the pervasive tendency of the electrical automobile is apparent. Hence, the market for electrical is reasonably competitive and risky. With the constant maturity of 5G, AI, autonomous driving, and other peripheral technologies, new energy vehicles, including future intelligent vehicles, have become a reality. Shortly, the auto industry is going to undergo very significant changes. Countries and companies worldwide are actively promoting the landing of new energy vehicles. If a new industry does not have the support of various governments, the prospects of the whole market will be dim. At present, various countries in the world are actively promoting the landing of new energy vehicles for various reasons and have formulated relevant policies. However, there are still problems in the automobile industry.

This article focuses on solving the relationship between R&D and the risks. This paper chooses three samples, Tesla, BYD, and X-Peng, as the analyzed model industry as the model companies can represent

most futures and problems around the whole market. The paper can solve the relationship comprehensively.

During the section 2, this paper will introduce the current situation of the whole industry, including the sales volume of new energy vehicles and industrial policies in the first sequence. During the section 3, the paper then focuses on R&D analysis, and the three critical determinations are the expenses related to R&D personnel, the expenses of R&D materials, and the expenses related to facilities; the paper will analyze the data of the annual reports of three enterprises in recent years to get the proportion of R&D investment in each operating revenue. In addition, the output of patents in recent years can also reflect the R&D intensity of enterprises. During the section 4, it is central part which is about the relationship between R&D and risks. The central part of this paper will study the analyzed dimensions, market demands, consumer preferences, and cost of production. During section 5, the paper also will discuss other risks which are not relative to R&D. Finally, the paper will conclude and will make an overall assessment of enterprise risk from the

perspectives of market risk and profitability risk.

## 2. INDUSTRY ANALYSIS

Nowadays, the global automobile industry is constantly changing. The sales volume of new energy vehicles continues to increase, and the penetration volume is also gradually improving, from 0.41 percent in the first quarter of 2015 to 2.37 percent in 2018, and it keeps growing. The new energy vehicle market is mainly distributed in China, the United States and Norway. Moreover, sales in China accounted for more than 50 percent of the total. Represented by the United States, Europe and Japan, many countries have introduced policies related to new energy vehicles, further promoting the development of new energy vehicles.[1]

In terms of overall strategy, the United States has promulgated five industrial policies, proposed the goal of reducing acquisition costs, vigorously developing charging piles and other infrastructure, and accelerated legislation to promote the rapid development of the new energy vehicle industry. In Japan, it is mainly reflected in fiscal subsidies and tax incentives. In addition, taking Germany as an example, Europe has taken the same measures to increase policy support for the new energy vehicle industry and further increase subsidies to promote consumption. In terms of R&D and innovation, the United States has established an industry-university-research alliance group with government agencies, research institutes and enterprises as the research subjects. Additionally, in 2009, the United States Department of New Energy established the New Energy Vehicle R&D Fund Association with 25 billion dollars, specifically to provide help and support for new energy vehicle manufacturers. In 2019, the United States government reappropriated 80 million dollars to support the research and development innovation of new energy battery technology and energy saving emissions of new energy vehicles. Similarly, Japan and Germany have also continuously strengthened exchanges between the government and enterprises to improve the training mechanism of scientific research personnel. On the one hand, companies broaden the channels of talent introduction, building management, technical and skilled talent pool in order to increase the reserve of Human Resources. At the same time, according to the actual requirements of the company's industrial development, they introduce talent targetly. On the other hand, they utilize the leading role of key personnel to establish a senior personnel training system and constantly increase the investment in personnel training. Moreover, they also improve the growth environment of talents by creating a good enterprise atmosphere.[2]

As the world's largest new energy vehicle sales, China is also very optimistic about the development of

new energy vehicles. To promote energy-efficient and new-energy vehicles, the Chinese government has introduced a raft of policies, including regulations on fuel consumption and carbon quotas. While China has huge advantages in terms of manpower, resources and government, it still faces huge challenges in making cars, especially in the battery sector. Most of the research in the battery field in China is based on existing technology without substantial breakthroughs, and enterprises generally pay more attention to the quantity of car production than the quality and safety of products. In contrast, The United States, Japan and Europe have mastered the core technology of new energy vehicles, which is relatively lacking in China's auto industry.[3]

## 3. R&D ANALYSIS

The development of the new energy vehicle industry is externally affected by the market environment, and internally determined by many factors, such as the innovation of company management decisions and the innovation of scientific and technological level. Among them, the innovation of science and technology level is decided by the intensity of research and development. An enterprise's R & D intensity can be determined from three aspects: the expenses related to R& D personnel, the expenses of R & D materials, the expenses related to facilities.

According to the report, Tesla's R&D expenditure in 2020 was \$1,491 million, an increase of 11.1% compared to \$1,343 million in 2019. In 2021, its R&D expenditure soared to \$ 2,593 million, an increase of 74% compared to 2020. That includes a \$506 million increase in employee-related expenses, a \$263 million increase in R&D materials and a \$211 million increase in facilities and outside services as well as expenses in some new gigafactories.

However, Tesla's R&D spending as a percentage of revenue did not rise, remaining at around 5 percent. As revenue increases, research and development costs will increase accordingly. BYD spent \$1344 million on R&D in 2020, up 1.6 percent from \$1323 million in 2019. BYD's R&D expenditure in 2021 was us \$1670 million, with the number of R&D personnel increasing by 31 percent year-on-year, resulting in a significant increase in related expenses. The proportion of its R&D investment in operating revenue dropped from 6.5 percent in 2019 to 5.5 percent in 2020 to 4.9 percent in 2021, showing an overall downward trend, which has a strong relationship with the sharp increase in operating revenue. X-Peng Motor's R&D expenses in 2019 and 2020 were 325 million US dollars and 271 million US dollars respectively, accounting for 89.2 percent and 29.5 percent of total revenue. It spends \$645 million on R&D in 2021, nearly double what it spent in 2020.[4]

In terms of the proportion of R&D personnel, BYD

R&D personnel accounted for 15.92 percent of all employees in 2020, basically unchanged from 15.62 percent in 2019. It is worth mentioning that about 40 percent of X-Peng's employees are dedicated to R&D, much higher than the industry average. In terms of research and development costs, although Tesla and BYD spend more on R&D investment than X-Peng cars, but their research and development expenses in the income proportion is far less than it. Especially in 2019, X-Peng car put nearly all revenue into research and development, thus its R&D intensity is far greater than Tesla and BYD. In the fierce competition of the new energy market, how to ensure that their own advantages will not be plagiarized to seize the market, one of the effective methods is to obtain advantages in a certain field and apply for patents. Tesla's unique algorithms make it a leader in autonomous driving, and its OTA online updates to in-car software are also unique, making driving safer and easier. As an early battery supplier, BYD is far ahead in battery technology and has made technological breakthroughs in IGBT components in electronic components. The results of this research and development will eventually be displayed in the form of patents. In terms of the number of patent applications, Tesla filed 3,015 and 2,237 in 2019 and 2020, respectively, BYD 596 and 274, and X-Peng 906 and 549. It can be seen that The number of patents applied by Tesla is far ahead, followed by X-Peng, and finally BYD. Tesla and BYD are very close to each other in R&D spending, which implies that BYD may be less efficient in R&D. As X-Peng Automobile has the highest R&D intensity about 1/5 of revenue in 2021, the number of patent applications is much higher than the average level of the industry. However, its investment is much lower than Tesla's, so the number of patent applications is not as large as Tesla's. As can be seen from the above data, although Tesla's research and development cost is very high, but its proportion in the income is well below the industry X-Peng car, Tesla did so low proportion may influence the development of the company's future, X-Peng car research and development of such a high intensity will produce the potential risks to the company, these questions will be answered in the next paragraph.

#### **4. THE RELATIONSHIP BETWEEN R&D AND RISK**

With the development of society, a tech company has to increase research and development (R&D) investments in order to obtain the high technology in one field. The company can produce advanced products with new technologies, which could attract people to consume their high-tech products. And they can quickly occupy the market in that area consequently to gain more profits and free cash flow so that companies reduce the possibility of business risk.

#### **4.1 Market Demands**

As we all know, the sales volume of new energy vehicles continued to increase, and it kept growing. And the global automobile production as well as the proportion of new energy vehicles showed a trend of increasing, which mean electric vehicles are going to replace the gasoline car gradually. But the market is limited. If a company wants to take more shares of the pie, they must to create more advanced and attractive products to consumers. So they have to increase R&D investment to acquire more high technology. From what we have showed above, Tesla has a great number of techniques in 2019 and 2020, so Tesla undoubtedly dominated the electric vehicles market without any hesitation. By contract, BYD faced a difficult situation that they have a relatively low creativity ability to produce more high-tech products in such a big scale of production, because people are more willing to experience something new.

#### **4.2 Consumer Preference**

As old saying goes, "customer is god." And producer only produce those what people want to buy. It also makes sense in electric vehicles market. Tesla spent a lot of time and money to design those wildly liked EV models for consumers. It's well known that only continuous work on the perfection of the design will not be eliminated by the market. In order to cater to the public, companies are supposed to increase R&D investment. With the attraction of new product design, citizens sharing their new and good looking products with others and their friends will all become voluntary salesman for free and the companies will get all this free publicity.

#### **4.3 Cost of Production**

A new technology in producing can heavily reduce the cost of production per unit. For example, people hardly ever wear silk before textile machine came out because it is difficult and expensive to produce per meter. So how to reduce the cost of production will be high on the agenda for manufacturing industry. [9]

Too much R&D investment will leave high cost of production, which cause net profits decreasing so that companies might suffer the potential risk of operating. According the analysis above, The R&D expenditure of Tesla in 2020 was \$1,491 million and \$1,343 million in 2019. In 2021, its R&D expenditure go up \$ 1,250 million including a \$506 million increase in employee-related expenses and a \$263 million increase in R&D materials as well as a \$211 million increase in facilities, outside services. And BYD spent \$1344 million on R&D in 2020 and \$1323 million in 2019. X-Peng Motor's r&d expenses in 2019 and 2020 were

\$325 million and \$271 million respectively.

	Tesla	BYD	X-Peng
2019	\$1343	\$1323	\$325
2020	\$1491	\$1344	\$271
2021	\$2593	\$1670	\$654

**Figure1** the number of Patents of each company

However, even though Tesla has a large R&D investment, its proportion in income is fairly lower than X-Peng and BYD. X-Peng has invest nearly all of their revenue in 2019 into the R&D, it's much risky to spend that much cash flow into R&D. Because companies will meet with a big dilemma that there is no more money to operate the company and pay interests.

Patents quantity	Tesla	BYD	X-Peng
2019	3015	596	906
2020	2237	274	549

**Figure2** The expenditure of R&D

If companies fail to pay the interests to creditors, no more institutes and investors will be willing to buy the bonds they issued. So the firm will come near to bankruptcy. Apparently, such a high intensity of R&D will produce the potential risks to the company.[10]

**5. DISCUSSION**

The risk analysis of the new energy automobile corporation

**5.1 The Analysis for Tesla**

**5.1.1 The Risk of the Product Flaw for Tesla**

According to Business Insider, leaked emails from Tesla show that the company knew in 2012 that a poorly designed battery cooling unit in the Model S could short-circuit or even catch fire, but management turned a blind eye in favor of production and performance. When the news broke, terrible news followed, and the share price fell from its peak of \$1000.[5]

**5.1.2 The Marketing Risk of Tesla**

Competition from traditional companies and new pure electric vehicle companies is increasingly fierce. As a result, we believe Tesla's global market share is likely to decline from its current high levels (especially after 2023 as competitors expand capacity). [6]

Tesla shares, currently trading at \$902 a share, have fallen 20% in the past months as CEO Elon Musk has sold large amounts of stock to meet tax obligations.[7] Ali Faghri(Analyst at investment giant Guggenheim) supposes that Tesla appears to be losing market share as

traditional automakers tap into the electric-car market that has been hot in recent years. Tesla accounted for 66.3 percent of electric vehicle registrations in the second quarter of 2021, down from 79.5 percent a year earlier, according to Experian.[8]

**5.2 The Analysis for BYD**

**5.2.1 The Flaw of the Product for BYD**

The productivity of BYD is a severe problem, which means that BYD can not produce enough automobiles to fit their sales amount. BYD's s current production capacity of 100,000 a month is enough to completely solve the car delivery problem in two to three months. That would allow BYD to double its production capacity in a short time. On 2021, May 17, BYD issued a "note on order delivery of DM-I Super hybrid Model," saying that due to a large number of orders, it still takes 3.5 months to deliver the new orders. We sincerely apologize for the inconvenience caused to DM-I customers. The initial stage of the market is always insufficient capacity, supply can not keep up, order cars often wait for 3-4 months or even more than six months, and so on consumer patience runs out after many people return the car, BYD began to supply in large quantities, dealers can only sell at a lower price.

**5.2.2 The Analysis of Cost and Benefit**

In the past 20 years, the company's operating income has increased by 70 times, while the cost has increased by nearly 100 times in the same period, while the net profit has only increased by eight times. As a result, the company's cash flow is enormous, but it does not earn as much money as we imagine. Operating cash flow in 2020 was \$45 billion, while net profit in the same period was only \$6 billion.

The company's gross profit rate and net profit rate are also gradually decreasing, especially the net profit rate, which has dropped from 20% to about 3%. This is because the cost has increased, and the cost has increased dramatically, especially the research and development cost, which is 5 billion, 5.6 billion, and 7.5 billion in the past three years, which is a terrible investment.

After all, BYD is still a manufacturing company, no matter how strong it is. If it cannot keep competitors out, profits will eventually be diluted until the industry's profits are too low to attract capital, and it will "die out." Byd's advantage lies in the technological advantage, the layout of new energy vehicles early, in the face of all parties to build new forces, want to keep the hegemon, a bloody battle is inevitable.

### 5.3 Analysis for X-Peng

#### 5.3.1 Analysis the Profitability of X-Peng

Car manufacturing is originally a pie-driven industry, need to spend money at the same time, the return cycle is very long, in the early stage, often is a severe loss. As Lin Mi, CEO of Yundu Automobile, said, it is "too ridiculous" for a car manufacturer to achieve profitability within 3 to 5 years. This means that once capital is withdrawn in the middle of the journey, the new forces of car building will be completely paralyzed, and all previous efforts will be in vain.

In 2018, 2019, and the first half of 2020, X-Peng Motor's net loss was 1.399 billion yuan, 3.692 billion yuan, 796 million yuan, and a loss of 5.886 billion yuan in two and a half years, realizing total revenue of 0.01 billion yuan, 2.32 billion yuan, 1.003 billion yuan, respectively.

#### 5.3.2 The Analysis for Marketing

X-Peng auto-selected the price range of 150,000 to 200,000 cars is a hot market. However, there are also many mid-end fuel cars produced by traditional ones and ordinary new energy cars or plug-in hybrid cars that do not sell on intelligence. From consumption habits to price, X-Peng automobile does not occupy absolute advantage.

## 6. CONCLUSION

Overall speaking, not only a great intensity of R&D can both cause positive and negative effects to the enterprises producing electric vehicles, but also some other risks like the risk of product flow, and the risk of product cost as well as marketing risk can leave the companies in financial dilemma by affecting their sales. So, set a suitable portion of R&D in revenue and control the risk exposure will be high on the agenda for companies, which benefits in financing by present an excellent financial report to investors and managers. The example showing in passages give us a strong visual strike that the new Chinese company X-Peng producing electric vehicles exclusively has pour into nearly 90% of revenue in Researching and Development to invest the new designs and technologies in EV modes at the beginning in 2019. Consequently, now X-Peng becomes an advanced leading company occupying a huge market share in Chinese. This is the advantage to maintain a great intensity of R&D, but it also could reduce the risk we had talked about.

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