The Driving Factors and Implementation Path of Digital Transformation of Manufacturing Companies: Case Study Based on W Company

Xiaobo Fang, Chengxiang Li

School of Business, Xinyang Normal University, Xinyang, Henan, 464000, China

Abstract: On the basis of reviewing the research results related to digital transformation, we have summarized seven main factors driving the digital transformation of manufacturing industry. These factors are process improvement and innovation, employee factors, data collection and grasp, cost factors, customer needs, competition between peers, and government regulations. We selected W Coal Machinery Co., Ltd., which has 64 years of business history, as the sample of the case study, and used in-depth interviews to collect data. We analyzed the dilemma of W Company's traditional business model from three aspects: "customer experience" "operation process" and "business model", and proposed a digital transformation path to enhance customer experience, optimize operation process and upgrade business model.

1. Introduction and Literature Review

1.1. Introduction

The COVID-19 has had a certain impact on the manufacturing industry, and manufacturing companies began to actively seek new business models to respond to the challenges of epidemic normalization, which led to thinking about the digital transformation strategy [1], and accelerated the pace of digital transformation of manufacturing enterprises. The digital transformation of manufacturing enterprises is the cluster innovation breakthrough of various digital technologies and the deep integration with manufacturing enterprises. It is also the transformation of the whole process, whole chain and all elements of manufacturing enterprises' design and development, production and manufacturing, warehousing and logistics, sales services, etc. [2]. While giving full play to the value creation role of data elements, the enterprise's value model Systematic changes have also taken place in solutions, methods and tools [3]. It can be said that digital transformation not only brings unlimited possibilities to the development of manufacturing enterprises, but also challenges them. What factors are driving the digital transformation of manufacturing enterprises? What are the successful paths of digital transformation? This paper attempts to explore these issues through theoretical analysis and case studies.

1.2. Literature Review

The arrival of Industry 4.0 has promoted industry digitalization. Global industries are looking for digital transformation solutions to maintain the competitiveness of enterprises. The so-called "digital transformation" means that enterprises use digital technology to create value from the core idea of the enterprise, the optimization of manufacturing process, the expansion of the connection between upstream and downstream supply chain manufacturers, the enhancement of product value, and the deepening of customer relations. In order to grasp the trend of the economic market and the different needs of the consumer market, a large number of different data can be collected on the Internet through data analysis, mobile devices, community activities, business models, etc. for different analysis, so that enterprises can classify according to the big data they need, obtain the information they need, improve the service value, and change the business model to meet the different needs of customers. The most important thing about digital transformation is that the enterprise mainly has the recognition of digital transformation, and all employees regard digital transformation as the core goal of the company [4].

2. Theoretical Analyses

2.1. Drivers of Digital Transformation

After collecting different literature data, we summarized the following seven driving factors for digital transformation.

2.1.1. Process Improvement and Innovation

The process drivers can be divided into production process transformation and service process transformation according to the change object. Based on the need to improve production efficiency and reduce error rate, the self adaptation system of digital transformation can improve efficiency and reduce error rate simultaneously by mastering the planning, control and execution of production processes. Through the use of advanced information technology, the purpose of self-monitoring, prediction and correction can be further achieved [5].In addition, the drivers of the process will also be based on the transformation of customer service process, and the service process can be further improved or even recreated through digital technology [6].

2.1.2. Employee Factors

Employees considerations are also one of the factors driving enterprises to implement digital transformation. In order to improve the work efficiency of employees, enterprises apply advanced digital technology to make employees more efficient in their work through digital transformation [7].Improving the working environment of employees is also one of the driving factors for enterprises to carry out digital transformation. Based on the consideration of improving the safety and availability of the workplace, enterprises use robots in high-risk work scenes to replace manual operations and achieve the purpose of improving the working environment [5].

2.1.3. Data Collection and Mastery

The demand for data is also the driving factor for enterprises to choose to implement digital transformation. Digital transformation can also be based on data needs. Through the application of sensors, data can be directly collected in each link of production and sent back to each manufacturing management level. Through the exchange of control information, the control and

planning of the entire production process can be more accurate and have the opportunity to achieve a higher degree of customization, thus achieving vertical integration [5].With the increase of data collection, the demand of enterprises to master data and ensure data security also increases. Through digital transformation, it helps enterprises to effectively master more complex data [7].

2.1.4. Cost Factors

Enterprises will conduct digital transformation to reduce costs. In terms of decision-making, with the help of new technologies such as artificial intelligence and big data, we can make more intelligent decisions, which not only reduces the use of manpower, but also reduces the occurrence of errors [6].In addition, by improving the production process, shortening the preparation time and reducing the error rate , enterprises can reduce costs[5].

2.1.5. Customer Demand

The driving factors for enterprises to engage in digital transformation come from customers' needs, including the improvement of customers' demand for product quality traceability and the enhancement of customized products. Through digital transformation, enterprises can improve the traceability of products, parts and raw materials in the entire production process, so as to meet customers' requirements for product quality [5]. On the other hand, with the transformation of the interaction mode with customers, the partnership between the company and customers has been strengthened. It is necessary to achieve timely, accurate and high-capacity information exchange through digital transformation, and enhance cooperation between them [7].

2.1.6. Competition among Peers

Competition among peers is one of the driving factors for companies to implement digital transformation. As the company is facing more and more fierce market competitions, its competitors have adopted new technologies. Under the pressure of competition, the company needs to use new technologies to ensure its product competitiveness [8].The direction of competition between companies is also different from the past. In the past, the focus of competition was product functions and marketing strategies, but now most companies are committed to improving customer experience, which requires advanced digital technology support. To maintain the company's competitive advantage in the market, digital transformation must be implemented [9].

2.1.7. Government Regulations

Finally, relevant government regulations or project plans promote the digital transformation of enterprises. The implementation of regulations or the promotion of the government will often drive the application of new technologies. These regulations affect the entire environment and the sustainable standards [5], which will also directly or indirectly become the driving factors for enterprises to implement digital transformation.

2.2. Phase and Path of Digital Transformation

The digital transformation can be divided into three stages: digitalization, digital optimization and digital transformation. The first stage is digitalization, which refers to the introduction of enterprises into the computer system, and the input of digital and pattern data into the computer to make data and drawing files for digital management. The second stage is the process optimization, which refers to the combination of digital tools and existing work models to enhance work efficiency and product quality and improve customer experience. The third stage is digital

transformation, which refers to the business model that enterprises use large-scale digital tools, take digital data as the change of enterprise operation mode, and expand access to new customers and increase product value [4].

Westman, Bonnet, and McAfee (2014) believed that enterprises need to formulate digital transformation strategies from three levels: customer experience, operational processes, and business models. At the same time, they put forward three paths respectively at these three levels [10].

The first path is to improve customer experience. The company collects a large amount of customer information, analyzes the big data, and provides the information needed by customers. Through systematic classification and analysis of information, it communicates with customers through digital platforms, and makes effective product information in both directions, so as to meet customer needs, improve customer satisfaction, and maintain good customer relationships in the fastest way.

The second path is to optimize operational processes. By combining digital tools with people, the company can effectively analyze systematic big data, so as to change the optimization of workflow and manufacturing process, improve product yield, reduce material costs, effectively improve production performance, quickly track the digitalization of processes with digital tools, reduce staff working hours, workload, and reduce human costs, Maximize the ability of employees, and set performance KPIs to encourage employees to strive for good performance, so as to optimize the operation process of the manufacturing process.

The third path is to innovate business models. The company uses digital tools to change customer relationships, optimize manufacturing processes, improve product quality, and improve customer satisfaction. Under the change of external and internal environment, the risk of enterprise operation will be minimized, and the core value of enterprise culture and organizational change will be changed through digital transformation to cope with the change of business environment.

3. Research Design and Case Analysis

3.1. Case Selection

The object of this study is W Coal Machinery Co., Ltd. (hereinafter referred to as W Company), which has 64 years of business history. This company belongs to the machinery manufacturing industry, mainly produces and serves auto parts and coal mining machinery, and is listed on the Shanghai Stock Exchange. We analyzed the process of W Company's implementation of digital transformation, analyzed the difficulties of its traditional business model, and summarized the achievement path of its digital transformation.

We use in-depth interviews to collect data, specifically describe the problems faced by the enterprise, and do not specifically discuss a certain problem. The interviewees were senior managers, department heads and core technicians of the company. We recorded the content of the interview through face-to-face interview, e-mail, WeChat and other methods, obtained preliminary relevant data, summarized through the analysis of secondary data, established a logical relationship between the extracted concepts, and conducted a second interview for the vague areas to guide the interviewees to accurately express their ideas.

3.2. Difficulties of W Company's Traditional Business Model

The new coronavirus epidemic since 2020 has greatly changed the business environment. W Company did not respond adequately to the challenge of an external environment. The main production and service project of W Company is to "customize" automation equipment for

customers. In the face of the government's COVID-19 control policy, the main customers of W Company have taken high isolation measures. Under such conditions, W Company needs equipment installation and service at the customer's site, and cannot enter the site for construction, resulting in a decline in W Company's work efficiency. From the traditional business model to the dilemma of "customer experience", "operation process" and "business model".

3.2.1. Customer Experience

The relevant departments of W Company were unable to reply to the customer's order quotation, delivery date, work progress and poor quality in a timely manner, resulting in customer dissatisfaction.

Because the control system of the products of W Company needs to be customized according to the needs of customers, it should match the original production management information system of customers once and for all. Before January 2019, the customer technical requirements archives of W Company mainly made paper documents, which could not timely and effectively analyze the customer's technical requirements, resulting in lower customer satisfaction.

Some customers require to embed AI technology into the products already sold by W Company to realize the digital transformation of these products. The technology of W Company cannot meet the needs of these customers. These customers have to turn to specialized information technology companies, including IBM and Huawei, for help. However, W Company lacks talents who master digital technology, and cannot effectively cooperate with information technology companies to solve customer problems. In addition, due to the absence of digital product archives, the traceability of product quality is low. When the sold products fail, engineers of W Company need to spend a long time to find out the problem points, and may not be able to find out the key problems. This makes customers have no confidence in the service ability of W Company.

3.2.2. Operation Process

67% of Employees in W Company have worked in the company for more than 8 years. The company has applied ERP system for more than 2 years and used it together with paper reports, but 76% of employees are unwilling to use ERP system, which leads to the virtual existence of digital tools, leading to the failure to effectively digitize the company's main production, operation and technical information. Employees are still used to running the operation process with self-made work forms. It is easy that because of the shelving of paper documents, the information can not be handled in time, which affects the product delivery date and the timely reply to quality problems, and also causes employees to shirk their responsibilities. The sensor deployment of the production process is insufficient and the connection state is at a low level, which causes difficulties in data collection and analysis. At the same time, all business links have not yet achieved comprehensive and high-level connectivity, resulting in the data chain has not achieved full coverage of business processes and product life cycles. At the company level, it is difficult to make timely and accurate business reports based on business data. When conflicts arise when cross department responsibility issues cannot be effectively clarified, senior executives are responsible for communication and adjudication. Senior executives often make decisions based on the importance and urgency of the department. The information on which senior executives make decisions mainly comes from their subordinates' oral and written reports, rather than the analysis of business data.

3.2.3. Business Model

A department manager with high performance in W Company once led his subordinate team to resign and set up another company, becoming a competitor of W Company. This event represents

that the company's senior executives have unfairly assessed the work performance of department managers, and have not grasped the ideological trends of employees. For the demand of existing customers for product upgrading, W Company is unable to provide effective services technically. The core components of the product, such as the operation control system and sensors, need to be purchased from other companies. Our technicians are unable to deal with the failure problems of these components, nor to carry out intelligent transformation of these components. W Company lacks the ability to extend the value chain, customize products, integrate services, etc. At the same time, the information that the company can grasp is limited in scale and scope, which makes it difficult to provide sufficient evidence to support the enterprise to make decisions. Therefore, the heterogeneous needs of customers are suppressed. W Company relies on the traditional marketing mode of face-to-face marketing, and its efficiency continues to decline due to geographical and time constraints.

3.3. The Path of W Company's Digital Transformation

The digital transformation scheme must be personalized according to the industry, professional technology and operation direction of the enterprise. This scheme should be able to cover the internal and external relations of the company. The internal relationship should be based on the company's senior management to declare the importance and determination of digital transformation to all employees, change the mentality of employees, introduce advanced digital technology based on existing software and hardware, reform the management process, and achieve transformation from three aspects: "customer experience", "operation process" and "business model".

3.3.1. Improve Customer Experience

In the purchasing process, W Company's digital platform provides customers with personalized recommendation and customization services. In addition, the company can collect the data of smart products being used by customers through the Internet of Things, enabling the company to achieve remote and efficient real-time services. Data driven design can improve R&D agility and reduce customer waiting time. In the R&D stage, the data from e-commerce platforms and online social networking platforms can quickly grasp the new trend of the market, build user portraits, and achieve efficient decision-making. After sales, customer preferences can be further clarified by analyzing sales data to achieve rapid iteration. In addition to using market and sales data to reduce R&D costs and improve agility, the sustainability of R&D can be improved through the analysis of consumable emission data throughout the product life cycle. In addition, digitalization also helps enterprises to build a new manufacturing mode of collaborative design, so that both other posts and customers can participate in the R&D process, increasing the sense of interaction of customer participation. By collecting plans and opinions through the digital platform and using collective wisdom to assist R&D decision-making, the R&D time is also shortened. On the one hand, this new mode of collaborative design enables products and processes to achieve collaborative design, and promotes design to move faster towards manufacturing, on the other hand, it meets the needs of customers for personalized customization. The "e-maintenance" intelligent service platform established by W Company can realize intelligent management, fault diagnosis, remote technical support and other functions, so that it can provide customers with fast, high-quality, full life cycle services.

3.3.2. Optimize Operation Process

All employees must receive ERP education and training. All work processes are operated

through the ERP system. The data generated by ERP is shared by all departments according to the use authority, which improves the efficiency of information processing. W Company introduced intelligent equipment and established a digital workshop. Big data technology has been used to promote the company's digital process. The introduction of intelligent equipment and the establishment of digital workshops have enabled the production process to achieve full process monitoring and management. In the production link, the digital workshop uses the Internet of Things perception system to contact materials and equipment, and uses the network to achieve real-time information transmission. The background perception system monitors and alerts in time to ensure efficient and orderly production. The intelligent workshop can also enhance the management of inventory, production capacity and delivery, which is conducive to improving the management level of the workshop. ERP system, a large number of sensors and the Internet of Things technology are used to link the production plan with the on-site control of workshop operations, which solves the problem of disconnection between the upper level production plan management and the bottom level production process, opens up the enterprise's information channel, and gradually realizes the intelligence and automation of each implementation link of the enterprise's production tasks, and the information is timely, accurate, efficient and fast, The production and manufacturing information of key links shall be timely fed back to relevant personnel through Kanban for timely response. The process driven efficiency is conducive to reducing human error, reducing loss, controlling cost, etc. The application of advanced intelligent equipment terminal interconnection technology can achieve timely early warning, reduce the failure rate and production cycle in the manufacturing process, reduce waste loss and material waste in the production process, and increase the coordination of production management tasks.

3.2.3. Upgrading the Business Model

In the process of transformation, W Company changed business process driven into data driven, with the purpose of identifying and eliminating non value creation activities. Through the identification, design and deployment of data value driven processes, the data business processes drive the organization for digital management. However, the original fragmentation, lengthy business process links, departmental barriers and other problems were solved along the digital business process idea. Through the application and adjustment of the enterprise management system, the business structure can be changed. Through the data integration of the value chain, various business data processes are integrated; by crossing different functions, departments and levels, identify the key links in the business process, and re plan and optimize them. W Company realizes the digital vertical integration based on the value chain by connecting the internal links of "enterprise resources (ERP) - manufacturing execution system (MES) - automatic control (PLC) - equipment (sensor)"; The digital horizontal integration of "user demand order - product design - raw material procurement - personalized manufacturing - logistics distribution - customer service" is formed based on the industrial Internet industry chain; The horizontal and vertical digital integration finally achieved end-to-end cross-border integration.

W Company believes that excellent business models and efficient business processes are the key to transformation, and data assets are important resources. Through the implementation of digital transformation, the company has realized online digital design, online digital marketing, digital industrial products and services, and realized the innovation of business model.

Realize online digitization of product design. The whole process of R&D and design of the company connects with the market and end users through the private network. Through the Internet, users can directly participate in digital R&D, design and digital products (applications). Digital R&D design is close to customers' individual needs and consumption experience.

Digitize product marketing online. W Company mainly creates digital marketing through online

and offline marketing, and expands marketing channels in a digital way, including target customer marketing, big customer oriented marketing, two-way interactive marketing, global marketing, and terminal customer integration. At the same time, through the digital order system, the Group mainly creates digital marketing through online and offline marketing, and expands marketing channels in a digital way, It includes target customer marketing, key customer oriented marketing, two-way interactive marketing, global marketing, and terminal customer integration. At the same time, through the digital order system, it has changed from store sales to online digital exhibition halls.

Digitize products and services. In order to meet the needs of customers, W Company has created intelligent core products, mainly including intelligent interaction, intelligent networking and intelligent (automatic) operation. In order to realize the transformation of providing digital industrial products and services, it has carried out from batch products to personalized customized products. W Company has realized the transformation from traditional products to "intelligence+new energy".

4. Conclusion

According to the case analysis of W Company's digital transformation, 67% of the employees of a listed company with 64 years of business history have worked in the company for more than 8 years. Most employees are used to the original working mode and are unwilling to use digital tools. In this case, only by changing the organizational culture first, can employees understand the importance of digital transformation for the survival of the enterprise, which is the basis of digital transformation. Digital transformation is a process of continuous improvement. Only continuous implementation and review, strengthening the ability of internal employees, understanding the trend of external markets, and enhancing various driving factors can ensure the success of digital transformation. The company needs to build a value chain collaboration mechanism, realize the integration of platform, cloud computing, big data and other data resources through overall planning and multi-stage, realize the integration of products and services, hardware and software, applications and platform data, and open up the information exchange, resource sharing and capacity collaboration channels of all elements, all links, and all processes of R&D, design and manufacturing.

Acknowledgements

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