

Research on the business model of papermaking enterprises under the background of low carbon

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Abstract

Papermaking enterprises are not only the source of paper and paper products for consumers, but also the forest industrial enterprises with the highest carbon emissions in China. With the registration and production capacity of paper enterprises increasing year by year, consumers' demand for paper and paper products has been satisfied. However, most domestic papermaking enterprises also produce a lot of carbon emissions because of business model problems such as traditional mode of production, emphasis on production over management, lack of awareness and capacity of low-carbon transformation and so on. Obviously, papermaking enterprises' business models, which gain benefits at the expense of the ecological environment, does not match the requirements of social low-carbon development. From a long-term point of view, this is not conducive to papermaking enterprises to achieve their own sustainable development. Therefore, combined with the low-carbon background, it is very necessary to study the business model of papermaking enterprises. This paper has studied a large number of literature on the business model of papermaking enterprises under the low-carbon background by using the method of literature analysis. This paper has described the business model of papermaking enterprises, depicted the carbon emission footprint of the business model of papermaking enterprises, and summarized the key influence of low-carbon concept on the business model of papermaking enterprises.

Keywords: Papermaking enterprises, Low carbon, Business model, Business model canvas

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I. INTRODUCTION

Climate change has become one of the hot topics in the international community since the 1980s. Since the 1990s, the United Nations Climate Conference has gradually established international climate norms based on the *United Nations Framework Convention on Climate change (UNFCCC)*, the *Kyoto Protocol* and the *Paris Climate change Agreement (Paris Agreement)* according to the conventions / agreements of multilateral environmental agreements[1]. They all list carbon dioxide as one of the main greenhouse gases that cause global warming. Today, global climate governance is in the stage of full implementation based on the *Paris Agreement*[2]. On September 3, 2016, China joined the *Paris Agreement* and became one of the signatories. In order to fully achieve the relevant goals in the agreement, in September 2020, at the 75th session of the United Nations General Assembly, China solemnly promised the world that carbon dioxide emissions would reach the peak by 2030 and achieve carbon neutrality by 2060[3].

Papermaking enterprises, wood processing and wood, bamboo, rattan, brown, grass products enterprises and furniture manufacturing enterprises are classified as forest industrial enterprises, which are the main economic activities based on forest output. Papermaking enterprises are also the forest industrial enterprises with the highest carbon emissions[4]. With the increasing demand for paper and paper products in China, the registration of paper-related enterprises in China is also increasing year by year. According to the statistics of China Business Industrial Research Institute, the number of paper-related enterprises registered in China was 5836 in 2021, an increase of 36 over 2020 and 2290 over 2019[5]. The growth of the number of papermaking enterprises undoubtedly promotes the improvement of the national economy, but it also warns us that if we do not carry out scientific low-carbon management in papermaking enterprises, the carbon emissions generated by papermaking enterprises will be expanded to a greater extent. This not only affects the development of social environment, but also hinders the papermaking enterprises to establish sustainable competitive advantage and achieve long-term development. Business model has always been a hot topic in the field of management, and it is widely regarded as an effective means to help enterprises create, delivery and capture value. By drawing a business model canvas, managers can have a clear understanding of the operation

and profitability of the enterprise. Based on the above, it is urgent to solve the high carbon emissions in business model of papermaking enterprises. However, there is still a lack of discussion on this issue in previous studies. Therefore, this paper makes an in-depth study of this problem, trying to help papermaking enterprises find the problem of carbon emissions in the business model, and lay the foundation for the follow-up low-carbon business model innovation of papermaking enterprises.

II LITERATURE REVIEW

2.1 Low carbon

In general, carbon emissions refer to greenhouse gas emissions caused by human activities or naturally. According to the No. 19 measures for the Administration of carbon emissions Trading (trial) recently approved by the Ministry of Environment of China, carbon emissions refer to greenhouse gas emissions from fossil energy combustion activities such as coal, oil, natural gas and industrial production processes, as well as activities such as land use change and forestry, greenhouse gas emissions caused by the use of purchased electricity and heat. Greenhouse gases refer to the natural and man-made gaseous components that absorb and re-emit infrared radiation in the atmosphere, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). In recent years, carbon peak and carbon neutralization have become important goals of global low-carbon development. Peak Carbon Dioxide Emissions means that at some point, carbon dioxide emissions of carbon emitters reach a historical peak and show a gradual decline, which is the historical inflection point of carbon dioxide emissions from growth to decline[6]. Carbon neutralization (Carbon Neutrality) refers to the absorption of carbon dioxide emitted directly or indirectly by human activities such as afforestation within a specified period of time (usually one year), so as to offset each other and achieve zero carbon dioxide emissions[6]. In order to achieve carbon peak and carbon neutralization, people began to take various carbon reduction and carbon sequestration measures. As the name implies, carbon reduction is to reduce carbon emissions in a variety of ways, and this term is often well known. In contrast, people's understanding of carbon sequestration is still shallow. Carbon sequestration is a measure that can increase the carbon content of carbon pools outside the atmosphere. The existing carbon sequestration methods can be divided into physical, chemical and biological methods[7]. The physical method realizes land aquifer and deep-sea carbon storage mainly through dissolution and phase transformation; the chemical method is to synthesize chemicals such as ethanol by the reaction of hydrogen, water and methane with carbon dioxide or to combine carbon with chemicals to form organic compounds (organosilicon, organophosphorus and epoxy resin, etc.). In a broad sense, biological carbon sequestration refers to natural carbon sequestration, that is, the absorption of carbon dioxide through plant photosynthesis, including forest, grassland ecosystem and agricultural carbon sequestration (soil and crop carbon sequestration)[8]. For example, forest carbon sequestration (Forest Carbon Sinks) is the amount of carbon dioxide that a forest absorbs and stores. The ability of forests to absorb carbon dioxide is affected by forest net productivity and cutting age, especially the input and turnover rate of forest soil carbon[9].

2.2 Business model

The term "business model" was put forward as early as the 1840s, and it still attracts much attention in academic circles. Scholars are also in full swing to discuss the meaning, element composition and research framework of business model. However, so far, the concept of business model has not been unified. As one of the first scholars to define a business model, Timmers (1998) believes that a business model is an architecture that includes products, services, and information flows, and that the architecture also includes a description of the roles, potential interests and sources of revenue of the participants[10]. Osterwalder et al. (2005) have described the business model as the value that an enterprise can provide to one or more segmented customers, and the framework for the company and its partner network to create, market, and deliver this value and relationship capital to generate profitable and sustainable revenue streams. They also have proposed the nine modules that make up the business model[11]. Zott and Amit (2010), experts in the field of business model, have shown that business model is a system containing all kinds of interdependent activities, which is run by enterprises and their partners, and it is also an important mechanism for connecting these activities to each other[12]. Sadowska et al. (2023) have interpreted the business model as a way to generate revenue and value[13]. In view of the fact that the business model described by Osterwalder et al. (2005) is more comprehensive and more in line with the content of this paper, the discussion of business model in this paper will be carried out on this basis. The concept of business model is the connotation of business model, and the constituent element of business model is the extension of business model[14]. The existing research classifies the elements of business model differently. For example, some scholars classify them from the perspective of the basic composition of management terms such as strategy and organization, and some generalize them from the perspective of enterprise supply chain and value chain. The research of this paper is based on the nine elements of the business model proposed by Osterwalder et al. (2005) and Osterwalder and Pigneur (2019). Osterwalder,

etc. have divided the elements of the business model into four aspects: product, customer interface, infrastructure management and finance, which includes nine basic elements: customer segment, value proposition, channel, customer relationship, revenue stream, key resource, key partner, key activity and cost structure[11, 15]. See in the Table 1. Moreover, Osterwalder, etc. have distributed these nine elements in the business model canvas. See in figure 1.

Table 1: Nine elements of business models[11, 15]

Main interface	Element	Description
Production	VP	Provide panoramic view of enterprise products and services.
	CS	Describe the customer segment that enterprises want to provide value.
Customers	CH	Describe the ways in which enterprises connect with their customers.
	CR	Explain the specific relationships established between the enterprises and their different customer groups.
	KA	Describe the arrangement of various activities and resources of enterprises.
Infrastructure management	KR	Demonstrate the ability that enterprises must have to run business models.
	KP	Display the cooperative network with other enterprises, which is necessary to effectively provide and commercialize value.
	C\$	Summarize the capital requirements of the business model operation.
Finance	R\$	Describe the way companies make money from revenue streams.

Source: according to the research data of Osterwalder et al. (2005) and Osterwalder et al. (2019).

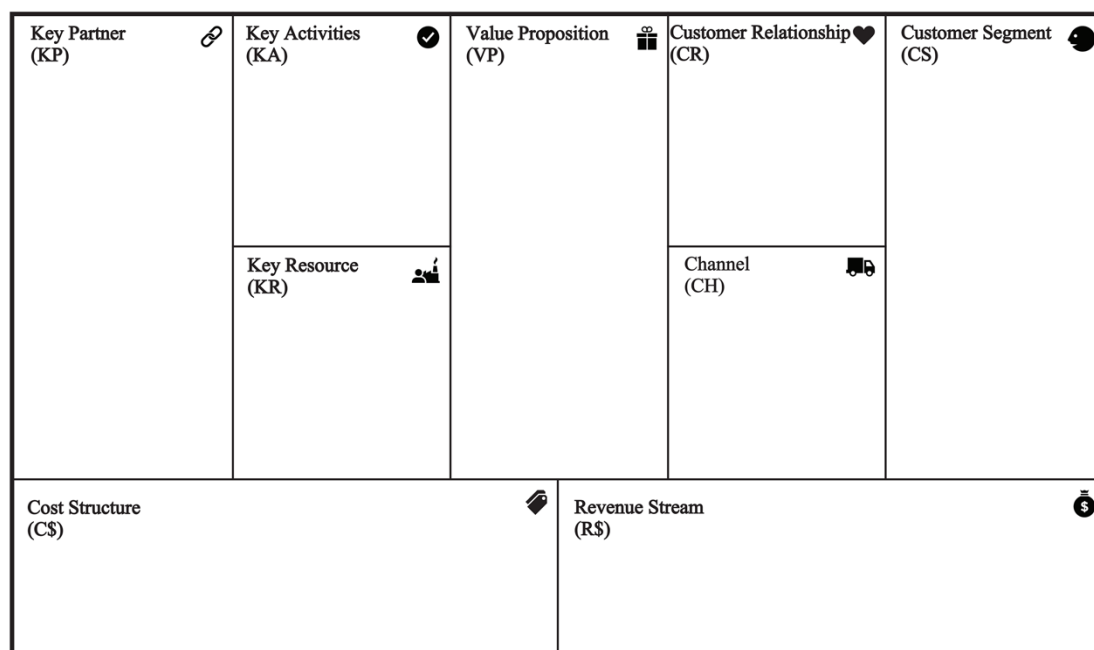


Figure 1: Business model canvas[15]

2.3 Low-carbon business model

At present, there is a great lack of research on the low-carbon business model. Only Hall et al. (2020) have proposed to meet the five basic requirements of a clear heating and electricity transport strategy and adequate carbon price can make the low-carbon business model of the UK energy system flourish[16]. Low-carbon is one of the emerging trends in the field of green business model. Low-carbon business model is an important branch of green business model, that is, there is an inevitable internal relationship between low-carbon business model and green business model. In view of this, this part expands the scope of the literature to green business model, so as to deepen the research in the field of low-carbon business model. “Sustainable innovation” is the biggest research hotspot in this field. Other hotspots include “value acquisition” and “green niche market”. “Circular economy”, “value creation” and “low carbon” are the emerging trends of green business model research. The rest of the piecemeal studies focus on the impact and implementation of green business models. Low carbon is one of the emerging trends in the field of green business model. At present, there is a lack of literature on this. Only Bergmann and Utikal (2021) have helped start-ups develop solutions by developing green business models of start-ups, thus promoting society to complete the low-carbon

transformation[17]. With regard to sustainable innovation, Song et al. (2022) believe that sustainable innovation is an innovation model based on sustainable development, and there are more and more public policies that encourage sustainable innovation[18]. Rantodo (2019) has focused on the social aspects of sustainable development and argues that integrating social sustainable development goals into business models can promote sustainable innovation[19]. With regard to value acquisition, Evans et al. (2017b) have put forward five propositions about the value acquisition of green business model, which laid the foundation for the innovation of green business model in terms of concept[20]. With regard to the green niche market, Schaltegger et al (2016) have analyzed the evolution path of the business model from the traditional mass market to the green niche market with the goal of sustainable development with the help of theoretical framework[21]. With regard to circular economy, it is the ultimate goal of many green business model studies. Fonseca and Domingues (2018) believe that the willingness to improve environmental performance and achieve a sustainable business model has a positive impact on the level of enterprises to achieve circular economy[22]. With regard to value creation, Shakeel et al. (2020) have showed that sustainable business model innovation can be achieved through sustainable value proposition and delivery innovation, value capture and value creation[23]. With regard to the rest of the research on the green business model and its impact, Geissdoerfer et al. (2018) advocated that the green business model can enable multiple stakeholders to actively take management actions that can create value for the enterprise in the long run[24]. Lüdeke-Freund (2014) has further emphasize that the green business model creates, distributes and acquires value to all stakeholders in a way that does not consume natural, economic and social capital[25]; In the implementation of green business model, Goni et al. (2021) have constructed a theoretical framework to describe the characteristics of green business model, which helps relevant practitioners understand the essential aspects of sustainable implementation[26]. However, given that the establishment of a green business model is affected by many factors, Bertoni (2017) has figured that little research has been done to explore ways to establish a viable green business model[27].

2.4 Low-carbon business model of papermaking enterprises

There is a lack of research on this issue, but there are many studies on papermaking enterprises, among which the treatment of industrial waste, especially wastewater, is the hottest research topic. Kumar et al. (2021) have proposed that the paper industry discharges a large amount of sewage and non-ferrous wastewater every year[28]. Mavroulidou and Shah (2021) have pointed out that the annual municipal solid waste produced by the paper industry accounts for 25%, 40% of the world's municipal solid waste, mainly including a large amount of paper sludge and ash[29]. In addition, the carbon emissions and emission reduction of papermaking enterprises have also attracted the attention of some scholars. Del Rio et al. (2022) have argued that the paper industry is one of the five most energy-consuming industries in the world, accounting for about 6% of global industrial energy use and 2% of direct industrial carbon dioxide emissions[30]. Griffin et al. (2018) have suggested that a significant reduction in greenhouse gas emissions in the UK paper industry in the long run mainly depends on the adoption of a few key technologies, such as energy efficiency and heat recovery technologies, bioenergy (with or without cogeneration) and cogeneration, and decarbonization of electricity supply[31]. Mobarakeh et al. (2021) have believe that in the production process of paper enterprises, compared with the applied technologies (chemical pulping and paper drying), steam supply electrification, that is, by replacing fossil fuel boilers (such as commercial electric boilers or heat pumps) with direct heating, emissions can be reduced by up to 75%[32]. There are also a small number of scholars who have studied the business model of papermaking enterprises. Early on, Dansereau et al. (2012) have pointed out that the concept of biological refineries is emerging as a promising solution to improve the basic business model of the pulp and paper industry[33]. In recent years, circular economy has attracted more attention. Brunnhofer et al. (2020) have carried out research on European pulp and paper industry (PPI). They believe that although PPI is a more mature industry, PPI needs to change its business model to improve profitability and contribute to climate change mitigation as the world pays more and more attention to circular economy[34]; Sopelana et al. (2021) have introduced the framework design and implementation of circular business model innovation from the perspective of the whole value chain and supply chain with the help of a papermaking enterprise[35].

III METHODOLOGY

In view of the fact that this paper is combined with the low-carbon background to study the business model of papermaking enterprises, trying to depict the business model of papermaking enterprises and explore the carbon emission problems, whether the exploration of previous research results is comprehensive and in-depth can directly determine the quality of this paper. Therefore, this paper mainly uses the method of literature analysis to collect and study a large number of documents about low-carbon, business model, low-carbon business model and low-carbon business model of papermaking enterprises. Additionally, this paper collates and analyses the important theories put forward in the literature. It proves the feasibility of the article in theory, and lays a solid theoretical foundation for the follow-up description of the business model of

papermaking enterprises and finding out the problem of carbon emission.

IV RESULTS AND DISCUSSION

4.1 Business Model elements and canvas of Papermaking Enterprises

Osterwalder divides the business model into nine modules and distributes them evenly across the business model canvas to visually describe, evaluate and change a business model[15].

(1) Key Partner (KP)

Obtaining raw materials and equipment for pulp, paper and paperboard is the ultimate goal of important cooperation among papermaking enterprises, so the important partners of papermaking enterprises mainly include raw material suppliers, papermaking equipment suppliers and material suppliers[36, 37]. Among them, raw material suppliers mainly provide pulp manufacturing main materials (mainly wood, waste wood and waste paper suppliers) and papermaking accessories (various chemical additives); papermaking equipment suppliers mainly provide mechanical equipment and accessories such as pulping equipment, paper making machines, paper coilers and paper cutters. Material suppliers mainly provide products such as lubricating oil, papermaking wire and fire safety equipment, which are indispensable in papermaking, although they are in small demand.

(2) Key Activities (KA)

Production activity is the core business of manufacturing enterprises, papermaking enterprises as a typical manufacturing enterprises, the production and sale of paper and paperboard[38] is the key activities to ensure the successful operation of enterprises.

(3) Key Resource (KR)

The development of papermaking enterprises is inseparable from papermaking equipment and technology[39]. In addition, factories, technical workers and sales staff are also important conditions for the smooth operation of papermaking enterprises. Therefore, the core resources mainly include physical resources (pulping and papermaking equipment and plants), knowledge resources (papermaking processes) and human resources (technical workers and sales staff).

(4) Value Proposition (VP)

Pulp, paper and paperboard are the core tangible products produced and sold by traditional papermaking enterprises[40]. At the same time, service ability has always been one of the important factors affecting the core competitiveness of papermaking enterprises[41]. Therefore, in addition to pulp, paper and cardboard products, paper enterprises also provide customers with product-related customized or order tracking and other intangible product supporting services.

(5) Customer Segment (CS)

The direct customers of papermaking enterprises are mainly paper products enterprises. According to the types of products produced by papermaking enterprises, the customers they serve can be subdivided into household paper enterprises, cultural paper enterprises, special paper enterprises and packaging paper enterprises[42].

(6) Customer Relationship (CR)

In the face of the increasingly fierce market competition and the aggravation of the degree of product homogenization, the market environment of papermaking enterprises gradually shifts to the buyer's market. Therefore, papermaking enterprises often need to take measures to reduce product prices, improve product quality, build product brands and provide quality services to maintain or develop long-term customer relationships[40, 43-45].

(7) Channel (CH)

Papermaking enterprises generally sell offline products through sales offices, authorized dealers and retailers[46]. With the continuous maturity of Internet technology, papermaking enterprises are gradually selling online products through Internet channels[47].

(8) Cost Structure (C\$)

The cost structure of papermaking enterprises can be roughly divided into two categories, the first category is production cost, which accounts for the highest proportion in the whole cost structure of papermaking enterprises. it mainly includes raw material cost (pulp raw material cost and chemical material cost), energy power cost, freight in the production process, packing cost, depreciation, labor cost and so on[48]. Among them, about 60% of the paper production cost is the pulping cost, and another 10% is the energy cost needed for the operation of the equipment. The second category is the marketing cost, which mainly includes dealer agency fees, market development and maintenance costs, product promotion (advertising, manual publicity, etc.) expenses.

(9) Revenue Stream (R\$)

The source of income of papermaking enterprises is relatively simple, mainly relying on the production of paper and cardboard sales to customers for profit. Therefore, the income from the sales of paper and paperboard is its source of income. [49].

To sum up, the contents of these nine modules are drawn into the business model canvas (see figure 2 below), which visually shows the business model of papermaking enterprises.

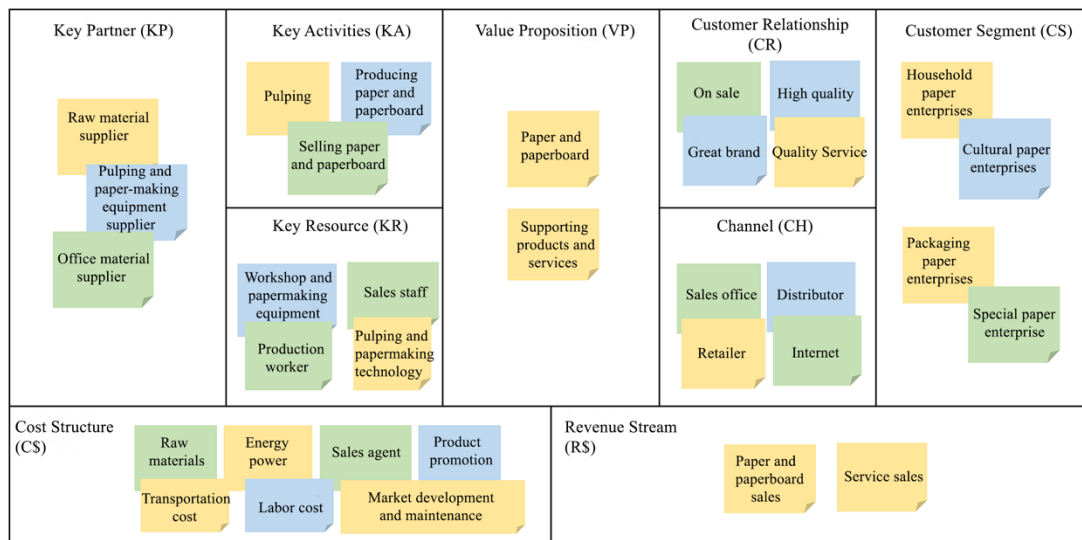


Figure 2: Traditional business model of papermaking enterprises

4.2 Carbon footprint of Business Model of Papermaking Enterprises

The previous section describes in detail the elements of the business model of papermaking enterprises and gives the canvas, but it cannot directly show the carbon emissions within its business model. Therefore, this paper tracks the carbon footprint of the business model of papermaking enterprises in this section, in order to provide a scientific guarantee for the later innovation of the business model of papermaking enterprises under the low-carbon background.

The carbon emissions of papermaking enterprises mainly come from two aspects: internal carbon emissions and out-of-enterprise carbon emissions.

The carbon emissions in papermaking enterprises are mainly caused by the carbonate decomposition process added during pulping, the combustion of fossil fuels used in the pulping and papermaking process and the anaerobic treatment of papermaking wastewater. On the other hand, the external carbon emissions of papermaking enterprises mainly come from the decline of forest carbon sequestration capacity caused by deforestation, the purchase of thermal power for the thermal power demand of the whole enterprise and the transportation process of various materials such as raw materials and products. Among them, fossil fuels produce the highest carbon emissions. According to the research of Zhao et al. (2019), when cogeneration is carried out in papermaking enterprises, fossil fuel combustion produces the largest carbon emissions[50]. Similarly, Yu Yue (2018) also found that the combustion of fossil fuels is the main source of carbon emissions after modeling and studying the carbon emissions of papermaking enterprises[51]. The carbon emissions of papermaking enterprises are detailed in figure 3 Through the above analysis and diagram, we can clearly understand the links of carbon emissions generated by papermaking enterprises in the production process and outside production. This is conducive to this paper combined with the low-carbon background of the paper enterprise business model innovation more targeted design of a new business model to control or reduce carbon emissions.

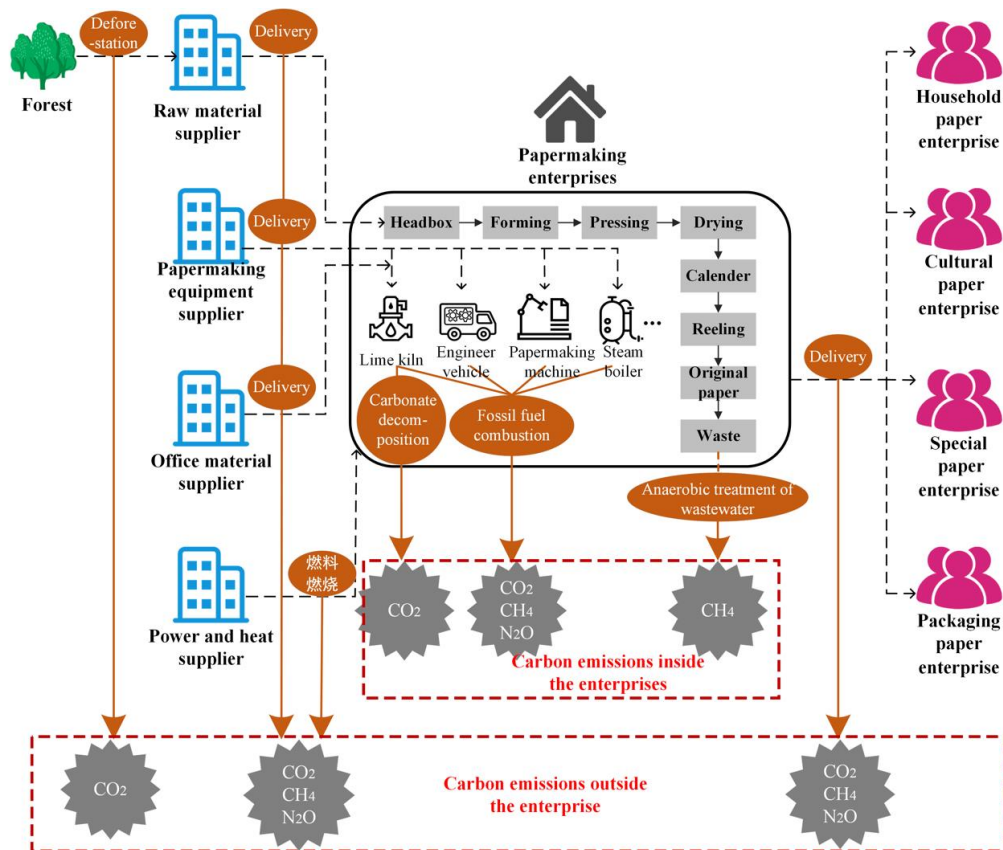


Figure 3: Carbon emission from papermaking enterprises

4.3 The influence of low carbon concept on the Business Model of Papermaking Enterprises

This part will use the literature research method to analyse the impact of low carbon on the business model of papermaking enterprises from the four aspects and nine elements of the business model designed by Osterwalder mentioned above. The summary of the main research viewpoints in the past is shown in Table 2. In this paper, it is found that the previous research views do not directly explain the impact of low carbon on the nine elements, and the relevant conclusions are relatively scattered.

Table 2: The influence of low carbon on the nine elements of traditional business model of papermaking enterprises

Main interface	Element	Author (Year)	Opinion
Production	VP	Garcia-Alvarado, Paquet & Chaabane (2016)	The low-carbon supply chain creates opportunities to reduce carbon emissions in the entire product value chain of papermaking enterprises[52].
		Yanan Hou, etc. (2022)	The paper industry has the attribute of natural green, and the organic waste liquid and waste produced in the production process can be recycled as biomass resources[53].
		Schulte (2021)	Low carbon provides an opportunity for papermaking enterprises to produce low carbon wood products with good substitution effect[54].
		Granacher, etc. (2022)	Paper companies providing more low-carbon biofuel products to the market can bring better resource utilization and higher energy efficiency[55].
		Johansson, Broberg & Ottosson (2021)	The challenges of papermaking enterprises are related to climate and environmental impacts, resource efficiency and so on. However, these challenges also provide strategic opportunities for the industry to develop into a competitive, resource-efficient and low-carbon industry[56].
Customer	CS	Qing Chen (2022)	Cultivate the products with the least impact on the environment to form consumer demand and achieve low-carbon sales[57].
		Newell & Vos (2011)	Green consumers are new customers of papermaking enterprises[58].
	CR	Jinhua Sun, LinLin Xu and Jian Hu (2021) Wei Xu and Qinfeng Gao (2022)	Under the guidance of the global goal of low-carbon development, customers will be more loyal to enterprises with a sense of social responsibility and green image[59, 60].

		Shengyuan Wang and Yizao Chen (2021)	To create an environmentally friendly corporate image of papermaking enterprises and enhance their reputation for low-carbon environmental protection will help them to attract high-quality customers[61].
	CH	Jing Ding, Lin Wang and Yaping Lu (2020)	Effectively develop the market of green consumer paper products with the combination of online and offline[62].
		Xiangling Wu (2012)	In the process of green upgrading and transformation of papermaking enterprises, green logistics plays an important role, such as green transportation[63].
		Wenyan Wang (2022)	Strengthen the utilization of waste, reduce energy consumption and improve the utilization of energy resources are the key activities for papermaking enterprises to reduce emissions[64].
	KA	Qin Xie (2022)	Improve the enterprise energy management system and carbon management system, improve the level of carbon management[65].
		Xiaoxu Ran (2016) Hongjun Peng, Miaomiao Wang (2016)	Implement the integration of forest, pulp and paper to realize the unity of social, economic and environmental benefits[66, 67].
Infrastructure management	KR	Bin Zhou and Maobin Hu (2022) Qingjian Zhao, Zuomin Wen, Minxin Zhang (2018)	The application of low-carbon technology is very important for papermaking enterprises to achieve low carbon[68, 69].
		Bin Zhou and Maobin Hu (2022) Ju Huang, Linqing Chen, Caiyun Guo (2022)	Papermaking enterprises should vigorously introduce and train double-carbon standards and other related talents, and strengthen the team of double-carbon talents[68, 70].
	KP	Xiaolan Qiu and Jianhui Yu (2015) Bin Zhou and Maobin Hu (2022)	Papermaking enterprises can strengthen their cooperation with farmers, forest farms and agricultural cooperatives to realize the integration of forest, pulp and paper[71]. Papermaking enterprises can cooperate with universities and research institutions to develop low-carbon papermaking technology[68].
Finance	C\$	Caiping Zhang, Ting He and Meijuan Liu (2021) Yang Zhang and Yonggang Hu (2021) Qingjian Zhao, Zuomin Wen and Minxin Zhang (2018)	Low carbon will increase the environmental protection cost of papermaking enterprises[72, 73] and the cost of low carbon technology innovation[50].
		R\$	Dowell, Hart & Yeung (2000) Johansson, Broberg & Ottosson (2021)

The introduction of low-carbon concept makes people innovate the elements of the business model of papermaking enterprises. In terms of products, papermaking enterprises have begun to look for new value propositions under the low-carbon background, mainly for the recovery and re-production of some papermaking waste, the production of new low-carbon paper products and so on. With regard to the customer interface, when low-carbon paper products enter and occupy the market, customers will gradually form a green and low-carbon consumption concept. Then consumers who have the concept of green and low-carbon consumption and are willing to accept low-carbon paper products will become new target customers for paper enterprises. At the same time, part of the customer relationship of papermaking enterprises will become more stable with its low-carbon environmental protection image gradually rooted in the hearts of the people. With regard to channel access, the combination of online and offline and green logistics is the focus of papermaking enterprises, so as to reduce a large amount of carbon emissions generated by fossil fuel combustion during transportation; in terms of infrastructure management, under the low-carbon background, papermaking enterprises add resource recovery, carbon emission management and forest-pulp-paper integration to the list of key activities. In order to carry out these activities smoothly, papermaking enterprises expand their own cooperation network, form new cooperative relations with universities and research institutions and agriculture and forestry departments, and strive to introduce core resources such as low-carbon technology and carbon management personnel. In terms of finance, papermaking enterprises will inevitably incur additional governance costs (including labor, equipment and technology, etc.) in the process of low-carbon management, but they will also get tangible income from the sale of related low-carbon products and intangible income from the image of low-carbon environmental protection.

V CONCLUSION AND PROSPECT

5.1 New findings

Through studying the development of papermaking enterprises under the low-carbon background, the paper has found that papermaking enterprises belong to forest industrial enterprises with high carbon emissions. Meanwhile, through combing the relevant literature, the paper has explored that the problem of carbon emissions in the business model of papermaking enterprises has not been deeply studied, which is not conducive to papermaking enterprises to find the source of carbon emissions in the business model and innovate a new low-carbon business model. Therefore, it is very necessary to study the business model of papermaking enterprises under the low-carbon background. Based on the division method of business model elements of Osterwalder, this paper probed into the business model of papermaking enterprises and depicts the canvas of business model of papermaking enterprises. In view of this, in order to explore the carbon emission sources of the business model of papermaking enterprises, this paper further tracked the carbon emission footprint of papermaking enterprises. This paper has found that the carbon emissions of papermaking mainly come from fossil fuel combustion, logistics and transportation and deforestation. These activities come from the key business, channel access and important cooperation of the business model of papermaking enterprises. The introduction of low-carbon concept makes people innovate to varying degrees on the elements of the business model of papermaking enterprises.

5.2 Theoretical and Managerial Implications

About theoretical implication, based on the low-carbon theory, this paper tracked the carbon footprint in the business model of papermaking enterprises, which has filled the gap in previous research. About managerial implication, through the description of the business model of papermaking enterprises and the exploration of carbon footprint, this paper has helped them find the source of carbon emissions and rethink their own production and management model and development orientation. This can promote the follow-up low-carbon business model innovation of papermaking enterprises, establish a new business model in line with social low-carbon development goals, and make it possible for papermaking enterprises to achieve profitability and low carbon at the same time.

5.3 Future research

This paper has studied the business model of papermaking enterprises based on the low-carbon background. According to the research results of this paper, it can be found that there is more room for innovation on the elements of the business model of papermaking enterprises combined with the low-carbon background. Therefore, in the future research, we will deeply study the business model innovation of papermaking enterprises under the low-carbon background. Future research will design a more low-carbon business model for papermaking enterprises and promote papermaking enterprises to successfully achieve low-carbon development.

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