Proceedings of the 4th International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/2026.33692

Artificial Intelligence Applications in Manufacturing Finance: A Case of Siemens

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Abstract. Under the flow of digital transformation, Finance-Operations Integration became a key factor of effectiveness improvement in manufacturing enterprises. In the conventional model, the Finance department and Operations department are unconnected, which may form a data silo and make it difficult to support real-time decision-making and cost control. However, most of the current studies focus on AI technology itself and lack focus on the mechanism of Finance-Operations Integration. The study takes Siemens as a single case to explore the specific process of Finance-Operations Integration with "questions →motivation of transformation → AI application→ effectiveness → key factors" analysis framework. The results find that because of the digital transformation, such as ERP-MindSphere integration, Digital Twin (DT) system and OT/IT data integration, the enterprises decrease their defect rate, increase their customer stickiness, decrease their inventory and improve their cash flow. This study finds the successful factors, risks and challenges of the enterprise, which may provide a practical reference for digital transformation in Finance-Operations Integration in manufacturing enterprises, such as real-time cost control. Because this single-case study is limited, there should be more multiple-case studies in the future.

Keywords: Digital transformation, Finance-Operations Integration, manufacturing enterprises

1. Introduction

In the current era, a flow of digital transformation in manufacturing, Artificial Intelligence (AI) reforms the method of Finance-Operations Integration in enterprises. In conventional finance, disconnected from Operations, which is easy to give rise to data silos, hinders impromptu decision-making, decreases the control of the cost and decreases collective sensitivity. In order to compensate for this gap, this study takes Siemens as single case research subject to explore how AI can help enterprises achieve Finance-Operations integration. Specifically, this study aims to analyze the application paths, effects and key influence factors of AI-driven Finance-Operations integration. There are three questions that guide this study.

Q1: What financial and operational problems of Siemens have before the digital transformation?
Q2: How do AI apply to Finance-Operations integration?
Q3: What effects do AI applications bring? What are the key factors of success?

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This study uses a single-case research method and takes Siemens as a typical case because the enterprise started digital transformation early and gained great success. The structure of this study is: Section two is the Literature Review. Section three is the case introduction. Section four is case analysis. Section five is the core influencing factors. Section six is the conclusion.

2. Literature review

2.1. Finance-Operations integration

Finance-Operations integration refers to enterprises combining financial data with operations in order to improve the efficiency of the organisation, transparency, and strategies [1]. At the center of this study have Enterprise Resource Planning (ERP) systems. They are digital platforms with integrated software, simplifying the process and restoring information which covered overall core business, improving accuracy, quality, and availability of information [2].

2.2. Digital transformation in manufacturing

Digital Transformation (DT) is integrating the advanced digital technologies into the operations, strategies, and culture of organizations in perspective of manufacturing enterprises. It covered Awareness, Readiness, Technology, and Operations (ARTO), which can help create value, improve adaptability of the organization, and improve production systems. The Awareness dimension covers the process of digital transformation. The firms which decided to undergo digital transformation required employees who have related capacities, such as organizational strategies to ensure the benefits of the transformation. The second dimension is readiness. The enterprises need to have a complete self-evaluation after preparing work and ensure it has enough preparation about digital transformation [3]. In the T part, the enterprises should choose and integrate technologies that are related to the products of the company and are practical as well as useful to digital transformation. Operations dimension means the enterprises should take actions to achieve the goal of digital transformation they project through the technologies they choose before and supervise and manage the processes of the programs [3]. The ARTO model gives the enterprises a systematic and practical guide and a method of maintaining competitiveness in the market. Digital transformation can make a great difference in production, management and culture. In production, the enterprises can make the machines connect to the internet, AI, etc. and supervise the whole process to change the process and effectiveness of the production system. In management, the enterprises should have a systematic adjustment in their structure of organization, leadership style, strategy and process. In culture, the enterprises will have a creative, innovative and adjustable culture because of the transformation. It depends on the enterprise's overall attitude in creation and strategy coordination [3].

2.3. The current situation of AI applications in the financial area

Artificial intelligence can integrate data of financial functions and accounting, which can alter the methods of management of organization, overall information and strategic decisions, improving efficiency and accuracy [4]. AI will be more frequently used in accounting and financial analysis because of its capacity for large-scale data integration, which can promote the efficiency of other parts of companies' financial systems. However, the empirical evidence of total organization performance is limited, particularly in the background of emerging economies [4]. In the auditing area, AI also transforms the traditional way (sampling by humans and audit after the event) into a real-time and comprehensive way, which can deal with large-scale data and increase the accuracy of

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anomaly detection as well as fraud identification and achieve continuous auditing and real-time supervising [5]. Nevertheless, the transformation by AI also brings challenges such as explainability of algorithms, bias in algorithms, and a shortage of staff who have relevant skills [5]. And in the predictive analysis area, AI can analyze data and self-study to predict the risks and achieve the transformation from checking after the events to forecasting before the events. Overall, the work of auditors transforms from data processing to data analysis and supervision [5]. However, current studies still exist with systematic limitations, such as integrating complexity, and a shortage of talent, especially in the financial area of manufacturing.

Most of the current studies focus on improving the AI technologies of digital transformation itself and on how to achieve its functions. Nevertheless, they have limited in-depth research on the mechanism of Finance-Operations Integration in manufacturing enterprises. Therefore, this study takes Siemens as a typical case and makes a study [6].

3. Case introduction

3.1. Basis of case selection

This study takes A as a case study. Siemens AG (Berlin and Munich)'s industries cover 4 areas: industry, infrastructure, mobility, and healthcare [7]. It focuses on the creation of integration of real life and the digital world [7]. As one of the largest producers of efficient energy and technologies for resource, the company operates globally and leads in high-efficiency power generation, transmission solutions, infrastructure solutions, industrial automation, and drive and software solutions [7]. The reasons for selection are as follows: First, Siemens AG has world-leading technology and abroad scope of business coverage. It started the digital transformation early and invested heavily, having a relatively complete system. Therefore, it is typical and representative. Second, it is both an Enterprise Resource Planning (ERP) user and developer, which means its Finance-Operations integration used by digital transformation in practice is top-level in the area. Thus, its experience is an available reference for other manufacturing enterprises. Third, because Siemens AG is one of the earliest companies to research digital transformation, it has substantial and various documents and studies by experts about digital transformation. The documents and studies can provide data support for in-depth research better.

3.2. Data recourse

The data resource of this study is divided into two categories. First, public literature and industry reports. This study refers to a study about digital transformation, artificial intelligence application, ERP system and Siemens AG development. Second, Siemens official materials. This study draws on related information on Siemens official website.

3.3. Framework of analysis

This study uses questions → motivation of transformation → AI application→ effectiveness → key factors analysis framework. First, it identifies the problems of operations and finance before digital transformation. Second, it analyze the diversity of Siemens digital transformation. Third, it provides examples AI specific application in Finance-Operations Integration, including ERP-MindSphere bidirectional integration, digital twin, and OT/IT convergence via Snowflake. Fourth, it evaluates the performance of the transformation by defect race, NPS, inventory, etc. Finally, it shows the key factors of success and challenges the company may face.

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4. Case analysis: siemens

4.1. The operational and financial problems before digital transformation

Before the digital transformation, Siemens lost heavily. And because of the tense market, its business complexity is increasing continuously, and its conventional value chain is disintegrating [8]. Therefore, the process of decision-making decreased, and operational costs increased. It lost control of the complete production process, so it only depends on cooperative business and the businesses are vulnerable to shocks. The company's efficiency of collaboration may also decrease and the profit margin may decrease, which means the cost may increase and other participants have weaker bargaining power. What's more, the enterprise had a knowledge silo and insufficient collaboration. Its knowledge decentralized in various regional sales organizations and lack of global sharing, which causes an inability to utilize local innovations [8]. The situation may cause creative resource waste and local teams' innovation initiative decreased. The localize competitive advantage may also be missed.

4.2. The drivers of digital transformation

In the current era, enterprises have a high requirement for innovation and technology. Digital transformation can address the shortage of high-skilled human capital and have more innovative production to gain a greater competitive advantage and more profit by operating [9]. What's more, without digital transformation, enterprises may face low Total Factor Productivity (TFP) because of their weak cost control and resource management, which means they may lag behind peers in the fast era [10].

As a typical response to the above challenges, about 11 years ago, because Siemens's industries expanded to a global scale and its supply chains became complex, it started to build an integrated digital transformation based on the EPS system and integration of production and logic processes [11]. It needs to improve the efficiency of operations and management and increase customer content to contain market competitiveness [12]. In addition, at that time, people were aware of the importance of knowledge management and international cooperation [8]. Siemens decided to become a global solution provider which required digital transformation [8]. Similarly, Siemens needs more knowledge to support every team's idea; the solution to which was that every local team should share its knowledge [8]. And digital transformation was also a useful tool.

4.3. The specific application of AI in Finance-Operations integration

Siemens uses bidirectional integration between SAP S/4HANA ERP and MindSphere to gain predictive work orders, improve processes and manage resource. Some of its factories also have AI analysis to recognize and optimize capacity planning [11]. What's more, it's integrating digital twin technology can enable real-time supervising and prediction to improve the result and decrease risks in operations [12]. In the case of Siemens cooperating with Snowflake, Siemens used Industrial Edge to connect to Operational Technology (OT)(equipment, sensor), integrate with Snowflake's Information Technology(IT)(including finance data)to achieve Finance-Operations Integration [13]. AI provide deep insight and intelligent agent automation, improves the efficiency, quality, and maintenance of the equipment, integrates production and financial data, supports real-time cost accounting and accurate decision-making, which can increase both the operational and financial synergy efficiency [13].

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4.4. Application effects

4.4.1. Effectiveness

After digital transformation, Siemens has available real-time data, a larger scale of production, LOT sensors and ERP automation, and better control of logistics, which can improve the efficiency of strategic design, flexibility of production, accuracy of projection, and control of inventory [11].

Table 1. Average defect rate of siemens (2021-2023)

Year	Average Defect Rate	YoY Change	Cumulative Reduction
2021	15%	-	-
2022	12%	-20%	-20%
2023	10%	-16.7	-33.3%

Data resource: Siemens Production Quality Report (2021-2023).

According to Table 1, the average defect rate of Siemens decreased from 15% in 2021 to 10% in 2023, decreasing by 5%, which means the development of digital transformation can improve the capacity of supervision and inspection of production.

4.4.2. Customer stickiness and revenue impact(NPS)

Figure 1 illustrates that the Net Promoter Score (NPS) of Siemens increased from 70 in 2021 to 80 in 2023, increasing by 10, which means Siemens uses AI to produce high-quality production to increase customer stickiness and the number of promoters. Because of this, the firm can get more revenue. Overall, Siemens can achieve digital transformation, save more money on cost control and risks in processes and get more money because of its high-quality production.

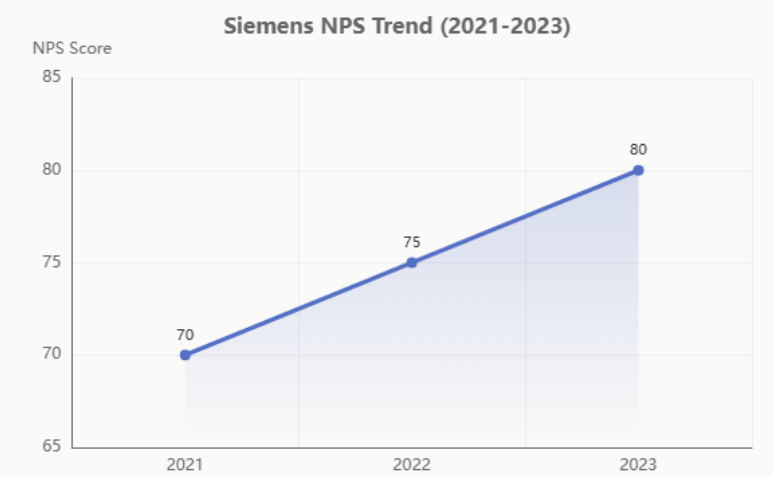

Figure 1. NPS of siemens (2021-2023)

4.4.3. Efficiency improvement

Siemens's inventory decreases, and its synchronized control and process at the global level (cloud) improved [11]. And because it cooperated with, its equipment operating efficiency and availability increased, the entire factory production process improved, quality increased, performance improved and maintain requirement decreased [13]. In 2025, Siemens' orders increased by 28%, free cash flow

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increased dramatically and net income increased by 5%, which also means the enterprise's financial performance benefited from digital transformation [14]. The CEO of the company, Roland Busch, pointed out that digital transformation and sustainable development continue to be our growth drivers [14].

4.4.4. Risks

During the process of digital transformation in manufacturing enterprises, because of massive input of technology and human investment, the financial risks will increase. A study finds that financial flexibility can release this problem, which means a company which has strong capacity for quick access to and deployment of financial resources to restore massive money to withstand the risks and profit from uncertain events can finish digital transformation easier and eventually increase final financial performance [15]. This method is more effective and practical in small and medium businesses [15]. Small and medium businesses have less ability to withstand risk. They don't have massive cash reserves and enough various industries and relationships, so they will have more risks if they start digital transformation.

5. Conclusion

After the research, this study finds that AI can make Finance integrate with Operations and decrease the gap between Finance and Operations usefully. The main finding shows that an AI application (ERP-MindSphere integration, digital twin, OT/IT convergence via Snowflake) can make defect race decrease, NPS increase, inventory decrease, net profit increase, etc. This study reviews the research of Finance-Operations integration in manufacturing. In implication, manufacturing enterprises should connect the data between Finance and Production first to improve the agility and capacity of real-time cost control. However, as a single-case study, the generalizability of this study is limited. Thus, there should be multiple case studies of comparison between Siemens and other enterprises and quantitative research, such as the relationship between investment in AI and financial performance.

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