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Investigation of the Commercial Potential of Emulsified Asphalt Cold In-Place Recycling Based on SWOT Analysis

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Abstract

The development of the building materials industry has targeted at the research on new green, environmentally friendly, and sustainable economic products. The emulsified asphalt cold in-place recycle project owns better performance of the product, product quality, the effect of energy conservation and environmental protection, and security in comparison to traditional materials. Therefore we believe it enjoys broad prospect. Nevertheless, technology R & D companies often have certain deficiencies in the construction of business models. Therefore, this article analyzes the industry's competitive environment of emulsified asphalt cold in-place recycling, as well as uses the SWOT model to analyze the basic competitive situation of this technology industry and the advantages and disadvantages of the company's current commercial operations. Meanwhile, the important points in this paper are directed at the development issues of emulsified asphalt cold in-place recycling, laying a foundation for the innovation of its business model, and providing powerful guidance for corporate decision-makers, managers, and investors.

Keywords

Commercial Potential, Emulsified Asphalt Materials, SWOT Analysis Model, Competitive Environment Analysis

1. Introduction

Research Background

As a pillar industry in the national economy, the construction industry has made

great contributions to the development of the national economy and national defense construction. Moreover, serving as the foundation of the construction industry, building materials play a vital role (Zhu, 2018). In the current context of severe overcapacity of building materials and more mandatory requirements from the countries forcing relevant enterprises to suspend production, limit production, encourage reduction of energy consumption and reduce environmental pollution, some enterprises call for innovative development and self-rescue through transformation to meet the requirements of supply-side reforms and green development, thus better adapting to the current development situation (Zou, 2020). Therefore, green and sustainable economical new building material products enjoy broad development prospects in the building material industry.

At present, with the development of the socio-economy and the acceleration of the urbanization process in various regions, in the road-building materials industry, the maintenance needs of existing roads and the road planning of governments at all levels call for the need to build a broader road transportation network in the future, enlarging the current road maintenance-related market capacity. The broad market development prospects provide conditions for the application of emulsified asphalt cold in-place recycling. Compared with the traditional road maintenance method of re-milling and pouring roads, cold recycling material technology takes an integrated recycler as the core and applies emulsified asphalt to recycle road-surface materials. As for asphalt pavement recycling, it can handle medium and lower layer diseases, and handle continuous operations of milling, recycling, lifting, paving, and rolling, which complies with the policies and regulations of green maintenance, energy conservation, and emission reduction. During this whole project, the emulsified asphalt cold in-place recycling is the core part of the project.

Compared with traditional pavement maintenance methods and other asphalt pavement maintenance technologies, the emulsified asphalt cold in-place recycle projects have significant economic, social and environmental benefits, which objectively put them in a superior position. In comparison with traditional materials, this project is superior in terms of using effect, product quality, effect of energy saving and environmental protection, and security, enjoying a very bright future development prospect.

However, for the operation and management of the emulsified asphalt cold recycling project, when it enters the market after its research and development, it needs to go through a long-term application assessment and a large amount of capital investment, which triggers certain risks in the initial use of downstream users. Besides it is difficult to fight for the pricing power of the product with competition against traditional materials, which objectively leads to problems such as the disconnection between production and application, and the difficulty in promoting and applying products. Here comes the biggest challenge how can we promote cold recycling technology of emulsified asphalt to the public, successfully pass the introduction period of the product life cycle, smoothly enter

the growth period and occupy a certain proportion of the market segment, and then quickly grow bigger and stronger, and maintain the leading position in the industry. In order to optimize project experience management, it is indispensable to delve into the commercial potential of the project, investigate the possible business opportunities in the field of new road-building materials and monitor the development trend of external competitors.

This paper focuses on the current situation in the field of highway asphalt materials. Firstly, we employ the method of Porter's five forces model to analyze the current intensity of competition in the current industry from five aspects: suppliers, customers, substitutes, new entrants and direct competitors. Moreover, we apply the SWOT model to probe into the basic competitive situation of the industry in the field of emulsified asphalt materials, as well as the advantages, disadvantages, opportunities and threats faced by enterprises in the current commercial operation process. Then we conduct research on the product development issues under the new normal environment. This study deeply analyzes the competition situation, existing opportunities and the development direction of emulsified asphalt cold recycling technology, and provides powerful solid references and guidance for future investors, managers, regulatory authorities and project developers, ensuring the validity and scientificness of decision-making direction.

The article is organized as follows: the first section provides an overview of the industrial background of emulsified asphalt cold in-place recycling. The second section analyzes the industry competitive environment of this technology. The third section investigates the commercial potential based on SWOT analysis. The fourth section concludes the findings of this study.

2. Industry Competitive Environment Analysis

In order to further analyze the competitive edges of the emulsified asphalt cold in-place recycling in the current industry, it is vital to study the market position and market conditions of this project in the industry. By adopting Porter's five forces model analysis method to analyze the industry competitive environment of this project, we can bring together different internal and external factors more clearly into a clear and simple visual model to analyze the basic competitive situation of an industry.

Porter's five forces model unfolds the discussion of the external competitive environment of the industry from five aspects: from five aspects: bargaining power of buyers, bargaining power of suppliers, threat of new entrants, threat of substitutes, and degree of rivalry in the industry (Porter, 2014), as shown in Figure 1 below.

In view of the status of the highway asphalt building materials industry, we carry out a preliminary Porter's five forces model analysis of the competitive environment of the emulsified asphalt cold in-place recycle project from the above five aspects:

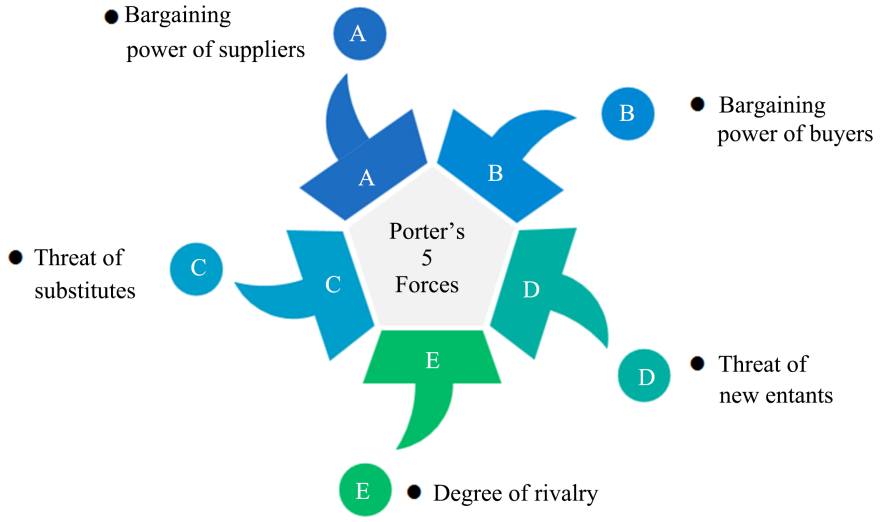

Figure 1. Porter's five forces model of enterprises.

2.1. Bargaining Power of Suppliers

If we can regard the materials, equipment and services that the company needs to purchase as a series of purchasing behaviors of the company, the current relevant suppliers of emulsified asphalt material road maintenance technology companies can be summarized into the following categories: the suppliers of main materials (such as matrix asphalt, raw materials for emulsified asphalt material production), suppliers of auxiliary materials (such as additives), suppliers of other related materials, equipment providers, outsourced labor services, transportation suppliers, rental tool buyers, etc. Judging from the above-mentioned suppliers, there are currently many domestic manufacturers of base asphalt raw materials with relatively low industry concentration ratio, which allows the company to have more supply sources to choose from. It can be seen that the company currently possesses strong bargaining power compared to the suppliers of major materials. It can rely on its long-lasting and stable procurement quantity advantage to obtain better quality products at lower prices and costs through bargaining. However, the industry entry threshold is high due to the high demand of the production of matrix asphalt, involving the sufficient supply of fixed assets and funds, the specificity of equipment, etc. Furthermore, once it enters the field of raw material production and processing, backward integration gets more tricky on account of the high exit costs and conversion costs.

2.2. Bargaining Power of Buyers

Our target customers mainly include expressway companies, local transportation systems, highway management systems, and local municipal systems. Relatively speaking, customers have strong bargaining power. Specifically, as a public functional organization, the service that the government wants to obtain is not only high-quality and cheap commodities, but also the consideration of various factors such as local economy, society, and people's livelihood. For some untapped

markets, such customers may be more inclined to adopt traditional construction methods and cooperate with enterprises with previous interest chains, such as cement, concrete, asphalt, construction materials and other processing enterprises. Because local enterprises can create more tax revenue and assume certain social responsibilities, the current relationship is relatively stable, and the transfer cost for the government to implement new products is relatively high. At the same time, traditional enterprises also have a large number of local labor services, creating more employment relationships. If they need to enter and expand into the local market, there may be greater resistance, and the implementation process gets more difficult.

For some more developed areas that have not been exploited, due to the traditional way of road maintenance and construction, and without the consideration of economic and environmental factors, the government has a relatively sufficient budget for roads, which makes it difficult to shake the division of the local market by various local enterprises. In addition, in some poorer areas, due to the constraints of relatively backward local economic development and technical level, customers may possess a negative attitude toward new technologies, and may also lack the budget for road maintenance projects. They have financial problems regarding this.

Generally speaking, with the backdrop of changes such as green production, supply-side reform to reduce overcapacity, and the government's increased support for environmental protection projects, future customers' consumption preferences will get ameliorated, and their consumption concepts will swiftly shift towards products like emulsified asphalt road maintenance technology. With the goal of pursuing lower costs, better economic results, and environmental benefits, we can objectively improve the corporate status of emulsified asphalt projects, thereby reducing the bargaining power of customers to a certain extent.

2.3. Threat of Substitutes

Substitutes that currently provide similar services are implementors or imitators of similar technologies, such as rivals applying foamed asphalt materials on the market. Such kind of competitors put pressure on our company by seizing the market with their lower costs and charges for services. Their products can also basically be used for road maintenance, however, with relatively low technical quality and effect during the implementation process. Compared with the technical construction of emulsified asphalt materials (structurally, the asphalt completely coats the mineral materials, and the cement hydration products are intertwined with the asphalt, filling the gaps and connecting the coarse aggregate to build the whole), emulsified asphalt cold in-place recycle forms a mortar with asphalt and fine aggregate, and then connect the coarse aggregate in the form of "spot welding". The process is relatively simpler during the implementation process with lower corresponding cost, and the final implementation effect gets

relatively poor. Secondly, a poor industry reputation brought by potential substitutes of new emulsified asphalt materials serves as an embodiment of the pressure that substitutes put on current enterprises. Since substitutes have relatively low cost pressure, the following possible quality problems of products for the road maintenance may affect the entire market's attitude towards the use of asphalt cold recycling technology, in turn, affecting the use of emulsified asphalt cold in-place recycle. In addition, from the perspective of marketing capabilities, although current substitutes are set in a lower position in the technical strength, such companies should not be underestimated in terms of marketing, publicity and promotion, and customer service. Therefore, when dealing with such substitutes, it's essential that the company should focus on reinforcing the degree of market development, strengthening the promotion of its own products, and improving the quality of its own products, so as to form entry barriers for undeveloped markets and improve its core competitive advantages. Finally, imitators in the industry also pose a threat. Combined with the current operating experience of emulsified asphalt cold in-place recycling, emulsified asphalt materials are easily imitated by other units, and through more targeted methods to explore potential demand markets, they bring competitive pressure and cause damage to the reputation of the industry, triggering a certain degree of loss to the company.

2.4. Threat of New Entrants

At present, for the emulsified asphalt road-building materials industry, the pressure from new entrants is relatively low, while the entry barriers for emulsified asphalt material-related industries are relatively high. The corresponding reasons are as follows. First, to enter this industry, the technical research and development work is very complicated, and high specificity is also required for the equipment and tools in experiments and test productions. Meanwhile, there is a great demand for funds during the development and operation of the project. In addition, the emulsified asphalt cold in-place recycling also relies heavily on senior talents in R & D and technology. The technology and R & D of emulsified asphalt construction materials are led by well-known scholars in the field of materials from a first-class university in China. Other well-known scientific research units and universities at home and abroad take part, supporting our project with strong technical expertise. Although there are other domestic universities and scientific research institutions conducting research on this product technology, and even bears some fruits. But compared with our project, they lack advantages in technology, talent, funds and other aspects. At the same time, after years of development, our products have gained rich experience in product design, R & D and management. At the beginning of 2020, the emulsified asphalt cold in-place recycling has yielded the third generation of technical products, forming innovative and inimitable ability. In addition, companies in the asphalt industry have already more experience in product operation, busi-

ness management, marketing and promotion, etc. The current emulsified asphalt cold in-place recycle has already a relatively stable market and target planning market, so new entrants are bound to be stricken by local companies in the industry. In the meantime, new entrants also need support from the government. Currently, the government has high entry thresholds for the road materials industry, and relevant agencies have strict technical requirements. For different regions, the strength of support from the government varies a lot, but overall, it's under tremendous stress.

2.5. Pressure from Direct Rivals

Through the analysis of direct rivals in the current industry, we can sort them into three categories: The first category is traditional maintenance construction units. They occupy a dominant position. By means of traditional ways, they perform road maintenance (that is, it's performed by re-milling and re-pouring). Due to the re-pouring of roads, there are many stakeholders involved, mainly including companies related to concrete, sandstone, lime, earth materials, steel, cement, and other construction materials in various regions, among which Chinese companies take up a large proportion, and others include some private road and bridge construction companies. Judging from the markets in various regions, this type of enterprise pursues a relatively stable environment. They often serve as strategic guardians and prefer the stability of the existing market. Once new entrants carve up their shares, they will be met with strong retaliation and response. Pressure on the other side comes from competitors using similar technologies (such as plant mix recycling technology). Although this type of technology has not been widely applied in the market, it is a great alternative compared to traditional road maintenance methods. Although it is not yet mature and faces many technical shortcomings, in terms of the development strategies of competitors, it has adopted active technological improvement methods and promoted them vigorously in the market. Although its current strength is not formidable enough, we can never ignore the direct competition. Judging from the pressure brought by this type of competitor, chances are that they may also develop and grow and become stronger players in the future. The third type is similar companies that employ this technology. They often have certain equity relationships and some technical and operational cooperation. In fact, this type of company has accumulated practical experience in the process of using this technology and has strong production and R & D capabilities. In the future, it may imitate or innovate higher-level products directed at this technology, thus posing a threat to the enterprise. As temporary partners, they are actually direct rivals in the future market, which cannot be ignored.

3. Business Potential Analysis Based on SWOT

For any new technology product, no matter what type of business operation model is adopted, it may encounter various problems and situations during the

development process. Hence, decision-makers need to conduct research on the pros and cons of the operation process of the current product's own business model. Meanwhile, it is also indispensable to analyze the product's own development issues under the new normal internal and external backdrop, identify its current competitive position, adapt to the current environment, and seize external opportunities to avoid crises. Only in this way can we better start from the original intention of enterprise development, find out the shortcomings in the original business model, and improve and enhance it.

3.1. Introduction to SWOT Analysis Model

Strategic analysis methods are mainly divided into qualitative method research and quantitative method research, of which qualitative method research occupies the majority, and many scholars use PEST analysis method (Du, 2014; Xing & Jiang, 2014) and internal and external factors analysis (Dun, 2009) when analyzing the internal and external environment. The PEST analysis analyzes the external political and economic environment, social culture, technology, etc., and lacks a connection with the internal situation of the enterprise. Compared with the former, the internal and external analysis method can combine the internal situation of the enterprise with the external environment, but its biggest defect is that it is a static analysis method and cannot adapt to the changing environmental requirements. The SWOT analysis overcomes the problems of the above methods to a certain extent. It is a method to analyze the situation of the enterprise from the perspective of the internal situation and the external environment. It also provides effective guidance for formulating its own development strategies and making decisions, by analyzing external opportunities and threats, strengths and weaknesses. In the SWOT analysis model, the combination of opportunities and advantages can result in the "active offensive" SO strategy; the combination of opportunities and disadvantages can result in the "weakness strengthening" WO strategy; the combination of threats and advantages can result in the "differentiation" ST strategy, and the combination of threats and disadvantages can result in the "defense/retreat" WT strategy (Weihrich, Cannice, Koontz, & Ma, 2011).

In order to further explore the commercial potential of the emulsified asphalt cold in-place recycling, find market positioning, and improve the existing business model, this paper adopts the SWOT analysis model, and takes the industry-leading DR Company as an example to further analyze the advantages and disadvantages of the current development of the technology, opportunities and threats outside the environment, and carry out a thorough analysis of the development status and outstanding problems of current products.

DR Company is a specialized enterprise responsible for the research and marketing of new materials in the construction industry. Due to its relatively short establishment time, the company currently has a small scale of development. 85% of the total number of employees in the company hold master's or doctoral

degrees, indicating a strong technical research and development capability. Additionally, DR Company's parent company, DR Technology, has extensive business operations in the road construction materials industry, possessing rich practical experience, marketing channels, and customer relationship networks. This provides great convenience for the promotion of this technology. Therefore, this article selects DR Company as the research subject, as it is applicable and representative.

3.2. Strength Analysis

Through the analysis of the situation of the emulsified asphalt cold in-place recycling, the advantages of this project over competitors' products are mainly reflected in the following aspects:

First, the strength of product quality. The cold-recycling method used in emulsified asphalt technology involves reusing old materials, resulting in a more successful outcome compared to conventional methods and similar competing products. In terms of product usage, it is possible to repair the semi-rigid base or minor damages of the base by evaluating the average bending value, showcasing the stable effectiveness of the product. By examining and monitoring the statistical data of relevant projects carried out in the last five years, it can be observed that emulsified asphalt projects benefit from favorable traffic conditions. Overall, the results are highly satisfactory, with no significant structural damages, thus highlighting the positive application of this technology. In relation to properties, emulsified asphalt exhibits superior strength and mechanical attributes when compared to traditional foam asphalt. Overall, emulsified asphalt offers better fatigue, crack, water damage, and high-temperature resistance, gaining a more competitive advantage.

Furthermore, the efficacy of product research and development is noteworthy. Presently, the emulsified asphalt cold-recycling technology products are a consequence of collaboration between industry, academia, and research. The project is supported by a highly skilled and capable research and development team. By partnering with renowned domestic universities and research institutes, the cooperative units carry out various aspects of the project such as research, technology demonstration, and experimentation of new products. This collaboration ensures project implementation and ongoing enhancements. Additionally, the robust research and development team, technical support team, and industry-academia-research platform serve as a firm foundation for subsequent technical maintenance and updates, as well as facilitating the research and development of the next generation of technology. Moreover, they guarantee the stability of product quality. Consequently, the influence of the benefits derived from technology research and development on a product cannot be disregarded.

Third, the strength of infrastructure. The emulsified asphalt cold-recycling technology products benefit from the assistance of various other potent supporting products within the organization. These auxiliary products primarily

contribute to the areas of product research and development, production, and marketing management. Concerning product research and production, the enterprise necessitates the utilization of multiple infrastructures in conjunction with the emulsified asphalt process. For instance, during the production and operation phase the company currently relies on mixing trucks and road Internet data platform products, which significantly facilitates the emulsified asphalt project. Furthermore, the company's extensive production and operational experience have brought about valuable insights for product development and production. Regarding product marketing, the company's other supporting products and customer relationships with related enterprises enable the provision of various services for the emulsified asphalt project, including bundled sales, purchasing, gift services, and collaborative promotion. Consequently, these efforts play a pivotal role in enhancing the marketing of emulsified asphalt cold-recycling materials.

Fourth, the strength of resources. Following the gradual implementation of the emulsion asphalt venture in Eastern China, the effectiveness and subsequent provision of its merchandise have been progressively acknowledged by clients, thus earning an initial positive reputation. Despite the current relatively modest size of the product business, it can be observed that it holds promising investment potential in recent times. The increased funding for the emulsified asphalt project has gained recognition from the group's headquarters, renowned domestic portfolio managers, investment banks, and equity investment-focused institutions, resulting in comparatively less financial pressure. Additionally, the collaboration between DR Company and esteemed university research institutes, suppliers, manufacturers, distributors, marketing research entities, and other institutions has formed a formidable strategic partnership, incorporating valuable resources such as capital, trade marketing, finance, brand development, and channel promotion. Presently, the emulsified asphalt project has successfully established a contemporary internet-based integrated platform encompassing research and development, production, quality assessment, logistical operations, procurement, and marketing endeavors, thereby ensuring the practicality of its technological advancements.

Fifth, the strength of energy conservation and environmental protection. We adopt cold regeneration technology with emulsified asphalt to recycle old pavement materials. In terms of regenerating asphalt pavement, it can address issues in the middle and lower layers and achieve a seamless operation of milling, recycling, lifting, paving, and rolling. This approach can minimize the utilization of traditional road maintenance materials like cement, concrete, steel bars, water, and other resources, thus contributing to environmentally friendly practices. The implementation of emulsified asphalt's cold-recycling technology also helps in decreasing the emission of greenhouse gases externally. Since the production of building materials heavily relies on coal as the primary energy source, its impact on the environment mainly involves the release of polluting gases and

greenhouse gases, as well as the discharge of wastewater and waste residue. Simultaneously, the reduced consumption of raw materials in the construction process results in cost savings for customers in terms of vehicle equipment, labor, and other aspects, which objectively leads to better economic performance.

Sixth, the strength of close relationships with customers. Compared to conventional road maintenance, the utilization of emulsified asphalt products for road upkeep significantly cuts down on costs for customers. By employing cold-recycling technology with emulsified asphalt, the expenses for raw materials and labor are effectively reduced, resulting in cost savings for maintenance. Additionally, this method eliminates the need for waste gravel processing and transportation, thereby minimizing the environmental pollution caused by gravel and dust. On top of these advantages, the implementation of emulsified asphalt road maintenance also offers convenience to customers. With the use of this scheme, the restoration of normal vehicle traffic can be achieved in a short period of time. According to relevant technical data, once the latest emulsified asphalt products project implementation plan is completed, a traffic closure of only 1 to 2 days is required, greatly facilitating the smooth flow of vehicles and avoiding traffic congestion and detours. Moreover, emulsified asphalt products are more convenient for maintenance and implementation compared to other construction materials for pavements. The early-stage application of emulsified asphalt regeneration technology yields high strength, with fast formation time, thereby enhancing the high-temperature stability and rut resistance of the mixture. This enables quick resumption of traffic. Such advantages hold significant practical value. Overall, the strong connection between emulsified asphalt projects and customers is evident, particularly in the local repair of pavement issues, as there is no need for prolonged traffic closure. Following road maintenance, traffic can be swiftly restored, bringing along substantial economic and social benefits.

3.3. Weakness Analysis

The weaknesses of the technical project of emulsified asphalt are mainly reflected in the following aspects:

First, there may be possible technical risks. In comparison to the conventional construction approach, the novel emulsified asphalt substances may not be fully developed. Despite the fact that the emulsified asphalt road maintenance plan has been in effect for almost a decade, it is still considerably shorter compared with the traditional road maintenance technique. As a novel method for environmental preservation, it may entail significant risks during the technical execution. These risks may manifest in the following manner: the new emulsified asphalt substances necessitate stringent requirements for both key material indicators and dosage, and the suppliers' provision of raw materials may struggle to meet the technical prerequisites. Furthermore, the proportion of emulsified asphalt substances and other supplementary materials is based on project im-

plementation experience. In the absence of adequate demonstration, it is haphazardly employed as a substitute product, which can readily result in project issues and create a negative impression on the project owner. Consequently, the technology may become entirely dormant.

Secondly, specialized equipment is required for the technical implementation. As a novel material, emulsified asphalt materials, serve as the raw material for road maintenance. The specific execution of this process necessitates the assistance of specialized equipment such as milling machinery, concrete equipment, working machines, etc. Such equipment exhibits a high level of specificity, considerable value, and substantial conversion costs. Consequently, when enterprises opt for the emulsified asphalt road maintenance scheme to carry out road cold-regeneration projects, they may need to put additional investments in fixed costs, particularly related equipment. This serves to amplify the implementation costs and assume the burden of high exit costs.

Thirdly, there is significant capital pressure. The application of new technology in maintenance has been rectified, but at a higher cost. Consequently, the project requires a larger investment, accompanied by higher fixed costs for research and development. Additionally, the technology's recovery cycle is prolonged. Considering the investment cycle required to recoup the technology, there is a potential capital risk, leading to objectively greater pressure.

Fourthly, the product project exhibits drawbacks in terms of its business model operations. Currently, although the enterprise demonstrates a high level of technical application in the emulsified asphalt project and possesses strong research and development capabilities, it lacks proficiency in project operations. DR prioritizes product research and development, design, production, and other aspects, resulting in a relatively weak focus on marketing, particularly in the establishment of a robust marketing team. Due to the limited scale of the enterprise's project, an excessive emphasis on products and technology leads the enterprise to overlook the strengthening and development of marketing and promotion to a certain extent. Throughout the ten years of actual application of emulsified asphalt project materials, the enterprise's ability to penetrate the market is confined to eastern China, specifically southern Jiangsu, Anhui, and other parts of Jiangsu. As a result, the market promotion has been sluggish, impeding the widespread acceptance of more advanced technology in the larger market. Simultaneously, the enterprise has failed to establish an extensive customer relationship network.

3.4. Opportunity Analysis

The opportunities of emulsified asphalt cold in-place recycle are mainly reflected in the following aspects:

Firstly, it confers advantages to the external economic and societal context. In the current economic landscape, the Chinese government's active promotion of supply-side reform and the adjustment of the new economic structure for the

building materials industry has prompted various entities to actively respond to the nation's new industry guidelines. The National Development and Reform Commission, the Ministry of Industry, industry professional associations, enterprise groups, and other government departments have actively participated in the formulation and execution of relevant documents. Over the past two years, policy documents concerning the elimination of cement and plate glass, as well as the comprehensive elimination of outdated production capacity, have created favorable conditions for the application and advancement of present-day emulsified asphalt technology projects.

Secondly, government policies are providing encouragement. Presently, the Chinese government is tirelessly enhancing support for research and development, as well as the production of novel technologies aimed at energy conservation and emission reduction. This includes offering policy support for the incubation of new materials and new technologies. Currently, local governments explicitly offer tax incentives to enterprises utilizing new materials and new technologies. Simultaneously, various provinces are intensifying financial support and rewards for qualified high-tech enterprises through by means of expedited certification, financial subsidies, etc. This creates a favorable policy environment for the large-scale development and commercialization of emulsified asphalt technology projects.

Thirdly, there is ample availability of resources. The research and development unit for the emulsified asphalt project is presently situated in a city within southern Jiangsu province, occupying a favorable geographical advantage. This region boasts convenient road transportation and a well-established road construction network. Its influence extends to Jiangsu, Shanghai, Zhejiang, Anhui, and other regions in East China, enabling project enterprises to tap into a wider range of resources, among which there are abundant technical educational resources, human resources, financing resources, and other infrastructure resources, creating an exceptionally resource-friendly environment for the development of emulsified asphalt projects.

Fourthly, the broad market space. Since the object of the emulsified asphalt cold in-place recycle is the road, the national road maintenance service can be regarded as the service goal of the enterprise, and the market can be expanded from the current market in East China to other markets in the country. With the acceleration of the urbanization process in various regions, there is a large demand for the expansion of the construction of roads. At the same time, the rise of the "rural road" policy can also attract the potential development customers of emulsified asphalt projects. In addition, the more frequent economic activities of enterprises and people's economic and social life, it cause more pressure on the road surface, which also objectively reduces the service life of the road, thus increasing the demand for road maintenance and bringing development opportunities to the road maintenance of emulsified asphalt project. In general, the current market capacity of emulsified asphalt is very large, and there are many

untapped markets, so the emulsified asphalt maintenance scheme has a very broad development prospect in the future.

3.5. Threat Analysis

The threat of emulsified asphalt regeneration technology is mainly reflected in the following aspects:

Firstly, there is a concern regarding the presence of direct competitors in the market. Currently, these direct competitors predominantly arise from conventional methods (the original discarded pavement milling plane, heavy new pavement). These competitors encompass cement production companies, concrete production companies, as well as traditional pouring vehicle equipment production companies, among others. Consequently, the competitors and stakeholders involved in the emulsified asphalt initiative are considerably widespread, which inherently poses a threat to emerging enterprises. When attempting to introduce the emulsified asphalt project to different regions nationwide, challenges arise not due to product or technological limitations, but rather from the complexities inherent in the relationship between society and interests. These stakeholders, particularly road and bridge construction companies, are predominantly locally owned state enterprises. The government must consider the survival and support of these state-owned enterprises, which leads to a certain degree of exclusion towards foreign enterprises. Additionally, local private construction companies hold significant influence. They are often able to establish a stable network of relationships with local governments and relevant enterprises, thereby impacting decision-making processes regarding technical solutions. Consequently, the promotion of the new technology of emulsified asphalt will substantially occupy the market share and profit margins of such enterprises in the maintenance market, and the individuals responsible for these enterprises will assume certain risks associated with the new technology. As a result, the emulsified asphalt project of DR Company will encounter substantial resistance when attempting to expand into new markets.

Secondly, threats from potential entrants such as similar road maintenance technology materials. Represented by foam asphalt regeneration technology, in the domestic research and development foundation and application, there's a large number of this type of related enterprise. As an equipment manufacturer, "Wittgen" is also sparing no effort to promote the expansion of its products, and it is also taking measures to carry out the research and development of road maintenance materials projects, which may become a potential threat to the enterprise. From a technical point of view, foam asphalt has its own characteristics and applicable conditions. The construction process is close, but the overall performance is slightly worse than this technique, mainly due to the lack of water stability, which is not conducive to the use of rainy areas in the south. In the early years (about 2010-2015), there was a large area of promotion in Jiaxing and other places in Jiaxing, Zhejiang province, but the effect was not ideal. At

present, the technology is also under continuous research and improvement. Usually, related enterprises will promote it at a lower price, and directly form a competition through pricing strategies. Overall for this kind of alternative or potential competitors, although the performance is worse than emulsified asphalt materials, they may have lower costs. At the same time, this kind of product enterprises may have a good advantage in some markets, such as customers, upstream and downstream enterprises, regulators and other agencies better relationships, etc. Objectively they are also a threat.

Thirdly, the threat from the stakeholders. The promotion of the emulsified asphalt cold in-place recycling may damage or reduce the interests of other units and departments. Therefore, the interests of various interest groups need to be considered in the market promotion, which is also a factor that cannot be ignored.

Fourthly, the threat of copycats. In terms of road construction, the imitation of technical processes is the inherent characteristic of China's transportation industry. Due to the strong openness of the technological process during construction, any unit or individual has access to it at any time, and the production process is no secret at all. In the material, it is easy to find the general substitute (usually there is a large gap in quality with lower prices). Driven by interests, the general enterprises has no choice but to cheat in work and cut down on materials to imitate or copy.

Table 1. SWOT analysis results of cold regeneration technology products of emulsified asphalt.

External Factor / Internal Ability	Strength	Weakness
	● Product quality ● Product research and development ● Infrastructure ● Energy conservation and environmental protection ● Close relationship with customers	● Possible technical risks ● High maintenance costs ● Requirements of supporting equipment for technical implementation
Opportunity ● Broad market space ● Favor for the external economic and social situation ● Government policy encourages ● Rich availability of resources	**SO**—strategy—Combination of strengths and opportunities ◆ (Strategies that may be adopted) ◆ Maximum development	**WO**—strategy—Combination of weaknesses and opportunities ◆ (Strategies that may be adopted) ◆ Make use of opportunities and avoid weaknesses
Threats ● The threat from the direct competitors ● The threat of copycats ● Threats from the stakeholders ● Threat of potential entrants	**ST**—strategy—Combination of strengths and threats ◆ (Strategies that may be adopted) ◆ Make use of advantages and reduce threats	**WT**—strategy—Combination of weaknesses and threats ◆ (Strategies that may be adopted) ◆ Shrink, peel, and merge

4. Conclusion

From the value perspective, this paper examines the commercial potential of cold-recycling technology for emulsified asphalt through the application of Porter's five forces analysis model and SWOT model. The findings of this study are summarized in Table 1. The constructed five-force analysis and SWOT analysis models effectively depict the present internal and external circumstances of emulsified asphalt cold regeneration technology products and the ongoing project status. These models serve as a valuable reference for the future commercial advancement of emulsified asphalt cold regeneration technology.

In general, the current emulsified asphalt road maintenance project continues to grow. However, it carries a notable management risk. To mitigate this risk, enterprises must capitalize on their inherent advantages, seize foreign opportunities, maximize development potential, address internal weaknesses, and implement measures to minimize external threats. In instances where there are weak links in the value chain during the development process, contraction and stripping strategies should be employed to enhance overall value creation efficiency.

This study enriches the current case studies on the business models in the road construction materials industry. It also provides favorable references for the decision-making of relevant stakeholders. Additionally, other related enterprises can draw on the research findings of this study to promote business model innovation in other products as well. To achieve better commercial application results, relevant enterprises should focus on the following points:

- Deepen the integration of industry, academia, and research to strengthen talent development.
- Optimize the value chain structure by adding value-added processes.
- Strengthen customer relationship building and expand promotion channels.
- Establish mechanisms for sharing and exchanging customer and stakeholder information resources.
- Build advantageous resources and develop core competitiveness.

Presently, the associated projects involving emulsified asphalt technology are in the tracking phase. Since the current products are still in the growth stage and external environmental factors are subject to rapid changes, further verification may be required to validate the results presented in this paper. Subsequent research will focus on quantitative analysis of the technology, gathering financial and operational management data from related enterprises during the development process, and employing quantitative methods to evaluate the qualitative conclusions of this study. These efforts aim to enhance the reliability and validity of the research findings.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Du, X. Y. (2014). PEST Analysis of the Macro Environment for Corruption Governance during China's Economic Transition Period: Based on Panel Data Analysis from 1990-2012. *East China Economic Management, 28,* 132-137. (In Chinese)

Dun, C. H. (2009). Case Analysis of the Design and Implementation of ERP Financial Control System. *Business Accounting, No. 24,* 47-48. (In Chinese)

Porter, M. E. (2014). *Competitive Strategy Techniques for Analyzing Industries and Competitors*. CITIC Press. (In Chinese)

Weihrich, H., Cannice, M. V., Koontz, H., & Ma, C. G. (2011). *Management: A Global and Entrepreneurial Perspective*. Economic Science Press. (In Chinese)

Xing, L., & Jiang, S. M. (2014). Research on the Driving Forces of Yunnan's Tourism Industry Development Based on PEST Analysis. *Academic Exploration, No. 5,* 71-75. (In Chinese)

Zhu, W. J. (2018). The Status of China's Construction Industry in the National Economy, Its Current Development, and Financial Service Strategies. *Chinese and Foreign Entrepreneurs, No. 4,* 6-8. (In Chinese)

Zou, T. (2020). Development Status and Future Prospects of New Construction and Decoration Materials in China. *Building Materials and Decoration, No. 5,* 52-53. (In Chinese)