

## Research Article

# Effectiveness Evaluation Model of Digital Cost Management Strategy for Financial Investment of Internet of Things Enterprises in Complex Environment

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In the current study, a depth evaluation for the strategic cost management (SCM) based on Internet of things (IoT) enterprises is performed. The SCM is analyzed under the umbrella of replication environment and financial digitization. Our proposed method of evaluation consists of the replication technology, the relationship between corporate finance, corporate performance, and SCM. However, in the second stage, we considered Xiaomi Corporation (Xiaomi), an IoT enterprise, as our hypothesis and benchmark model to analyze the existing issues related to cost management. Finally, the strategy and effect of Xiaomi's SCM based on the value chain are thoroughly investigated and an in-depth insight has been provided. Moreover, our results show that the SCM of Xiaomi based on the value chain has achieved optimum results, such as reducing the total cost per unit product and increasing the market share. However, a few issues still need improvements, such as insufficient innovation ability, the incomplete scope of cost management, and a small amount of patent authorization. This article is conducive to enterprises for better strategic planning and to improve cost management efficiency. Moreover, it provides a reference basis for the cost management problems faced by other IoT enterprises.

## 1. Introduction

The ongoing development of China's economy has promoted the continuous improvement of the whole financial system [1, 2]. With the rise of China's capital market, Chinese companies have explored several financing channels, providing a driving force for China's economic development [3, 4]. In this regard, China has formulated some new preferential policies to stimulate economic development in recent years, including bond market policies [5]. This has made China's bond market more active and encouraged.

Digital finance has been a major innovation in promoting financial reform in recent years [6, 7]. As a new way of financing, it has profoundly impacted the traditional way of financing. The rapid progress of mobile Internet has promoted the progress of technology and the huge demand of the market [8]. China's mobile Internet market is becoming increasingly

mature and has broad prospects for development. Traditional cost management methods are not enough to realize the competitive advantage of enterprises, and enterprises must introduce strategic cost management (SCM) [9]. SCM is an efficient and advanced cost management method. SCM is used in most enterprises to manage the overall flow of product supply. It adopts the active streamlining of business supply to maximize customer satisfaction and grow business values. By using SCM, the companies can reduce extra costs and deliver products to the consumer quicker [10].

The components of individual supply chain orientation are analyzed by [11] to examine the causal relationships between supply chain management (SCM) and organizational SCO. The outcome of the applied method reveals the importance of the individual SCO and its impact on organizational SCO. The classification of SCM activities into strategic and operational tasks confirms the causal

relationship between the two concepts. The use of effective management philosophy inside a firm confirms the successful implementation of SCM [11].

It competes in the key links of the value chain and reasonably allocates the existing resources. The value chain is a business framework used by companies to analyze the detailed procedure involved in each step of business. The value chain is the buzzword in the IoT industry now and several IoT industries adopt value chain frameworks to analyze business procedures [12–14].

The close ties among countries have expanded the development of China's economic market, followed by increased pressure on domestic enterprises. Domestic enterprises should face competition in the domestic market and the challenges of foreign enterprises simultaneously. Enterprises cannot make more profits just by directly reducing materials, labor costs, and manufacturing costs. They need to combine the cost management of strategic thinking. Moreover, they should master the business objectives and external environment of the enterprise, maintain their advantages, conduct in-depth analysis, and find and solve the existing problems in time so as to realize the all-around development of the enterprise. SCM meets the requirements of the times, but the key problem is how to realize and evaluate it [15]. Recently, numerous researchers [16, 17] have studied this problem theoretically, but few empirical cases have explored the application of SCM [18–20]. Given the above analysis, under the background of replication environment and financial digitization, Xiaomi Corporation (Xiaomi), an Internet of things (IoT) enterprise, is taken as an example to analyze its current situation of cost management. Xiaomi Corporation is a Chinese company founded in 2010 (Beijing) to produce computer electronics and related software. In 2011, Xiaomi introduced the first smartphone, and by 2014, it became the largest market share of smartphones sold in China [21]. In 2021, Xiaomi grew into the second largest smartphone supplier worldwide after Samsung [22]. Moreover, the strategy and effect of SCM based on the value chain of Xiaomi are studied. Finally, the problems and solutions of SCM in Xiaomi are put forward. This research is conducive to better strategic planning and the improvement of enterprise cost management efficiency and can provide a reference for the cost management problems faced by other IoT enterprises.

## 2. Methods and Materials

*2.1. Main Forms of Replication Technology.* Replication technology replicates a set of particular forms of securities and then uses it to investigate other security indicators [23]. It is essential to pay attention to the types of securities (preset or a group) and to keep capital flow entirely meeting its characteristics [24]. The purpose of increasing asset income can be realized when the capital flow is completely matched. Meanwhile, these goals also contribute to the research of replication technology. Generally, replication technology is widely used in the financial market environment, mainly in the process of asset pricing, financial asset risk management, and the development of new financial instruments [25].

Applying replication technology to financial investment is mainly to unify the profitability, security, and liquidity of financial assets [26, 27]. Figure 1 presents the main form of replication technology.

- (1) Exponential replication form of replication technology. In stock investment, the return on investment is taken as the criterion to judge whether the investment is successful or not. When it is higher than that of the market index, the investment is successful [28, 29]. The so-called replication index is a way for securities investors to establish a new portfolio that can reflect the stock index based on all the constituent stocks in the target index and finally obtain a high yield. There are two methods of exponential replication: complete replication method and optimal replication method. In the portfolio construction, the complete replication method needs to determine the purchase proportion according to the weight of various stocks in the basic indicators so as to achieve the purpose of index replication. Using the method of complete replication can ensure that the constructed portfolio index is highly consistent with the basic index. This method is more suitable for split share structure, which requires a lot of capital investment, and is not suitable for weak investors. The optimal replication law can effectively control the tracking cost of the optimal replication method by setting parameters and indicators so that investors can invest within the acceptable range. Moreover, some stocks are eliminated in combination with their actual situation. In the process of portfolio allocation, it can be optimized according to the actual weight, and then, optimized allocation can be conducted. It makes the established portfolio apply the optimal replication method to financial investment and financial management, which can effectively control the warehouse construction cost and maintain cost.
- (2) Bond replication form of replication technology. Bond replication is a form of replicating other bonds based on bonds. In the construction of composite bonds, first, the cash flow of bonds is decomposed to a certain extent, and then bonds are combined. After the correct bond price is determined, the trading opportunity is accurately grasped to realize appreciation. The realization of cash flow replication is based on bond replication. The consistency among cash flows should be ensured during replication. Thereby, in the process of copying and constructing synthetic bonds, it can be calculated according to the intrinsic value equation and cash flow. The intrinsic value equation calculates the discount of bond cash flow. The expression reads as follows:

$$p_0 = F_i \sum_{t=1}^T D_t + FD_T, \quad (1)$$

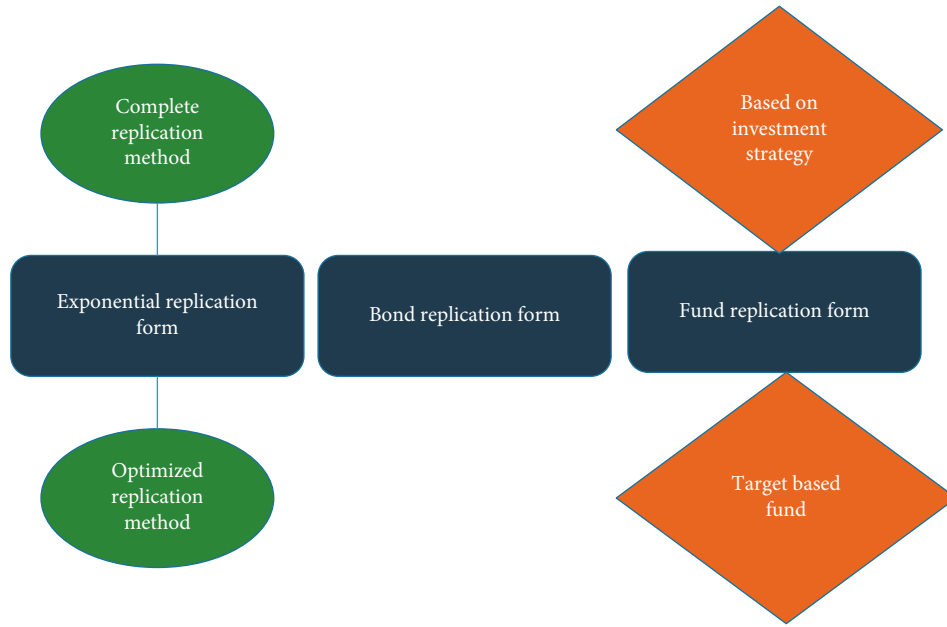


FIGURE 1: Main forms of replication technology.

where  $p_0$  reveals the present value of the bond;  $F$  represents the face value of the bond;  $i$  is the coupon rate;  $T$  represents the holding period year;  $D_t$  represents the discount factor of time  $t$ , and  $0 \leq t \leq T$ . The equations are constructed based on the same time and characteristics of the bond to be replicated and the replicated bond. The expression reads as follows:

$$\begin{cases} N_1C_{11} + N_2C_{21} + \dots + N_QC_{Q1} = W_1, \\ N_1C_{12} + N_2C_{22} + \dots + N_QC_{Q2} = W_2, \\ \dots \\ N_1C_{1T} + N_2C_{2T} + \dots + N_QC_{QT} = W_T, \end{cases} \quad (2)$$

where  $C_k$  represents the cash flow of bonds;  $T$  is the time period;  $Q$  indicates the number of bonds in the market;  $W_1, W_2, \dots, W_T$  are cash flows at different times;  $N_1, N_2, \dots, N_Q$  refer to the number of existing market bonds of replication bonds. The replication bond can be realized through the above equations.

- (3) Fund replication form of replication technology. This replication form is mainly aimed at fund products, which has two forms at present. The first is mainly aimed at the target fund and it is to replicate through financial derivatives, which can reflect a kind of financial market. The second is mainly based on the relevant investment strategy to achieve replication, and this replication form is applied to the fund products of relevant financial companies to ensure the success of the fund products so as to more effectively safeguard the interests of investors and make the investment management process of fund manager more convenient.

**2.2. Enterprise Financialization and Enterprise Performance.** Existing academia believes that enterprise financialization will have a crowding-out effect and a reservoir effect on real industries. With limited resources, the financial investment will increase with the decrease of physical investment. When an enterprise transfers the resources used for entity operation to financial investment, it will harm the enterprise and cause a crowding-out effect [30]. When enterprises use idle funds to invest, this can improve the utilization rate of funds and contribute to the growth of business performance, so this is the “reservoir” effect. The financial assets of enterprises are the main form of enterprise financialization. Many enterprise take financial investment as a crucial way to improve the capital composition and alleviate the financing difficulties. Therefore, multiple enterprises will use idle funds to buy some financial products with strong liquidity and low profitability so as to prevent the above situation [31, 32]. The impact of enterprise financialization on enterprise performance can be analyzed from two aspects.

On the one hand, from the perspective of the “reservoir” effect, financial assets are an effective means to maintain enterprise capital liquidity. When an enterprise is in urgent need of cash, it can quickly realize cash assets at a low cost, which is conducive to improving the operation efficiency of enterprise investment. Moreover, it can improve the enterprise’s performance, increase financial revenue, and urge the enterprise to reduce material expenditure and financial assets [33]. In the short term, financial returns can alleviate the low production and operation performance and improve the enterprise performance temporarily. On the premise of reasonable financial investment, it can not only increase the enterprise value but also realize the diversification of asset investment so as to effectively reduce investment risk and improve enterprise performance. Therefore, enterprises should reasonably invest in liquid financial assets.

On the other hand, from the perspective of the “crowding-out” effect, such pursuit of profit may lead to excessive financial investment, which will inevitably crowd out other investments. This will make the operating profits of enterprises mainly come from financial investment and change the main body of enterprises so that the real economy will be overhead. Unrestricted investment in financial products will hinder the development of the main business of the enterprise and make the profitability of the enterprise worse, which will negatively affect the enterprise’s performance. Meanwhile, other investment projects in the enterprise will be delayed due to the lack of funds, which will result in the low overall investment efficiency of the enterprise, so it is difficult to increase the enterprise performance. In addition, the vulnerability of the financial system will also affect the business risk of enterprises, resulting in the decline of enterprise performance, which is not conducive to the long-term development of enterprises.

**2.3. SCM.** The SCM is used to enhance the original cost management with the change of business environment. Since the SCM is a combination of strategic management and cost management, it is also beneficial to adapt to the external competitive environment. Table 1 shows the differences between SCM and traditional cost management:

The biggest difference between SCM and traditional cost management is that SCM creates an environment within the enterprise, which can reduce costs. Figure 2 displays the characteristics of SCM.

SCM is to enable enterprises to achieve sustainable development, so it will not be limited to temporary profits and losses but focus more on the long-term interests of enterprises. SCM will focus on the relationship between the enterprise and the external environment. In addition to the internal consideration of the enterprise, it will also begin to expand management outside the enterprise and optimize the cost structure by improving the relationship between the enterprise and the external environment so as to reduce the cost level of the enterprise, finally improve the competitiveness of the enterprise, and promote the sustainable development of the enterprise [34, 35]. SCM should not only analyze the enterprise’s own cost structure but also constantly analyze its competitors as the basis for the implementation of the strategy. In this way, a cost management scheme suitable for the enterprise can be established, which can be conducive to enhancing its competitiveness. The SCM is adopted to manage the internal environment of enterprise so that the internal business environment of the enterprise can adapt well to the complex competitive environment. The SCM is useful to maintain the position of the enterprise in the industry as SCM provides useful information in time. In the specific stage of enterprise growth, SCM focuses on the change stage of the enterprise life cycle. Therefore, the focus of cost management varies with the stage of the enterprise. If enterprises develop different competitive strategies, the focus of SCM will also change.

**2.4. Current Situation of Xiaomi Cost Management.** Xiaomi focuses on the research and development (R&D) of intelligent hardware and electronic products. It is listed in Hong Kong, and it is the first industry to use the Internet to build mobile phone enterprises, with the Internet as its core idea. Traditional mobile phone manufacturers mainly focus on the real economy, and few enterprises adopt the Internet model. Xiaomi does not have much capital, so it has abandoned the traditional marketing method and opened up a new marketing method through network marketing. At the beginning of its establishment, Xiaomi had a clear understanding of the company’s positioning strategy, that is, integrating hardware, software, and the Internet. The hardware is Xiaomi mobile phone, the software is “MiTalk,” and the Internet service system is MIUI system. In addition, it has also released a series of products such as Xiaomi router and Xiaomi finance. At present, Xiaomi has also entered the field of smart homes and launched the Xiaomi ecological chain brand “MIJIA.” It has established the world’s largest IoT platform for consumption and invested in about 400 enterprises, including hardware facilities, games, social networks, finance, and multiple other industries.

After consulting the data, it is found that the costs of Xiaomi are mainly in sales, administration, R&D expenses, and promotion. Figures 3 and 4 present the sales costs of Xiaomi’s products in 2018 and 2019.

Figures 3 and 4 show that the total sales cost of Xiaomi in 2018 and 2019 was 152.7 billion yuan and 177.3 billion yuan, respectively; the total revenue of each project was 174.9 billion yuan and 205.8 billion yuan, respectively; the gross profit was 22.2 billion yuan and 28.6 billion yuan, respectively. In 2019, the sales cost of smart phones, IoT and consumer products increased more, which was due to the increase of product sales. Although the revenue of smart phones is the highest, the gross profit is relatively low. The gross profit of Internet services is the highest. The main reason is that Xiaomi’s profit mainly depends on software and the Internet, not hardware.

Figure 5 shows the sales, promotion and administrative expenses of Xiaomi in 2018 and 2019.

Figure 5 reveals that Xiaomi’s sales and promotion expenses in 2018 were 8 billion yuan and its administrative expenditure was 2.2 billion yuan; in 2019, Xiaomi’s sales and promotion expenses were 10.4 billion yuan and its administrative expenditure was 3.1 billion yuan, an increase of 30% and 40.9%, respectively compared with 2018. The main reason is that in recent years, Xiaomi has constantly conducted celebrity endorsements to improve the popularity of the brand so the advertising fee will increase. Moreover, the rapid development of overseas business will also lead to an increase in logistics costs.

Figure 6 shows the comparison of R&D expenses of Xiaomi technology from 2018 to 2020.

The results of Figure 6 show that Xiaomi’s R&D investment in 2018–2020 is increasing year by year, mainly because Xiaomi insists on technology as the centre and adds a lot of R&D projects. Meanwhile, the expansion of R&D personnel increases the salary of R&D personnel, so it will lead to more growth of R&D expenses. Although the R&D

TABLE 1: The difference between SCM and traditional cost management.

Comparison items	SCM	Traditional cost management
Target	Gain and maintain enterprise competitive advantage	Cost reduction
Management field	The whole value chain inside and outside the enterprise	Enterprise internal value chain
Management object	Strategic cost driver	Activity cost driver
Focus	Cost process information	Cost result information
Effect	Long term	Transiency

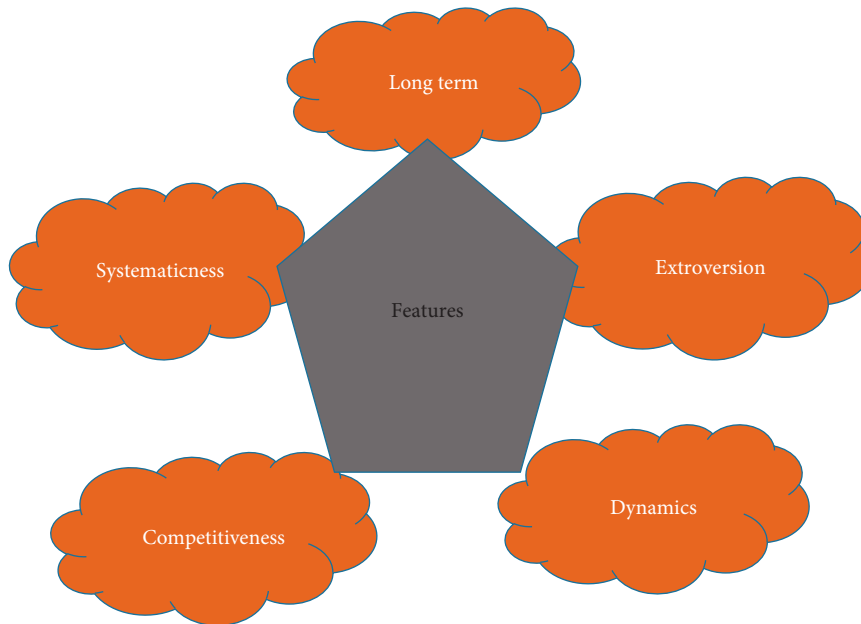


FIGURE 2: SCM features.

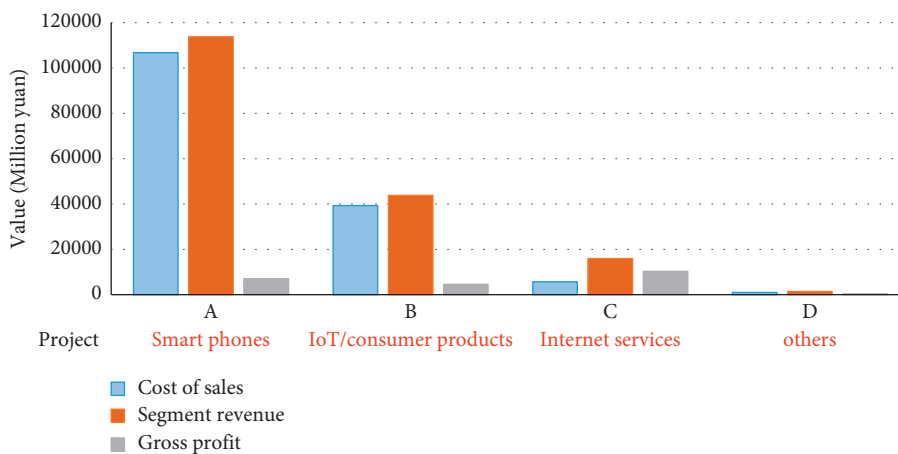


FIGURE 3: Sales costs of various products in 2018.

investment of Xiaomi technology reached 10 billion yuan in 2020, there is still a big gap compared with Huawei. Figure 7 shows the proportion of business revenue of Xiaomi from 2016 to 2019.

Figure 7 reveals that the revenue of Xiaomi’s smartphone business in 2019 decreased compared with that in 2018, while the revenue of IoT and consumer products increased. It

suggests that Xiaomi has continuously adjusted its revenue structure in recent years, reducing the proportion of smartphone business and expanding the proportion of IoT products.

2.5. *SCM Strategy Based on Value Chain.* Xiaomi introduces the SCM mode to enhance its market competitiveness.

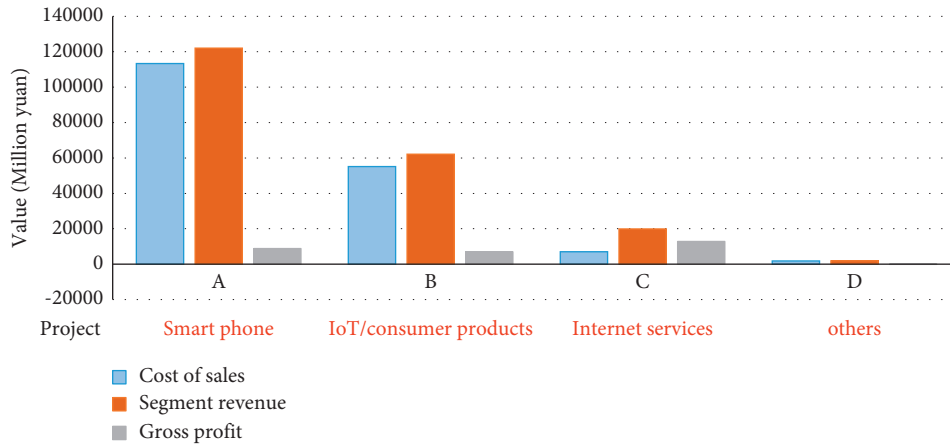


FIGURE 4: Sales costs of various products in 2019.

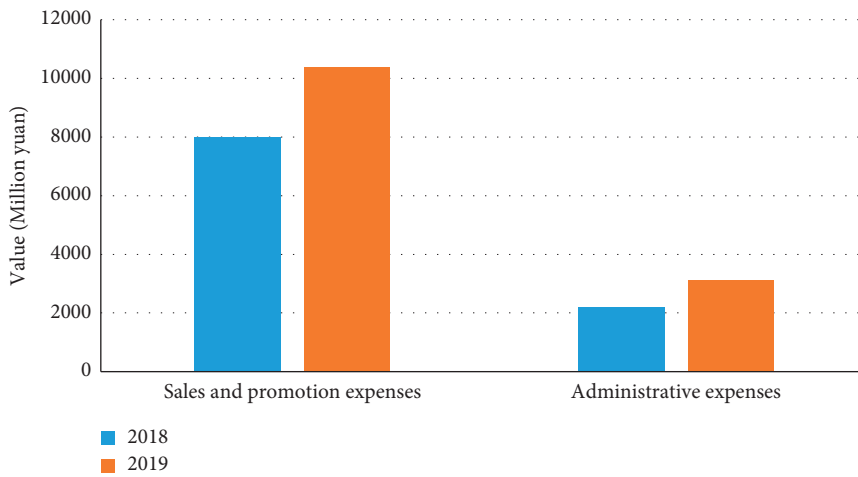


FIGURE 5: Sales and promotion and administrative expenses.

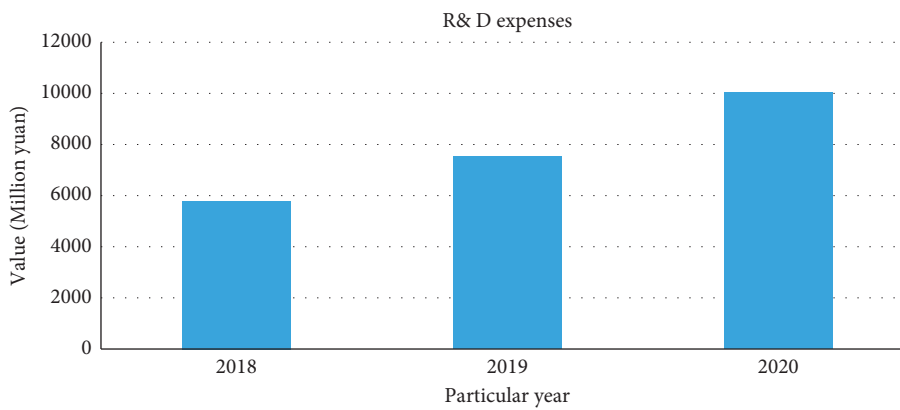


FIGURE 6: R&D expenses of Xiaomi from 2018 to 2020.

Xiaomi’s SCM starts with the internal value chain and then integrates the internal value chain to reduce the resource consumption of each link. The internal value

chain of Xiaomi mainly includes four links: raw material procurement strategy, R&D strategy, production and manufacturing strategy, and marketing strategy. First, the

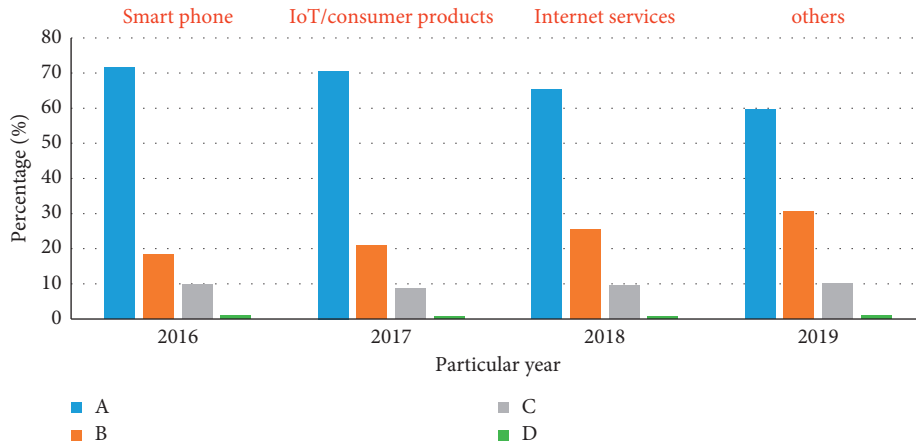


FIGURE 7: Proportion of Xiaomi's business revenue in 2016-2019.

raw material procurement link: Xiaomi first strengthens the management of the procurement department and strictly controls the procurement system. Second, the R&D link strategy: Xiaomi pioneers the networking mode to develop the mobile phone operating system and then only makes extremely popular products, thus reducing the unit R&D cost. Third, the production and manufacturing link strategy: on the one hand, Xiaomi is production outsourcing to realize the optimal allocation of resources; on the other hand, it has established a quality committee and adopted international testing standards. Fourth, marketing link strategy: Xiaomi implements online sales, focusing on fan marketing, while offline marketing is carried out through the “Mi Fan Festival.” Xiaomi's SCM strategy based on external value chain mainly includes supplier-related strategy, consumer-related strategy, and competitor-related strategy. The strategy related to suppliers is to cooperate with strong suppliers in multiple fields on the one hand and adopt zero inventory mode on the other hand. The consumer-related strategy is to accelerate the market sinking. Xiaomi learns from the business model of its competitor Apple. Regarding product strategy, Xiaomi mobile phone only releases one model every year.

### 3. Results and Discussion

**3.1. SCM Implementation Effect Based on Internal Value Chain.** Some SCM strategies adopted by Xiaomi have achieved excellent results. The total cost per unit of a product A, i.e., smartphone, is illustrated as an example in Figure 8.

Figure 8 presents that the cost components of product A have decreased to different levels. Among them, the cost of raw materials decreases the most, from 771 yuan to 726 yuan. This phenomenon is due to the establishment of strategic partners between Xiaomi and suppliers, which improves the bargaining power of the buyer and reduces the cost of raw materials. Moreover, the user demand increases so the sales volume will increase, and the fixed cost allocated to a single product will be reduced accordingly.

Figure 9 describes the gross profit of the changes in gross profit and gross profit margin of Xiaomi from 2016 to 2019. It is described that the gross profit of Xiaomi has increased year by year.

In 2017, it had exceeded 10 billion yuan, and the gross profit margin had increased from 10.6% in 2016 to 13.23% in 2017. In the following years, the gross profit margin has also been increasing. The reason is that the products of Xiaomi are relatively diversified in recent years, and the business is relatively mature, so the profitability is also gradually improving.

**3.2. SCM Implementation Effect Based on External Value Chain.** Figure 10 represents the growth rate of China's smartphone market share from 2019 to 2020.

Smartphones are the main business of Xiaomi so the market share can reflect the competitiveness of Xiaomi in the industry. Figure 10 shows that Xiaomi's market share in 2020 was 12%, which has increased. Under the impact of the epidemic, Xiaomi's smartphone market share maintains a relatively stable growth trend, suggesting that the enterprise's SCM based on the external value chain has achieved certain results.

The study analysis shows that the SCM effect of Xiaomi's value chain is obvious. However, there are still some deficiencies in the process of cost management, such as the incomplete scope of cost management and the small amount of patent authorization. The following tables describe the existing problems and their solution in terms of the value chain, strategic positioning, and cost drivers.

Table 2 presents the existing problems and solution about product suppliers, R&D technical level, and product after-sales in terms of the value chain.

In addition to some problems in the value chain, strategic positioning is also a rising problem in cost management. Table 3 presents the existing problems and solutions about cost management organization and market positioning.

Table 4 represents the existing problems and solutions about department contact and SCM awareness in terms of cost drivers.

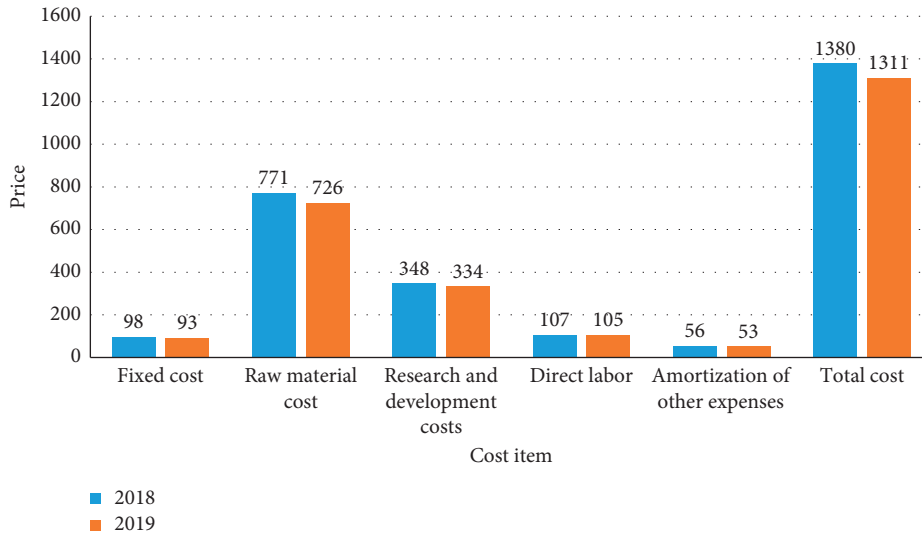


FIGURE 8: Change in cost composition of product A.

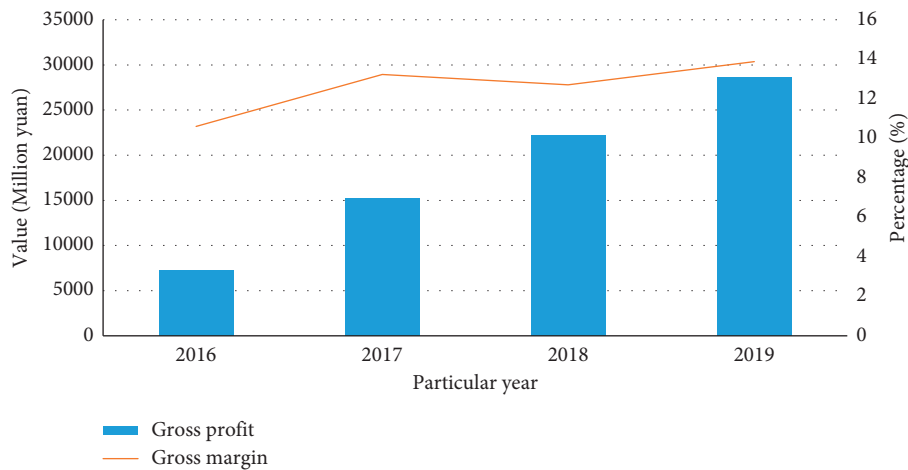


FIGURE 9: Changes in gross profit and gross profit margin of Xiaomi from 2016 to 2019.

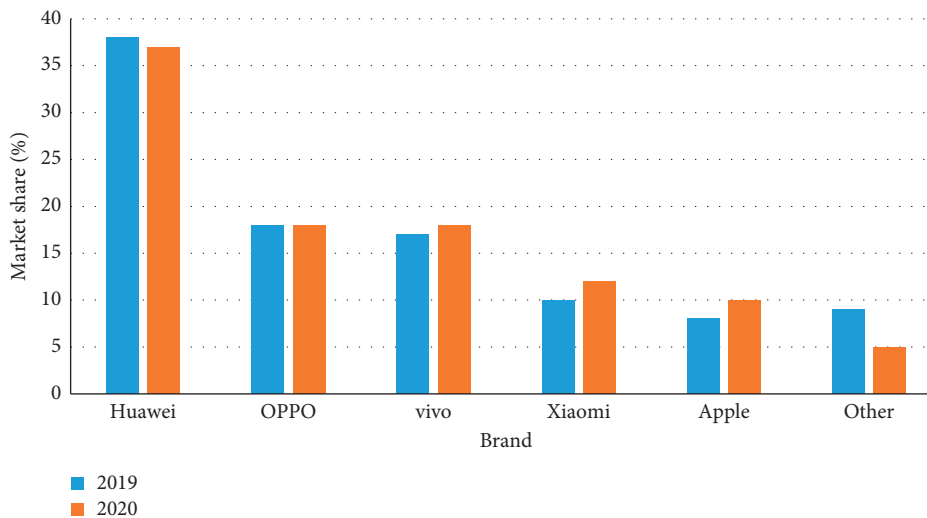


FIGURE 10: China's smartphone market share and growth rate from 2019 to 2020.



TABLE 2: Problems and solutions in the value chain.

	Existing problems	Solutions
About product suppliers	Excessive dependence on external suppliers and insufficient product supply capacity	Improve the upstream supply chain of the company and establish a supplier evaluation system
About R&D technical level	Relatively weak R&D capability and scientific and technological level strength	Increase R&D capital investment and improve the technical level and innovation ability of enterprises
About product after-sales	Imperfect after-sales service system	Improve the after-sales service system and enhance the brand reputation

TABLE 3: Problems and solutions on strategic positioning.

	Existing problems	Solutions
About cost management organization system	Imperfect cost management organization and system	Improve the cost management system and strengthen cost management
About market positioning	Inaccurate enterprise market positioning	Timely adjust the market positioning in a targeted manner

TABLE 4: Problems and solutions on cost drivers.

	Existing problems	Solutions
About department contact	The contact among various departments of the enterprise is not deep enough	Strengthen the communication among various departments of the enterprise
About SCM awareness of employees	Employees lack SCM awareness	Strengthen the training of enterprise personnel and improve employees' enthusiasm for work

## 4. Conclusion

SCM is considered an efficient and advanced cost management tool in various domains and its applications are integrated into various domains. In this research paper, we have carried out an intensive comparative analysis of our proposed method with the benchmark models. Moreover, to carry out our analysis and evaluation of the background of replication environment and financial digitization, Xiaomi, an IoT enterprise, is considered a cost management attribute. However, the strategy and effect of SCM based on the value chain of Xiaomi are discussed in detail and the comparative analysis has been provided for the evaluation and analysis purpose. Finally, a solution to the existing problem has been provided and the proposed method of evaluation has been justified and validated. The research results show that SCM based on the value chain of Xiaomi has played a positive effect in reducing the total cost per unit product and increasing the market share. From the literature, we found that there exist some issues related to SCM. These issues include insufficient innovation ability, the incomplete scope of cost management, and less patent authorization. This research is conducive to improving enterprise cost management efficiency and has a certain practical value. The deficiency is that the research is not very in-depth due to the incomplete information disclosure of Xiaomi. Therefore, the aim of this research is to analyze the strategic cost management of the case through the knowledge accumulated. However, we have also recommended future solutions and evaluation methods to decrease the cost and improve the management. Therefore, for future research directions, it is important to have a deep understanding of literature, learn relevant theories, and

take field investigation to obtain more detailed data, which can improve the existing research problem of SCM.

## Data Availability

The data used to support this study are included within the article.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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