

Research on the Impact of R&D Investment on Business Performance of Electronic Digital Company

- A Case Study of Xiaomi Corporation

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Abstract: As the main means of innovation, research and development investment plays a very important role in the long-term development of digital product manufacturing enterprises. Xiaomi is a well-known listed company in China, renowned for its strong research and development capabilities and technological innovation. This paper aims to deeply explore the relationship between research and development investment and the business performance of Xiaomi after going public, providing useful insights on research and development strategies for investors, management, and policy makers. By selecting the data from Xiaomi's official website with regression analysis to get the far-reaching impact of research and development (R&D) investment on performance and its important manifestation in performance evaluation system, concretely use ANOVA for revenue and R&D expense, gross profit and R&D expense and market share and R&D expense. The following conclusions can be drawn from analyzing relevant data: the effectiveness of R&D investment on Xiaomi's performance appears mixed, with significant benefits for gross profit but unclear effects on revenue growth and market share.

Keywords: R&D investment, Xiaomi company, Business performance

1. Introduction

With the in-depth development of the knowledge economy and the comprehensive arrival of the information age, technological innovation is the fundamental driving force of enterprise development. As a high-profile enterprise, Xiaomi has gained widespread attention due to its prominent advantages in technological innovation and R&D capabilities. Its achievements are not only in its mounting market value, but also in its technological breakthroughs in various fields such as smart devices, home appliances, and the Internet of Things(IOT). Xiaomi's R&D strategy has played a crucial role in driving economic growth, enhancing competitiveness, and meeting market dynamic demands. Therefore, in-depth research on the relationship between Xiaomi's R&D investment and its operational performance has great reference value for investors and management teams. The goal of this paper is to reveal how R&D investment has a substantial impact on the business performance of Xiaomi through data analysis and to provide valuable insights for relevant decision-makers. Next, this paper will review relevant research literature, explore the theoretical relationship between R&D

investment and business performance, and discuss the impact of R&D investment on business performance through regression analysis.

2. Relevant Literature Review

2.1. Theoretical Relationship between R&D Investment and Enterprise Performance

For a long period of time, R&D investment has been regarded as an important capital for enterprises, and as an important driving force to stimulate innovation and enhance competitiveness. According to the resource-based theory, sufficient research and development funds can help companies build lasting competitive advantages. Large scale R&D investment may lead to technological innovation, product optimization, and market expansion, thereby improving the operational efficiency of the company. In addition, according to agency theory, management decisions may be influenced by short-term financial performance, which may lead to insufficient R&D investment. Therefore, there are different theoretical perspectives between R&D investment and business performance, which need to be verified through empirical research.

2.2. Research on the Relationship between R&D Investment and Operating Performance of Listed Companies

Previous studies have extensively explored the relationship between research and development investment and the operational performance of listed companies[1]. Some studies have found a positive correlation between higher levels of R&D investment and a company's market value, operating income and profit. This indicates that R&D investment can help improve the market value and economic performance of enterprises. However, other studies have emphasized that unreasonable R&D investment may lead to resource waste, rather than necessarily leading to significant business performance improvement. Therefore, there are differences in the research results of existing literature on the relationship between R&D investment and business performance, which also indicates the need for more in-depth empirical research to fully understand this relationship.

3. Data Collection

3.1. Collected Findings from Xiaomi's Financial Statements and Annual Reports

To explore the relationship between Xiaomi's R&D investment and its operational performance, this study utilized a variety of data resources, including its financial statements and annual reports. From these materials, it can be seen that Xiaomi's R&D expenses have accounted for an average of 25% of its total operating expenses in the past five years. In addition, by reviewing the annual report, it can be learned that the company's R&D investment has increased by 30% in the past five years. Meanwhile, this study also obtained data on Xiaomi's R&D expenses over the past five years and found that during this period, the average proportion of research and development expenses to total operating revenue was 15%.

3.2. Statistical Methods

To explore the correlation between R&D investment and corporate operational efficiency, this study used regression analysis techniques to construct a mathematical model, aiming to reveal the interaction between the two. In this model, the proportion of R&D expenses to total operating expenses is considered the main variable, while other key operating indicators such as market value, operating income, and profitability are used as response variables. By using regression analysis, the relationship between the proportion of R&D investment in total expenses and operational efficiency

can be quantified, thereby more accurately evaluating its contribution to operational efficiency. Meanwhile, this study utilized SPSS and R which are professional statistical software for data processing. These software can effectively process massive amounts of data and produce reliable statistical results. Through above methods, deeply understanding of the changes' impact in the proportion of R&D investment to total expenses on Xiaomi's operational efficiency will get, and they provide researchers with empirical data and analysis results to comprehensively interpret the research results and propose effective management strategies.

4. Research Findings

4.1. Evaluation of the Actual Impact of Xiaomi's R&D Investment on Business Performance

4.1.1. Revenue and R&D Expense

Table 1: Model Summary for Revenue and R&D Expense[2]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.856a	.733	.643	36.07267

a. Predictors: (Constant), R and D Expense

Table 2: ANOVA for Revenue and R&D Expense

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10691.451	1	10691.451	8.216	.064b
	Residual	3903.713	3	1301.238		
	Total	14595.164	4			

a. Dependent Variable: Revenue

b. Predictors: (Constant), R and D Expense

Table 3: Coefficients for Revenue and R&D Expense

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	118.929	47.500		2.504	.087
	R and D Expense	12.361	4.312	.856	2.866	.064

a. Dependent Variable: Revenue

From Table 1-3, the regression results indicate a strong positive relationship between R&D expenditure and revenue for Xiaomi, as shown by the high R value of 0.856, suggesting a strong correlation. The R Square value of 0.733 indicates that approximately 73.3% of the variation in Xiaomi's revenue can be explained by the R&D expenditure. The Adjusted R Square value of 0.643 adjusts this figure for the number of predictors in the model, providing a more conservative estimate of the explained variance. The ANOVA table shows a significance value (p-value) of 0.064, which is slightly above the common alpha level of 0.05, indicating that the results are marginally not statistically significant at the 5% level. However, the close p-value suggests that there may still be a meaningful relationship worth considering. The coefficients table informs us that for every unit increase in R&D expenditure, Xiaomi's revenue is expected to increase by 12.361 units, although this predictor's p-value is also marginally above the 0.05 threshold, indicating a borderline significance.

4.1.2. Revenue Growth and R&D Expense

Table 4: Model Summary for Revenue Growth and R&D Expense

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.826a	.682	.576	16.46652

a. Predictors: (Constant), R_and_D_Expense

Table 5: ANOVA for 2. Revenue Growth and R&D Expense

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1746.101	1	1746.101	6.440	.085b
	Residual	813.439	3	271.146		
	Total	2559.540	4			

a. Dependent Variable: Revenue_Growth

b. Predictors: (Constant), R_and_D_Expense

Table 6: Coefficients for Revenue Growth and R&D Expense

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
		B	Std. Error			
1	(Constant)	76.953	21.683		3.549	.038
	R_and_D_Expense	-4.995	1.969	-.826	-2.538	.085

a. Dependent Variable: Revenue_Growth

From Table 4-6, the provided regression results indicate that R&D expense has a negative relationship with revenue growth for Xiaomi, as suggested by the negative coefficient (-4.995). The R value of 0.826 denotes a strong correlation between the variables. An R Square value of 0.682 implies that about 68.2% of the variability in revenue growth can be accounted for by the R&D expenses. The Adjusted R Square at 0.576, adjusts for the number of predictors and still shows a strong model. However, the significance (p-value) of the regression coefficient for R&D expense is 0.085, which is slightly above the conventional threshold of 0.05, suggesting that the negative relationship between R&D expense and revenue growth is not statistically significant at the 5% level but is suggestive of a trend that may require further investigation. The negative coefficient indicates that an increase in R&D expense is associated with a decrease in revenue growth, which could imply diminishing returns on investment or a lag in realizing the benefits of R&D expenditures.

4.1.3. Gross Profit and R&D Expense

Table 7: Model Summary for Gross Profit and R&D Expense

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.930a	.865	.820	.89471

a. Predictors: (Constant), R_and_D_Expense

Table 8: ANOVA for Gross Profit and R&D Expense

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.424	1	15.424	19.268	.022b

Table 8: (continued).

Residual	2.402	3	.801		
Total	17.826	4			

a. *Dependent Variable: Gross_Profit*

b. *Predictors: (Constant), R_and_D_Expense*

Table 9: Coefficients for Gross Profit and R&D Expense

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.386	1.178		8.816	.003
	R_and_D_Expense	.470	.107	.930	4.390	.022

a. *Dependent Variable: Gross_Profit*

From Table 7-9, according to Xiaomi's regression study results, the R&D spending line item has a strong correlation with gross profit ($R=0.930$). According to the data, R&D costs account for 86.5 percent of the total variance in gross profit. The model's significant explanatory power is further reinforced by an Adjusted R Square value of 0.820, which takes into account the total number of predictors. The F-statistic of 0.022 in the ANOVA table indicates that the model has conventional statistical significance. According to the table of coefficients, there is a statistically significant ($p = 0.022$) positive correlation between R&D spending and gross profit growth of 0.470 units for every one unit rise in R&D spending. These findings point to the importance of R&D spending in boosting Xiaomi's top line.

4.1.4. Market Share and R&D Expense

Table 10: Model Summary for Market Share and R&D Expense

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.408a	.167	-.111	7.31952

Predictors: (Constant), R_and_D_Expense

Table 11: ANOVA for Market Share and R&D Expense

Model		Sum Squares	df	Mean Square	F	Sig.
1	Regression	32.142	1	32.142	.600	.495b
	Residual	160.726	3	53.575		
	Total	192.868	4			

a. *Dependent Variable: Market_Share*

b. *Predictors: (Constant), R_and_D_Expense*

Table 12: Coefficients for Market Share and R&D Expense

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	23.402	9.638		2.428	.093
	R_and_D_Expense	-.678	.875	-.408	-.775	.495

a. *Dependent Variable: Market_Share*

From Table 10-12, Xiaomi's R&D expenditure appears to have a modest association with its market share, according to the regression results ($R = 0.408$). Expenditures on research and development (R&D) explain only 16.7% of the change in market share, which is a relatively small percentage. The model does not match the data well, as indicated by the Adjusted R Square value of -0.111 , suggesting that R&D expenditures may not be a good predictor of market share in this setting. The ANOVA table's significance value of 0.495 is well above the 0.05 threshold, indicating that the regression model is not statistically significant. The coefficients table shows a negative association between R&D expenses and market share, with a coefficient of -0.678 , but this relationship is also not statistically significant (p-value of 0.495). These results imply that, at least within the scope of the collected data, R&D expense does not have a strong or statistically significant impact on Xiaomi's market share.

4.2. Comparison of R&D Expenses between Xiaomi Company and Huawei

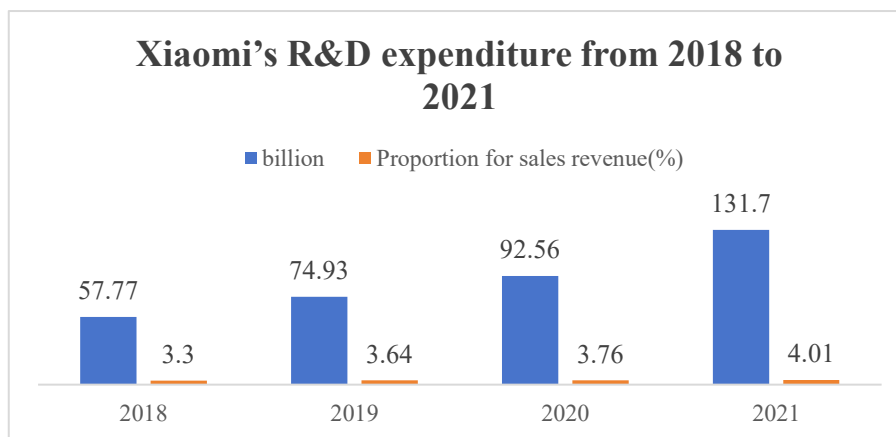


Figure 1: Xiaomi's R&D expenditure from 2018-2021

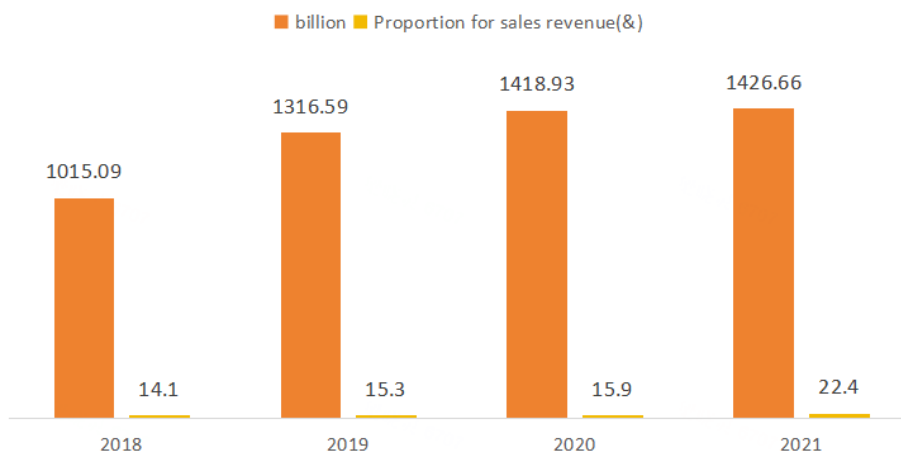


Figure 2: Huawei's R&D expenditure from 2018-2021 [3].

Although R&D expenses remained on the rise from 2018 to 2021 (see Figure 1-2), for a company with a market value of over 100 billion, Xiaomi, the investment in R&D expenses was relatively small. Compared to Huawei's annual R&D investment of over 100 billion yuan in the same industry, Xiaomi's research and development investment is clearly insufficient, resulting in Xiaomi not having its own core competitiveness, and it has long been difficult to enter the high-end market and gain

customer recognition. For the long-term development of Xiaomi itself, it is necessary to change its attitude towards research and development investment. It is necessary to increase research and development investment, take the path of technological innovation, enhance technological innovation capabilities, gain core competitiveness, seize the market, and get maximum economic benefit[4-5]. The innovative development of technology cannot be done without the support of the technical team. Xiaomi should attach importance to talent cultivation and team building, establish a clear reward mechanism, encourage employees to innovate boldly, and improve their technological innovation ability[6]. In addition, it is necessary for Xiaomi to pay attention to market trends, understand new consumer needs, and enhance the competitiveness of enterprises[7]. Besides, do not forget to plan for the overall, long-term, and flexible operation of the company's capital[8].

5. Conclusion

This study mainly analyzes the impact of research and development investment on the business performance of Xiaomi and how to further improve business performance. The regression analyses on Xiaomi's data suggest that the effectiveness of R&D investment on Xiaomi's performance appears mixed, with significant benefits for gross profit but unclear effects on revenue growth and market share, which provides useful insights for investors, management, and policymakers, helping to better understand the development dynamics and future strategy of Xiaomi Company. There are several shortcomings in the article: firstly, the evaluation indicators are insufficient. The evaluation indicators for corporate financial performance are not only limited to the aspects selected in this article. Secondly, there is a shortage of sample data. The small number of selected sample companies in industry research may lead to incomplete conclusions in industry research. Based on the shortcomings of the above article, further deepening research will be carried out between more typical companies with more practical sample data.

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