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Abstract: Traditional product research and development work has some problems, such as information asymmetry between departments and poor connection with marketing work, which affects the progress of product marketing work. From the perspective of process management, this paper studies the interface between marketing and R&D. Based on the analysis of the disadvantages of the traditional product research and development and marketing process, the interface conditions of product research and development and marketing are integrated, the corresponding interface mechanism is established, and the department process structure is innovated on the basis of making the two achieve effective collaborative management. Through empirical analysis, it can be seen that enterprises can build a process collaborative management scheme based on customer needs and forward the customer demand information to the R&D department through the information docking platform, so as to enhance the market competitiveness of products through the effective interface between marketing and R&D.

Keywords: process management; collaborative management; marketing; product research and development.

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1 Introduction

Since the reform and opening up, China's manufacturing industry has made great progress. But with the increasingly complex competitive environment of modern enterprises, the competition among enterprises is more intense. For enterprises, product research and development and marketing are the basis for their survival and development, but the source of product research and development and technology research and development is often from the outside to the inside. The purpose of product research and development and technology research and development is to help customers realise their

value, in order to achieve this purpose, the corresponding research and development management and marketing should also carry out the corresponding management.

Although the social interest of new R&D products is high, whether they can survive in the market competition mainly depends on whether they have realised the commercialisation of products. On the contrary, products that fail to achieve customer value will affect the reputation of other production lines. Therefore, it is of vital importance to develop the products and technologies needed by the market and how to introduce new products and technologies into the market, that is, to form a virtuous cycle of product research and development and marketing model by combining R&D with marketing. For large enterprises, this is the embodiment of their core competitiveness.

At present, most enterprises often neglect the integrated management of R&D and marketing, resulting in a lack of collaboration and trust between the various functional departments of the enterprise, which delays or even hinders the development of new technologies. Reference (Xing, 2019) point out that the success of R&D requires enterprises to combine technology with service requirements. However, the current research results are still in the management level. Reference (Li et al., 2019) suggests that most products cannot be commercially successful when R&D is isolated from the market. It also makes a quantitative analysis of the docking between the R&D department and the marketing department, and holds that the effective docking is an effective guarantee to improve the R&D efficiency of high-tech products, so as to realise 'demand-driven R&D and market innovation'. Reference (Kyeong-Seop, 2019) point out that organisational innovation has a significant impact on enterprise innovation management, and its research focus also focuses on the cooperation between marketing, R&D and production departments. It is found that information asymmetry exists in R&D and marketing departments at present. Reference (Maskus et al., 2019) point out that 'demand research and development and market innovation' depends on the ability of R&D departments to connect and manage. Based on this, the basic principles of demand research and development and market innovation management are proposed, and the importance of organic combination of the two is emphasised. Reference (Cirillo et al., 2019) point out that R&D in many developing countries, including China, is out of touch with reality. Because the R&D process is disconnected from the actual situation, most product development is not actually used or converted into products. Reference (Park, 2019) In the survey, it is found that the R&D department provides detailed product information to the marketing department, while the marketing department needs to provide timely and accurate market and industry information to the R&D department. Especially product research and development, that is, when a company develops a new product, research is concentrated in multiple functional departments.

However, the current research fails to investigate from the perspective of process management mechanism and cultural integration, so it is difficult to play an effective role in guiding practice. Therefore, this study proposes a research on the interface between marketing and R&D from the perspective of process management.

2 The docking process of traditional product research and development and marketing and its shortcomings

2.1 Basic docking process

According to the different attributes, products can be divided into general products and FMCG products. In economic life, a product is often described as a vehicle that can serve customers. Product research and development has a high degree of specialisation, which requires developers to have a strong technical awareness of customer needs.

The basic process of product research and development is: approval – review – research and development – sampling – test – pilot test, including product definition, design, experiment and other steps. The challenge at this stage is to develop a deep understanding of market demand, understanding relevant laws and regulations, and avoiding product safety, transportation, storage and other special risks during the import stage to make the product viable and applicable.

a Approval: determine whether to approve the research and development project through feasibility analysis.

b Review: carry out technical review on approved products, determine technical route and make technical plan.

c Research and development: design the product design sketch in detail according to the technical route and design scheme.

d Sampling: small batch trial production, sampling sample prototype test.

e Test: product test shall be conducted according to the R&D standards to verify whether various design parameters meet the design requirements.

f Pilot test: batch test samples will be shipped to the predetermined party to check whether they meet the design requirements.

2.2 Shortcomings in the joint process of product research and development and marketing

The deficiencies in the docking process of product R&D and marketing are shown in Figure 1.

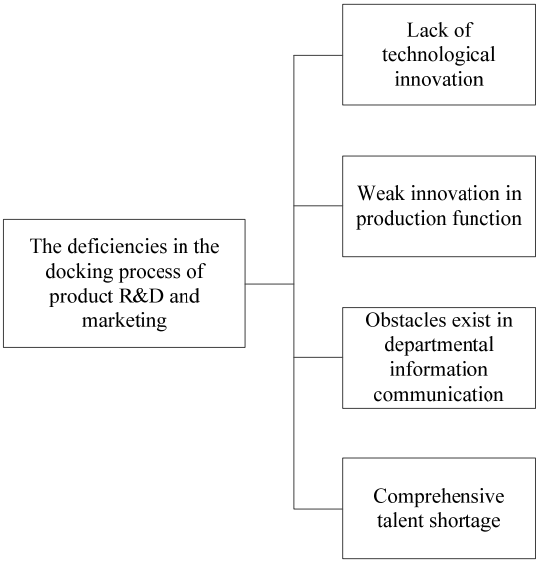
1 Lack of technological innovation. The number of products does not mean the competitiveness of the enterprise. The reason for the lack of technological innovation is that enterprises only focus on product research and development, but ignore the development of customer needs. Because the development cycle is long and the risk is high, there are fewer sustainable benefits (Sung et al., 2019; Davcik et al., 2020; Audretsch and Belitski, 2020). This situation leads to a lack of competitiveness.

2 Weak innovation in production function. The output of an enterprise is often no problem, and the quality can be well realised, but the product functions are often not comprehensive, and it is difficult to meet the market demand and customer standards.

3 Obstacles exist in departmental information communication. This obstacle hinders information transmission between departments, which is manifested as the weakened cognition of market pressure and insufficient analysis of market demand by R&D departments, resulting in reduced R&D activities, thus reducing the efficiency of production (Wang et al., 2020a; Garms and Engelen, 2019; Song and Zhao, 2021).

4 Comprehensive talent shortage. Research and development personnel often have clear goals, but the comprehensive innovation ability is poor, lack of market awareness and commercialisation consciousness. Even if the products can meet the functional standards, there are still problems in the standard use of production guidelines and tools.

Figure 1 The deficiencies in the docking process of product R&D and marketing



2.3 Related defects between product R&D and marketing system

The correlation defects between product development and marketing system are shown in Figure 2.

1 The interests and objectives of product R&D and marketing are different.

In order to achieve the overall goal of the enterprise, the functional departments must achieve efficient cooperation. Fierce competition is often reflected in the interface between various departments within the enterprise. Each functional department of an enterprise has its own goal, through the realisation of the development goal of each functional department. The management department will also evaluate each functional department.

However, functional departments usually focus on their own development goals, which lead to differences in the interests and goals of functional departments in the process of product R&D and marketing.

2 Imperfect interface mechanism leads to information asymmetry.

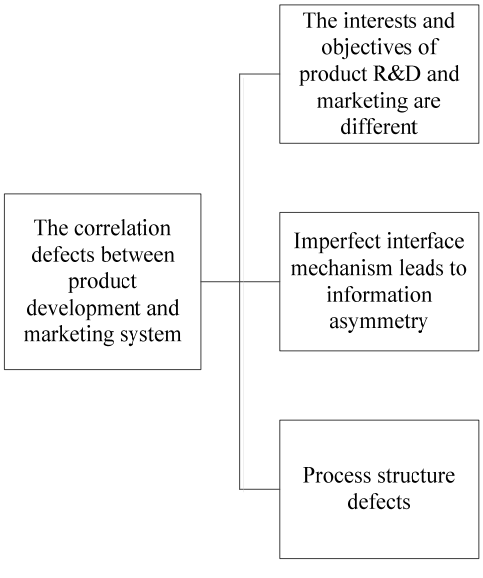
The effectiveness of docking mechanism determines the effectiveness of enterprise management. In the process of enterprise management, if we can do a good job of organisation docking, we can play a multiplier effect, and promote enterprises to achieve production goals faster (Kem et al., 2019; Wu et al., 2019; Wan et al., 2021). Smooth and effective organisation docking is conducive to the full flow and exchange of information in the organisation, so as to improve the efficiency of organisation cooperation and facilitate the enterprise managers to make scientific and reasonable organisation decisions. The more complex the product R&D and sales system is, the more difficult it is for departments to transfer information, which leads to the inefficiency of the whole team.

3 Process structure defects.

The larger the enterprise scale and the more functional departments, the more complex the management structure will be, which will produce contradictions and defects, and reduce the reliability and efficiency of information transmission. When the docking distance increases, the strangeness between departments gradually affects the actual docking effect and the gap between organisations also increases (Ruan, 2019; Wang et al., 2020b).

In addition, such as some traditional department process structure, there are defects in operation. In the process of improvement, it is bound to conflict with other functional organisations. Such a departmental process is bound to hinder the exchange of information.

Figure 2 The correlation defects between product development and marketing system



3 Analysis of integration condition of product development and marketing interface

In this section, the defects of product R&D and marketing system and the integration conditions of R&D and marketing interface are mainly analysed, so as to put forward the innovation path of R&D and marketing process based on market demand.

3.1 Set common goals that are 'needs-oriented'

'Demand-oriented' means to grasp risks and opportunities from a higher perspective, formulate product research and development strategies, improve the core competitiveness of enterprises, so as to open up a broader market (Wang and Su, 2018; Chong, 2020; Wang et al., 2020c). Facing 'demand-oriented', enterprises need to have strong investment ability and have a variety of technologies to meet the same demand of a variety of products. Enterprises need to invest a lot of human and financial resources to build production lines, tap new market resources, and carry out appropriate advertising campaigns. This content has certain requirements on the initial capital of the enterprise, and this method is not applicable to the enterprises with weak capital.

3.2 Research and development and marketing process innovation based on market demand

From the perspective of system theory, the internal R&D network and marketing network can be regarded as a common enterprise system. This system is placed in a specific enterprise environment. Therefore, it is necessary to combine R&D and marketing effectively from the perspective of overall management through a set of dynamic and self-disciplined system. For enterprises, it is very important to speed up R&D, improve R&D function and reduce innovation risk. It is the premise and basic guarantee for the realisation of the innovation goal. The process innovation with marketing research and development as the core is the only way for enterprises to succeed in innovation.

Some of the key elements of marketing include the study of market demand, the positioning of a product, the study of price, the selection of new products to enter the market, and the channels for commercial distribution. Each stage of research and development includes various elements related to the sale of innovative products. From the formation of the new product concept to the development and sale of the final product, the two need to coordinate and cooperate with each other, so as to achieve the best combination of market and technology, so as to establish an effective marketing research and development system to meet the market demand.

4 Research on the interface mechanism between product development and marketing

According to the different process structures of departments, the interface mechanism of product R&D and marketing can be divided into two parts: one is the vertical system formed by vertical activities; the other is the system formed through horizontal coordination between departments. Resource integration is the basic responsibility of

managers. In order to realise the improvement of the interface mechanism of product research and development and marketing, we must realise the integration of various modes. Horizontal integration is embodied in the close integration among the modes, and the boundaries between the modes are fuzzy and difficult to define. The second is the demand-based research and development and sales system, which is a horizontal system, it is produced in the collaboration and interaction between parallel departments and processes, which is the so-called parallel horizontal collaboration system (Meng and Shi, 2020; Wen et al., 2020). This interface needs to be connected horizontally, which, on the surface, requires the establishment of a sound R&D and marketing system and a coordinated and unified system, the monitoring of relevant factors, and the use of system methods to achieve the coordination and mobilisation of different elements. This kind of interface control is not only the interface between internal and external, between R&D department and marketing department, but also includes the cultural structure of the enterprise, the designed production system, the docking of institutionalised information, etc. (Xu and Yang, 2019; Chi et al., 2020).

4.1 Establish a mutually agreed interface mechanism to achieve interest coordination

The difference in profit distribution between R&D and marketing departments is an institutional obstacle. For example, research and development departments often use innovative, unique projects or products as evaluation criteria, while marketing departments focus on quantitative indicators such as product names, sales crosswise, and sales growth rates. The sales department wants the R&D department to provide more products to meet customer needs. Because the goal is not consistent, will inevitably make the two sides in the understanding of research and development conflict. Therefore, enterprises need to establish a comprehensive target system of the whole system to coordinate production goals such as research and development and marketing, so that the two departments can communicate and cooperate consciously for the common purpose and achieve their respective production goals. The overall interests can achieve a degree of alignment, and the two organisations can move from mutually exclusive to mutually supportive, which contributes to the overall goal of increased productivity.

4.1.1 R&D and marketing accountability mechanisms

Addressing rights and responsibilities through clear accountability mechanisms. The role of the accountability mechanism is to plan the authority and responsibility of the various functions. Various functional departments have different business crossover and marginal departments, and pay attention to the repetition and intersection of practical work to ensure the coordination and integration between functional departments. The portfolio of expertise in the R&D system is primarily used to improve the traditional accountability system of functional departments (Lai and Liu, 2019; Zhang, 2019; Guo, 2021). Accountability mechanisms emphasise specialisation and individual responsibility, and pay more attention to clear division of labour between departments. The integration of R&D and marketing requires a large amount of information exchange, and the initial model is bound to create serious systemic barriers. However, the use of professional accountability mechanisms can solve the problem of fulfilling their respective functions and can meet the need for coordination between departments. In other words, the

improvement of the accountability system can effectively eliminate the barriers to information exchange between departments caused by the system.

4.1.2 Multiple promotion mechanism for R&D personnel

Coordinating and ensuring the innovation vitality of R&D personnel is a complex problem faced by enterprise personnel managers. The employees of the R&D department expect the enterprise to provide a stage for the employees to display their talents, and require the enterprise to have a set of management system and efficiency system that can reflect the talents of the employees. For example, if the research and development personnel can make progress through excellent work, the company can offer management positions, etc. Companies argue that the replacement of a technical expert by a manager leads to an unreasonable allocation of technical staff. In this light, most of the incentive for technologists to invest in R&D is based on research results. Therefore, if there are two different promotion systems that can be used, it would be different promotion mechanisms for management and professional and technical personnel. Allow excellent R&D personnel to choose different career paths according to their own characteristics. This method also ensures the good status of the research and development personnel, and fully stimulates their enthusiasm and initiative.

4.1.3 Two-way collaborative assessment mechanism

The enterprise comprehensive evaluation system mentioned in this paper no longer evaluates each department separately when evaluating the R&D and marketing departments. In addition to the separate evaluation of R&D and marketing, the department also pays more attention to the overall evaluation of R&D and marketing systems. R&D and marketing systems focus on the characteristics of the team, so this comprehensive evaluation is usually based on the team's goals.

According to different development stages, the factors which will affect the research and development into a series of quantitative indicators, which determine the appropriate quantitative standard, from the three logical evaluation: the first logic to evaluate department, the second logic to evaluate team performance, the third logic to evaluate the role of research and development and marketing system throughout the organisation. After the mutual evaluation, individual self-evaluation, project management evaluation and enterprise general management evaluation should be combined together to achieve the harmony and unity of individual evaluation and overall evaluation. The average productivity per staff member is estimated and the public sector is estimated as a composite. The combination of compensation and punishment limits the interests of functional departments, thus enhancing the enthusiasm and unity of its members (Liu et al., 2020; Dong and Chen, 2020; Hu, 2020). Make each department give priority to the interests of the team, so that the connection between employees is closer, and there are fewer conflicts of interest.

4.2 Build an effective docking platform and mechanism

It can be seen from the analysis of the causes of the conflict between the R&D department and the marketing department that the information distortion is often the key factor that causes the obstruction of the connection between various departments within

an enterprise. The lag of managers' cognition and relevant personnel information may bring huge losses to the whole enterprise. Therefore, it is very important to ensure the reliability of information transmission.

4.2.1 Adopt an effective work connection platform

With the wide application of social platforms and e-commerce, a variety of remote tools continue to emerge. Advanced computer management department can ensure the continuous and timely transmission of information among functional departments, such as the currently commonly used Tencent, Shype and other efficient electronic platforms to provide electronic bulletin boards for enterprises. Trusted technologies can simplify and improve communication platforms, making communication between departments simpler and more effective. We believe that this kind of internal docking platform is a form of modern enterprise should establish, because it can really provide a great convenience for the development of the organisation, especially when we discuss docking management in the research and development and marketing departments. Through the electronic platform, the communication between regions and countries becomes very convenient, which provides a new model for the integration of research and development and marketing.

4.2.2 Establish an effective docking mechanism within the enterprise

At the institutional level, the docking mechanism, especially the regular meeting system of R&D and marketing departments, needs to be confirmed by relevant rules and regulations. Develop a habit of communication between different departments, especially in the development and planning stages, where such communication is more important. The enterprise must establish the standard regular meeting content, the restraint research and development and the Marketing Department. Its ultimate goal is to ensure the normal operation of the R&D and marketing system, and ensure that the R&D and marketing departments can effectively communicate the required information.

5 Empirical analysis

Taking a high-tech enterprise specialised in R&D, production and sales of textile products as an example, this paper studies the interface mechanism between marketing and R&D Based on process management.

5.1 Collaborative processing of information interfaces

The marketing department of the enterprise will forward the market information it receives to the high-level committee and the R&D department of the enterprise through the information docking platform. Then the R&D department carries out product research and development according to the requirements. The R&D department will hand over the new product specification to the sales department, which will take it as the basis for marketing and sales to be responsible for staff training. In other words, the products developed basically meet the needs of customers, so that the products produced by the enterprise can be sold. The assessment of the sales department is based on the work and

assessment of the research and development department. There is no restriction on the communication and cooperation between the sales department and the staff of the research and development department.

5.2 Collaborative management of processes based on customer needs

5.2.1 'Eagle culture' innovation and integration

The buyer's market will bring about the problem of product homogenisation, which makes price competition become the key to the survival of enterprises. In order to adapt to the changing market environment, we must redesign the domestic market chain. To be able to quickly and accurately meet the market demand is the key factor for the long-term development of enterprises. Therefore, it is necessary to overcome the internal dysfunction of enterprises and improve the quality of internal research and development. Therefore, enterprises should establish market-oriented R&D system based on departmental process structure. Create business collaboration department according to department process structure. The marketing department is in charge of product sales and the technical department is in charge of scientific research. This mode effectively eliminates the functional barriers of R&D department, solves the problems of R&D and market docking difficulties, lack of customer demand knowledge, low R&D efficiency. From the perspective of corporate culture, build the general eagle culture; especially pay attention to rapid research and development, rapid marketing, rapid response to market demand.

5.2.2 Co-management of R&D and marketing

Through the R&D and marketing departments of process management, enterprises have solved the two major problems of transforming research and development results into commodities and marketing to meet customer needs, quickly integrating into the rapid changes of the market, and effectively promoting the combination of R&D and marketing. If the product enterprise only focuses on the success of short-term projects, it cannot effectively deal with the long-term product development and marketing planning, nor can it coordinate the interface between R&D and marketing from the long-term strategic perspective of the enterprise. The current approach is used more to address such problems by establishing a workflow that is coordinated between the R&D and marketing departments. The planning department can coordinate the connection between various departments from the strategic height of the enterprise, so as to play a leading role. The senior leader is the person in charge of the planning department. He should have a clear understanding of the future development trend and strategic direction of the enterprise, be able to think about problems in the long term, and have good leadership ability. Product development is not just a solution to current market problems. The product line of an enterprise should be more forward-looking and should avoid short-term product research and development and marketing activities. Through weekly and monthly production and sales coordination meetings, the coordination between the heads of various functional departments is realised.

5.3 Collaborative management effect of R&D and marketing

After implementing the collaborative management of R&D and marketing departments, enterprises have made great progress in the research and development and sales release of new products. First, accurately communicate the market demand to the R&D department. The research and development of products separated from the needs of users cannot meet the market demand. Therefore, enterprises should develop diversified products according to the characteristics of consumer goods and the needs of customers. Therefore, the R&D department needs to investigate customer needs before marketing. Second, after the collaborative management of R&D department and marketing department, the speed of products entering the market is greatly accelerated. The R&D and marketing departments coordinate the innovation points under the specified unified process. The relevant marketing, sales and even finance departments can also work in an orderly manner. Before the planning and production of new products, the R&D department and the marketing department connect the product concept and product functional requirements, and the marketing department makes the corresponding marketing plan to ensure that everything is ready for the promotion of new products, including price setting and target market management after the trial production. This can effectively save time before the launch of the new product, so that the target customers fully understand the characteristics of the product. According to this mode of inter-department collaboration can not only save time, the marketing department of the enterprise can also inform the R&D department at any time according to the market feedback, and the R&D department can also increase the latest product design requirements. In other words, the R&D department's 'closed-door' phenomenon has been limited improvement.

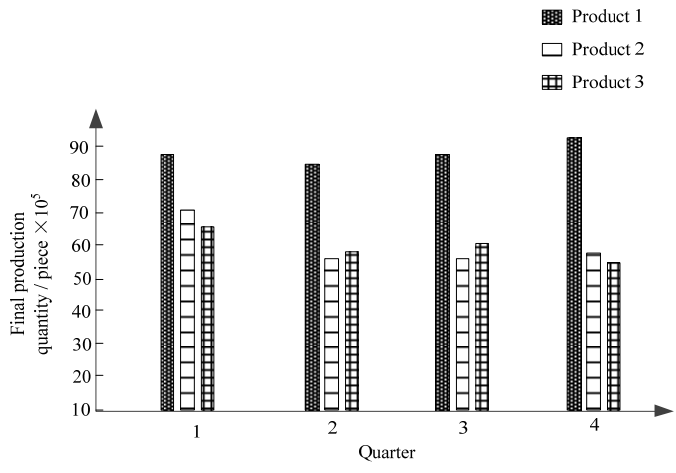
The empirical study shows that, the existing product research and development, product management and product life cycle management, are carried out under the framework of the marketing system. Under the leadership of the enterprise planning, the marketing department and the research and development department have achieved remarkable results. The time to launch new products is shortened to half a year, which greatly reduces the cost and operation cycle. Customer satisfaction has been greatly improved. With effective production management, the collaborative culture of corporate R&D and marketing departments has been greatly enhanced.

5.4 Comparative analysis

In order to further verify the application effect of the interface content of marketing and R&D Based on the perspective of process management, this paper takes the above enterprise as an example, analyses the current situation of marketing and product R&D of the enterprise, applies the research content of this paper to the production management of the enterprise, and tests the production and operation of the enterprise in four quarters, and the results will be presented in the form of data. In the empirical part, R&D efficiency (final production quantity) and marketing revenue are taken as indicators. In order to highlight the effectiveness of this study, product R&D types are divided into three groups. Product 1 is used as the experimental group, while product 2 and product 3 are not used as the control group.

The comparison results of enterprise product R&D efficiency are shown in Figure 3.

Figure 3 Comparison results of enterprise product R&D efficiency



From the analysis of Figure 3, it can be seen that in the four quarters, there are obvious differences in the R&D efficiency between the application of marketing and R&D interface optimisation method and the non application of marketing and R&D interface optimisation method. Product 1 applies the optimisation method of marketing and R&D interface, and its final production quantity is significantly more than that of product 2 and product 3. This shows that the marketing and R&D interface optimisation method based on process management can optimise the production and operation effect of enterprises.

In business management, marketing revenue is also an important indicator. Therefore, by analysing the marketing revenue of different products in different quarters, the results are shown in Table 1.

Table 1 Marketing revenue analysis of different products (ten thousand yuan)

Quarter	*Product 1*	*Product 2*	*Product 3*
1	48	36	34
2	44	30	31
3	46	30	32
4	52	31	30

According to Table 1, the marketing and marketing process of product 1 has adopted the optimisation method of marketing and R&D interface designed in this paper, and its marketing revenue is significantly higher than that of product 2 and product 3. This also shows the effectiveness of the optimisation method of marketing and R&D interface based on the process management perspective designed in this paper.

6 Conclusions

1 The interface management between R&D department and marketing department is an important part of enterprise management, which can make the enterprise adapt to the market demand and realise the maximum benefit. Therefore, combined with the

relevant theoretical basis of product R&D, this paper analyses the interface and interaction between product R&D and marketing, and puts forward countermeasures and suggestions for the collaborative management of enterprise R&D and marketing. The empirical study shows that the effective combination of R&D and marketing departments has played a positive role in the development of enterprises.

2 Although this paper puts forward some arguments on the basis of theoretical analysis and empirical research, product research and marketing is a complex and dynamic process, and the integrity of this research needs to be strengthened. Therefore, in the future, the economic dynamic analysis process will be introduced to reveal the relevance and regularity of marketing and R&D interface from a more macro perspective.

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