South African Journal of Business Management
ISSN: (Online) 2078-5976, (Print) 2078-5585



# Empowering employees for digital transformation in manufacturing enterprises: A case study

**Authors:**
Meirong Zhen[1]
Wenfeng Ding[2]

**Affiliations:**
[1]Department of Human Resource Management, School of Management, Jiangsu University, Jiangsu, China

[2]Department of Business Administration, School of Management, Jiangsu University, Jiangsu, China

**Corresponding author:**
Meirong Zhen,
zmr4233868@ujs.edu.cn

**Dates:**
Received: 17 Aug. 2023
Accepted: 08 Mar. 2024
Published: 29 Apr. 2024

**How to cite this article:**
Zhen, M., & Ding, W. (2024). Empowering employees for digital transformation in manufacturing enterprises: A case study. *South African Journal of Business Management, 55*(1), a4207. https://doi.org/10.4102/sajbm.v55i1.4207





**Purpose:** This study explores how manufacturing enterprises can effectively promote digital transformation through employee empowerment with ability, motivation, and opportunity empowerment at different stages.

**Design/methodology/approach:** Drawing on ability, motivation, and opportunity (AMO) theory, this qualitative research takes the Jiangsu Shangshang Cable Group as a typical case to discuss manufacturing enterprises' evolving employee empowerment model. Gioia structured data analysis method was adopted to analyse the data.

**Findings/results:** In the stage of information technology (IT) application, the main task of employee empowerment is strengthening the employees' abilities ('can do') and motivation ('want to do') by training their IT knowledge and skills, changing their mindset towards IT application, and letting them experience the efficiency of the latter. In the intelligence manufacturing stage, training employees to do better is the core content of employee empowerment. Enterprises can strengthen employees' intelligent manufacturing skills, practice data-based performance appraisal and salary management, and let employees participate in intelligent manufacturing. In the stage of digital transformation of the whole process, employees are required to 'do their best in the long run'. Enterprises could improve employee collaboration capabilities, build growth mechanisms, and involve every employee in innovation.

**Practical implications:** In the digital transformation process, manufacturing enterprises could empower employees according to the different goals and requirements in the three stages of IT application, intelligence manufacturing, and digital transformation of the whole process. It has reference value for manufacturing enterprises to achieve digital transformation.

**Originality/value:** This study explores a three-dimensional evolving employee empowerment model to promote manufacturing enterprises' digital transformation.

**Keywords:** manufacturer enterprises; digital transformation; employee empowerment; AMO; Shangshang Cable.

## Introduction

In the age of the digital economy, digital transformation is essential to the high-quality development of manufacturing enterprises. Digital technology has made profound changes in products, services, and tasks, as well as changes in organisational structure, management mode, and employees' knowledge and skills (Zhu et al., 2022). Digital transformation in manufacturing enterprises requires employees to learn new digital technology, such as digital equipment operation, data reading, and data analysis (Chen et al., 2021). In addition, digital technology adds flexibility to the job and needs employees to collaborate more (Cai et al., 2020). In such situations, digital technologies cause uncertainty and anxiety among employees; some reject the changes caused by digital transformation only if they believe it would benefit them (Solberg et al., 2020). 'People-centricity' is the underlying logic and cornerstone of enterprise digital transformation (Zhang & Hao, 2022). Digital transformation relies on objective resource conditions such as digital technology and is inseparable from individuals who can play a subjective role in joint promotion. Therefore, employee empowerment and digital employee development are the keys to the successful digital transformation of manufacturing enterprises.

Most existing studies focus on organisations' information technology (IT) ability, adaptability (Singh & Hess, 2017), and new knowledge acquired through strategic alliances as the key factors influencing digital transformation (Siachou et al., 2021). Additionally, studies also highlight the

realisation paths (Xiao et al., 2021) and the results of digital transformation (Wen & Wang, 2022; Zhang et al., 2022). Previous studies explored digital transformation from different perspectives. However, less emphasis is laid on the critical role of employees in digital transformation. This study focusses on the role of employees and illustrates how to empower employees to help manufacturing enterprises achieve their goal of digital transformation.

Ability, motivation, and opportunity (AMO) theory suggests empowering employees from three aspects: ability (A), motivation (M), and participation opportunity (O) (Appelbaum, 2000). In A, training and job design can improve the knowledge and skills of employees (Li et al., 2021). In M, an effective performance appraisal and compensation system can motivate employees to obtain a high level of performance. In O, participation and involvement provide opportunities for employees to be 'in' the process of digital transformation (Wang & Ma, 2015). These concepts give a significant theoretical framework for manufacturing enterprises to empower their employees in digital transformation. With this theoretical perspective, this study explores how AMO activities can enable employees and have reference value for the effective digital transformation of manufacturing enterprises. Thus, based on AMO theory and the practice of Jiangsu Shangshang Cable Group (from now on referred to as Shangshang Cable), this study explores the three-stage mode of employee empowerment in the digital transformation process in manufacturing enterprises. The following section contains the literature review. Research design, findings, discussion, and conclusions follow it.

# Literature review

## Employee requirements for digital transformation

Digital transformation can lead to work redesign. The organisation structure, workflow, and nature of work have changed in the digital generation. Digital technology replaces traditional tasks and positions, and the organisational structure is becoming a flat structure (Kretschmer & Khashabi, 2020). A virtual and networking trend occurs in the workplace. With the help of digital equipment, employees can go beyond the limitations of time and space (Marion & Fixson, 2021).

Hence, using digital technology to deal with problems is emphasised. For example, to efficiently fulfil complex tasks, drawing software is used for product design (Marion & Fixson, 2021). Applying digital technology also shortens the work cycle while reducing repetitive work.

All of these require employees to have the corresponding digital knowledge and skills (Chen et al., 2021). The upgrading of technology in production brought about by the digital transformation of enterprises has increased the demand for highly skilled labour (Xiao et al., 2022); therefore, it requires employees to master digital knowledge and skills. Digital technology further opens an organisation's boundaries. Employees must engage in cross-functional business and process activities, and undertake more technology-intensive tasks (Vial, 2019). Employees must understand the information on the digital display screen and operate digital devices (Lanzolla et al., 2020). The study by Cetindamar et al. (2021) showed a positive relationship between employees' digital literacy and the utilisation of cloud technology at companies. With the deepening of digital transformation, enterprises are slowly raising the requirements for employees' capabilities, such as independent learning and strategic making (Butschan et al., 2019). Especially for managers, digital thinking and leadership are essential for them to formulate strategies for digital transformation and control the transformation process.

Moreover, a change in the work environment, owing to digital transformation, affects employees' overall perception of their work experience and interpersonal relationships, thereby leading to varying perceptions of digital transformation (Zhang & Hao, 2022). Employees hold different attitudes towards digital transformation because of the uncertainty of new technologies and market environment change. Some employees regard digital technology as a job destroyer. Artificial intelligence (AI) and virtual agents brought by digitalisation have replaced specific labour forces (Verhoef et al., 2021). Real-time monitoring in the workplace has also increased tension and pressure (Carlson et al., 2017), and the interactions based on digital technology have reduced social-emotional exchange and ignored the employees' feelings (Colbert et al., 2016). More and more employees realise that digital transformation is an opportunity to learn new technology and subsequently helps improve production efficiency (Gu & Zhang, 2020). Only when employees believe digital transformation will benefit their work will they participate further in individual performance (Selimović et al., 2021).

## Employee empowerment and digital transformation in manufacturing enterprises

The primary feature of Industry 4.0 is the application of digital technology in the manufacturing sector. Manufacturing enterprises can leverage the positive role of employees to drive digital transformation (Sun et al., 2023) and emphasise employees' contribution to digital transformation. Employees' innovative behaviour and autonomy can help manufacturing enterprises achieve their goal of digital transformation by using their resources and advantages (Helian, 2023). Data feedback on performance and rewards based on intelligent assistance may motivate employees to participate actively in digital transformation (Qiu, 2022).

However, employees' current skills and knowledge do not align with what they should have under digital transformation (Fareri et al., 2023). Kuhn and Lucke (2021) proposed a low-threshold training concept with a modular approach to internet of things (IoT) technologies and applications for manufacturing employees. Khwakhali et al. (2023) showed that brilliant production can facilitate employee

empowerment by providing them with the necessary tools, skills, and knowledge, increasing their income and well-being, and reducing labour accidents. Hansen et al. (2021) emphasised employee empowerment with continuous learning and training, knowledge sharing and networking, independent and flexible work structures, and incentive structures by learning factories in digital transformation. Gilbert and Teglborg (2021) explored a symbiotic approach to reconcile digitalisation and employee empowerment by focussing on seven work situations encountered in one of the company's Chinese plants.

Despite the increasing interest in employee empowerment within manufacturing enterprises, the focus has been on studying the skills and knowledge necessary for digital transformation, with limited attention to understanding the employees' mindset. Employees are essential participants and executors of digital transformation (Ma & Guo, 2022). Thus, their attitudes and perceptions influence the digital updating of organisations (Shang et al., 2022a). In addition, few studies on employee empowerment methods with redesigned work structures and incentives exist. However, those studies overlooked the corresponding requirements for employees in different stages of digital transformation. Digital transformation in manufacturing enterprises is a long-term and complex process. The different stages of digital transformation have accompanying problems and requirements. Therefore, a comprehensive research on employee empowerment, encompassing aspects such as mindset, knowledge, skills, redesigned work structures, and incentives, should be conducted to satisfy the requirements of the different stages of digital transformation.

### Employee empowerment and ability, motivation, and opportunity theory

Empowerment theory originated from sociology and psychology; it highlights enhancing the control rights or particular abilities of social regions, individuals, or groups (Shang et al., 2022b). It has been widely used in organisational management for technical and employee empowerment. Ability empowerment examines the mechanism of digital ability empowerment by driving changes in corporate management methods, marketing models, and manufacturing processes (Peterson et al., 2005; Zhou et al., 2018). Employee empowerment refers to the process of setting employees as the empowerment objectives within an organisation. The goal of employee empowerment is to enable employees to acquire self-sufficiency and develop their abilities (Sun et al., 2020). This approach leads to authorised employees having a more positive attitude towards their work (Srivastava et al., 2006) and more autonomy in their job roles (Kimery, 1999). Employee empowerment aims to drive employees to high performance by improving their working skills and initiative and supporting organisations to achieve their objectives.

Ability, motivation, and opportunity theory is well-known in human resource management for high performance, and provides theoretical support for employee empowerment (Appelbaum, 2000). The AMO theory indicates that the ability, motivation, and opportunity of employees are the three major factors that drive individuals and organisations to generate high performance (Wang, 2021). Ability entails improving employees' work skills. Training, career development, and job design can improve employees' skills and competence. Such activities can satisfy employees in the long term and drive them to achieve other skills needed for work, thereby empowering employees with skills. Motivation refers to motivating employees for high performance. Compensation design and promotion can motivate employees in organisations. High salaries and good benefits could drive employees to generate high-quality products or services (Wu et al., 2021). Promotion can enhance employees' commitment and motivate them to work hard at high levels (Bennedsen et al., 2019). Therefore, such activities empower employees with 'motivation'. Opportunity means providing employees opportunities to be involved in their jobs and organisations. Participation and authorisation allow employees to experience increased work autonomy and perceive trust and respect from their organisations. Hence, employees have higher levels of job satisfaction (Yin et al., 2022), more enthusiasm for work, and less job insecurity (Yang et al., 2019). Such activities are to empower employees with 'opportunities'.

Employees are the core elements and powers of digital transformation in enterprises. Based on AMO theory, this study aims to explore how to empower employees with 'skills', 'motivation', and 'opportunities' in the different stages of digital transformation and support the digital transformation in manufacturing enterprises.

## Methodology

### Methods

This study adopted a qualitative approach to understand the role of employees in supporting digital transformation and explore how to empower employees to achieve manufacturing enterprises' goal of digital transformation.

To meet the objective of this study, an instrumental case study design was adopted (Crowe et al., 2011). Firstly, this study attempted to explain how employees can be empowered in the different stages of the digital transformation of manufacturing enterprises, which is a process study and a discussion of the 'how' (Yin, 2009). Secondly, developing an employee empowerment model in the digital transformation of manufacturing enterprises is exploratory and inductive. The case study method can present the empowerment details implemented by the case enterprises (Li et al., 2020) and deconstruct the problems that are not fully understood (Mao, 2020). Thirdly, a longitudinal exploratory case can identify the occurrence sequence of critical events in the case enterprises. It can also ensure the completeness and coherence of the employee empowerment model in the digital transformation of manufacturing enterprises and facilitate the induction and refinement of the research conclusions.

Shangshang Cable provided an ideal setting for determining how employees can be empowered at the different stages of digital transformation and met the case-chosen principles (Eisenhardt & Graebner, 2007) and thus allowed for the in-depth qualitative investigation of the digital transformation process and stages. (1) Typical employee management: Shangshang Cable was recognised as a 'benchmarking smart factory of China in 2020', and its 'si ge ren ren' quality-based performance management model for its staff actively supported digital transformation. (2) Typical case of digital transformation: Shangshang Cable underwent three stages of digital transformation. The first stage was IT application (1999–2011). Shangshang Cable introduced enterprise resource planning (ERP) in 1999, as well as office automation, the platform-level data model, the customer relationship management system, and computer-aided process planning in the succeeding years. The second stage was intelligence manufacturing (2012–2016), in which Shangshang Cable built an ultra-high-voltage computer-integrated manufacturing system (CIMS) to implement intelligent manufacturing. The third stage was the digital transformation of the whole process (2017–present). Shangshang Cable implemented a manufacturing execution system in 2017 to integrate the CIMS, ERP, and other systems to realise the digitisation of the entire process. The three stages align with the development laws of digital technology and digital transformation requirements for manufacturing enterprises. (3) Enlightenment practice: Shangshang Cable realised digitalisation and precision management by integrating digital technology and employee management. In the IT application stage, Shangshang Cable focussed on improving employees' IT knowledge and skills and developing their positive attitudes towards IT applications. Shangshang Cable further improved employees' intelligent manufacturing skills in the intellectual manufacturing stage and encouraged them to participate actively in the intelligent manufacturing process. In the digital transformation process, Shangshang Cable fostered collaboration among employees, resulting in winning the 'China Best Management Practice' and 'China Quality Award' for 3 years consecutively. It is an excellent example for other manufacturing enterprises to achieve successful digital transformation. (4) Obtainable data: Each digital transformation stage of Shangshang Cable, from IT application to intelligence manufacturing to the whole digital transformation process, is traceable and attainable; those characteristics support investigation and analysis from a longitudinal perspective.

## Data collection

The primary data source of this study was in-depth interviews (Table 1). Semi-structured interviews were conducted between 2020 and 2022, which lasted between 60 and 120 min. The interviewees included a production department manager, a human resource department manager, a digital operation centre director, staff in the postdoctoral research station, and grassroots employees. This study chose individuals involved in the whole digital transformation process as the interviewees to ensure the validity of the results. Broad questions about digital transformation and employee management were asked (e.g. 'Please list and describe the activities for improving employees' abilities in digital transformation'), and the interviews were audio recorded with the voluntary informed consent of the participants. The recordings were transcribed, and then the interviewees were asked to review the transcripts to clarify any inconsistencies.

**TABLE 1:** Data source and coding.

| Data source | Data object | Content | Code |
|---|---|---|---|
| Interviews | Production manager | The digitalisation process of management and manufacturing (1 interviewee, approx. 120 min). | A1 |
| | Human Resources Manager | Implement quality-based performance management, salary, and welfare principles (1 interviewee, approx. 120 min). | A2 |
| | Director of Digital Operation Centre | The process of informatisation and digital operation status (1 interviewee, approx. 120 min). | A3 |
| | Staff in the Postdoctoral Research Station | Innovation and digital technical support (2 interviewees, approx. 120 min in total). | A4 |
| | Ground-level employees | The work has changed since informatisation, as well as the views and attitudes towards digital transformation (6 interviewees, approx. 60 min in total). | A5 |
| Written data | Enterprise website and WeChat public account | Corporate culture, history, strategic implementation, important news and events, etc. | B1 |
| | Internal documents | 'Shangshang Craftsman Training Plan' and 'Reward Principles for Children of Employees Admitted by Universities'. | B2 |
| | Social media | 'Documents of the Jiangsu Provincial Economic and Information Commission' and materials of experience exchanging meetings. | B3 |
| | Books | *Si Ge Ren Ren's 'All-member Quality Performance Experience Model' is based on Quality Culture and Mechanism Innovation and The Road of Shangshang.* | B4 |

Data were also collected from internal documents, social materials, Shangshang Cable's official WeChat account and website, and the book, The road of Shangshang (Table 1), with permission from these sites and the respondents. In addition, the researchers conducted on-the-spot non-participant observation and talked with the employees about digital transformation events. Triangulation using the data from multiple primary sources was conducted (Yin, 2009), and the informants reviewed the draft of the case study to ensure the validity of this case analysis (Bryman & Bell, 2017; Yin, 2009).

## Data analysis

The three-level Gioia data analytical process was used to analyse the data (Gioia et al., 2013; Mao, 2020). Firstly, documentary analysis was conducted on all the data. The first-order terms were assigned as raw data, which were classified by source. The data from the interview records were labelled A1 to A5, and the data from the company documents and media reports were labelled B1 to B4. All the important events and activities since the digital transformation of the case enterprise were systematically sorted, and attention was

paid to the differences and connections between employee empowerment in the different stages, especially to staff training, the salary system, and the appraisal system. The items with different coding results were discussed repeatedly until an agreement was reached. Based on the procedure, 18 first-order terms were obtained, such as 'office software training' and 'standard information system training' (Gioia et al., 2013). Secondly, the first-order terms with similar meanings were abstracted into second-order themes. For example, 'measurable performance appraisal' and 'traceable salary' reflected the changes in the employee performance appraisal against the digital background. Therefore, they were abstracted as 'redesigning the performance appraisal system'. In this process, the second-order themes that were unrelated to this study, such as 'increasing return' and 'increasing in company popularity', were excluded (Mao, 2020). Lastly, the second-order themes were aggregated into the three theoretical dimensions of 'ability empowerment', 'motivation empowerment', and 'opportunity empowerment' by matching the data and theory.

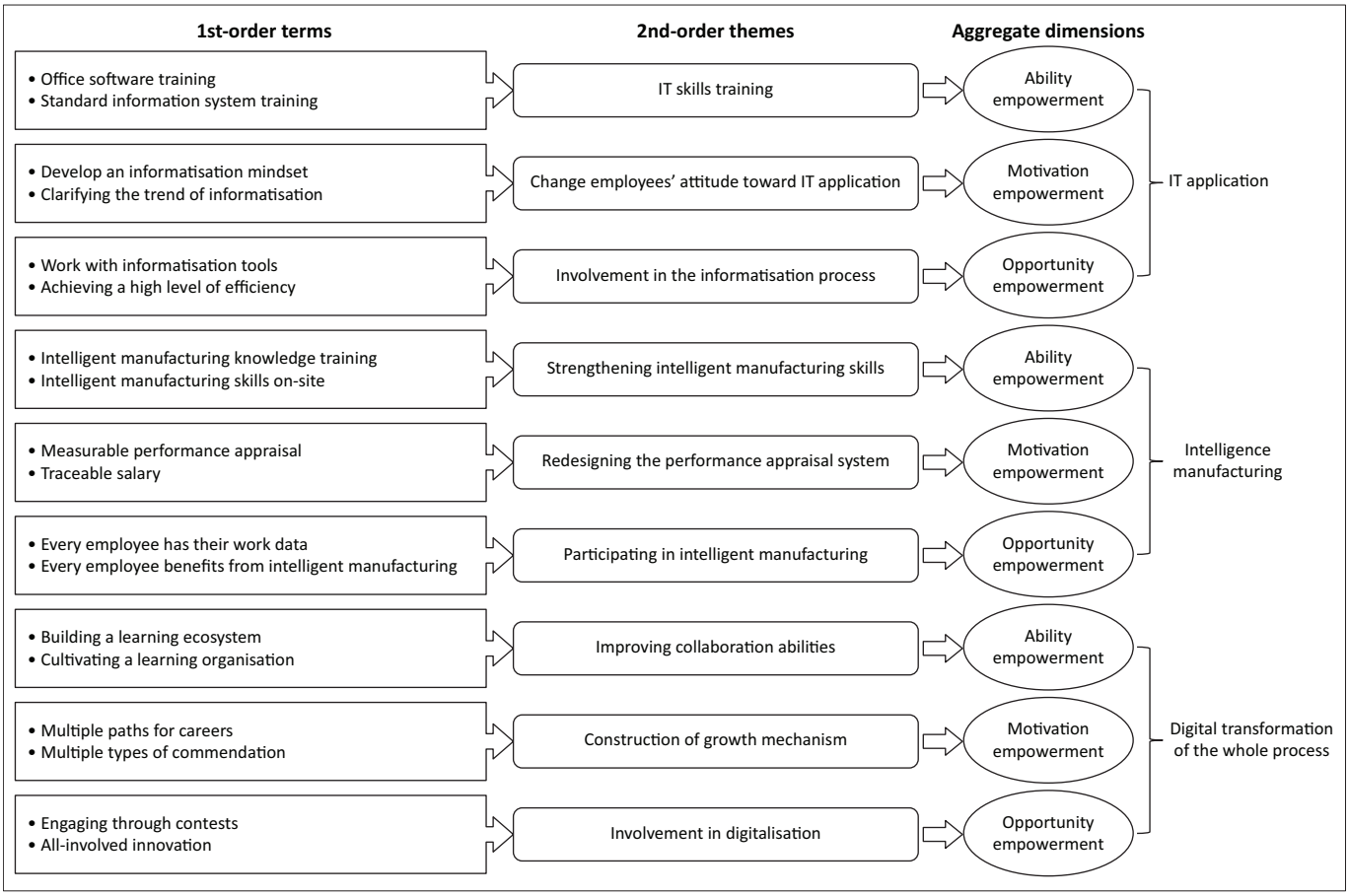
The data structure is shown in Figure 1, which displays the process from the first-order terms to the second-order themes, and then aggregate dimensions. The researchers cross-checked the aggregate dimensions in this study against the previous literature (Gioia et al., 2013). Through the iteration between data, theory, and suggestions from informants, the evolving model of employee empowerment in the digital transformation of manufacturing enterprises has been proposed.

# Findings

The research shows how to empower employees for digital transformation in manufacturing enterprises based on the three-stage digital transformation of Shangshang Cable. In the first stage (1999–2011), Shangshang Cable completed the digital infrastructure. In the second stage (2012–2016), Shangshang Cable realised the application of digital manufacturing systems in manufacturing. In the third stage (2017 until now), Shangshang Cable has been pursued for its comprehensive collaboration of all the digital systems in the value chain.

## Stage 1: Information technology application (1999–2011)

In 1999, Shangshang Cable started an IT application. Enterprise resource planning, office automation (OA), and product lifecycle dynamic modeling (PLDM) were implemented at this stage. In 2011, Shangshang Cable uploaded ERP and built a management information system that covered purchasing, producing, selling, and transportation. At this stage, to enable employees to adapt to information management quickly, Shangshang Cable empowered employees in three aspects: information




IT, information technology.

**FIGURE 1:** Data structure.

knowledge training, changing their attitude towards IT applications, and involvement in IT applications. In other words, Shangshang Cable strengthened employees' abilities ('can do') by empowering employees' knowledge and skills in IT during this stage. Table 2 shows the employee empowerment coding process.

### Information technology skills training

Shangshang Cable carried out office software skills training and standard information system training for employees to popularise their knowledge and skills for IT applications.

*Office software training:* Shangshang Cable periodically trained employees with office software skills and evaluated the training results. The training content included Word editing and Excel applications, such as recording the daily inventory of cables, classifying cables into different types, and a PowerPoint presentation, among others. Employees who passed the exam could obtain their total salary. In contrast, those who fail can only gain 90% of their salary and must continue the training until they pass the results evaluation.

*Standard information system training:* Shangshang Cable focussed on training standardised management on all aspects of production, technology, and management activities, such as the development of new products, adjustment of product structure, optimisation of the production process, formulation of a salary system, and performance appraisal, among others. In the training process, by analysing the typical cases, Shangshang Cable trained employees to achieve their basic knowledge of the standard information system and strengthen their sense of standardised management.

### Change employees' attitude towards information technology application

To better understand the purpose and significance of information construction and the change in attitude towards traditional manufacturing management, Shangshang Cable focussed on developing employees' mindsets towards IT and clarifying its relevance.

*Develop an informatisation mindset:* Shangshang Cable carried out the Shangshang Forum and trained employees to view information construction from the development perspective. Firstly, Shangshang Cable selected employees with excellent performance in information construction to share their work experience. For example, 'ERP has realized automatic production scheduling and distribution' and 'greatly simplified the huge workload of traditional manual bookkeeping and statistical reporting'. Secondly, Shangshang Cable emphasised the necessity to break free from existing knowledge and ability limitations in the changing environment and to learn new knowledge and skills with the opportunity of information.

*Clarifying the trend of informatisation:* Shangshang Cable carried out the strategy of integrating IT and industrialisation to promote information construction. Shangshang Cable explained the specific meaning and realisable path of this strategy to employees and let employees understand the trend of IT. At the same time, Shangshang Cable integrated ERP, OA, PLDM, customer relationship management (CRM), computer aided process planning (CAPP), and other systems to build information applications and industrial manufacturing systems. Therefore, Shangshang Cable was awarded the title of Jiangsu Provincial Informatization and Industrialization Integration Pilot Enterprise in 2012.

### Involvement in the informatisation process

Shangshang Cable provided various opportunities for employees to participate deeply in informatisation with the informatisation tools while allowing the employees to achieve high efficiency with the information system.

*Work with informatisation tools:* At Shangshang Cable, all the technical staff and managers have computers. Employees could read, revise, approve, and share various documents

**TABLE 2:** Stage of information technology application.

| Aggregate dimensions | Second-order themes | First-order terms | Illustrative responses |
|---|---|---|---|
| Ability empowerment | IT skills training | Office software training | Training included the essential Word, Excel, and PowerPoint knowledge by Live-Demo (A1).<br>In the past, the work was done for several hours with a calculator, but only a few seconds now using Excel (A5). |
| | | Standard information system training | Through standardised information system training, the enterprise has formed a culture where everyone pays attention to the standards and works as the standards (A2).<br>By popularising basic knowledge of standard information systems, employees' work behaviours have been standardised (B3). |
| Motivation empowerment | Change employees' attitude toward IT application | Develop an informatisation mindset | IT applications allow employees to learn new knowledge and skills (B1).<br>Outstanding employees in informatisation construction share their work experience (A3).<br>They emphasise that 'Work quality determines the quality of life, and everyone should improve themselves together with the enterprise in the IT age' (B2).<br>The application of ERP avoids the problem of information asymmetry, and the daily workload is greatly reduced (A1). |
| | | Clarifying the trend of informatisation | Integration of IT and industrialisation was a critical way to obtain competitive advantages in IT. As a cable manufacturing industry, we should seize this opportunity (B2).<br>ERP, OA, CRM, CAPP, etc., are the basics of the future of manufacturing systems (B3). |
| Opportunity empowerment | Involvement in the informatisation process | Work with informatisation tools | All technical staff and managers have computers (B4).<br>Orders are automatically allocated and scheduled in the information system, and corresponding data on how much to produce and pick is available (A1). |
| | | Achieving a high level of efficiency | With the integration of sales and inventory management, the salesmen could quickly retrieve the cables needed in the system (A3).<br>The 'automatic production' and 'selection of the best wiring' in the ERP system had vastly reduced employees' workload (A4). |

IT, information technology; ERP, enterprise resource planning; OA, office automation; CRM, customer relationship management; CAPP, computer aided process planning.

with the OA system instead of face-to-face communication. For example, the daily e-invoice could be directly submitted to the financial department for approval through the OA system.

*Achieving a high level of efficiency:* The information construction of Shangshang Cable simplified the working process and improved work efficiency. On the one hand, compared with the previous paper-based accounting work, all production data could be directly input into the ERP system, and the data could be read at any time for analysis. Thus, the accounting process is simplified, and errors from manual recording are avoided. On the other hand, the ERP system could directly connect sales data and inventory data. Thus, the salespeople could quickly retrieve the cables required, which reduced the handover process from department to department and enabled employees to achieve high efficiency.

Shangshang Cable's digital transformation was an evolving process. Shangshang Cable primarily solved the problem of employees, such as 'can not do and will not do' for IT applications by developing employees' IT abilities, changing their mindset, and creating opportunities to be involved in the IT process.

## Stage 2: Intelligence manufacturing (2012–2016)

In 2012, Shangshang Cable took the lead in building the ultra-high-voltage CIMS in the global cable industry, which realised intelligent manufacturing from the material inputs to the end products. With CIMS, the employees needed to track and control the entire production process and were required to handle and manage the intelligent manufacturing system. During this period, Shangshang Cable empowered employees by strengthening their brilliant manufacturing skills, redesigning the performance appraisal system, and encouraging their participation in intelligent manufacturing. At this stage, Shangshang Cable aimed to promote the application of CIMS by enabling the employees to 'do better' than the IT application stage. Table 3 shows the employee empowerment code.

### Strengthening intelligent manufacturing skills

To improve the intelligent manufacturing skills of employees and help them adapt to the smart working environment, Shangshang Cable carried out comprehensive training on the essential knowledge and abilities of intelligent manufacturing.

*Intelligent manufacturing knowledge training:* Shangshang Cable designed 17 courses on intelligent equipment, testing technology, and knowledge of ultra-high-voltage CIMS systems to strengthen employees' knowledge of intelligent manufacturing. In addition, Shangshang Cable held a forum on 'How to Win in the Internet Age for the Traditional Manufacturing Industry' and 'Cross-Border E-Commerce in Shangshang Cable'. They also invited experts to teach employees the six steps of network marketing and the connection between intelligent manufacturing and online sales.

*Intelligent manufacturing skills on-site training:* To ensure the effective operation of the ultra-high-voltage CIMS system, Shangshang Cable carried out on-site skills training. On the one hand, directors of branch factories, dispatchers, and team leaders were trained with skills in implementing and tracking production plans, product quality detection and traceability, and application of statistical tools, among others. On the other hand, the front-level employees were trained with skills on how to avoid the waste of raw materials, the operation of conductors, insulation, and other special equipment, among others. After training, the results would be evaluated through written and on-site operation exams. Only the employees who met the requirements could continue their jobs.

**TABLE 3:** Stage of intelligence manufacturing.

| Aggregate dimensions | Second-order themes | First-order terms | Illustrative responses |
|---|---|---|---|
| Ability empowerment | Strengthening intelligent manufacturing skills | Intelligent manufacturing knowledge training | More than 50 videos are available on the intelligent operation of cable-producing processes. If you do not understand the explanation, you could learn through the videos as a supplement (A5). |
| | | | Apart from the theoretical knowledge learning, a sample exhibition can assist employees' intuitive understanding (B1). |
| | | Intelligent manufacturing skills on-site training | Managers should learn a lot of mathematical and statistical technology for exemplary management in the production process (A1). |
| | | | Controlling the operating speed of the machine and avoiding material waste are necessary contents (A4). |
| Motivation empowerment | Redesigning the performance appraisal system | Measurable performance appraisal | By designing measurable performance indicators based on the intelligent manufacturing process, the front-line employees are all motivated to produce high-quality products (B3). |
| | | | Shangshang Cable implemented a quality-based point system. The employees would have a performance interview with 8 points deducted and be laid off with 12 points deducted (A2). |
| | | Traceable salary | All employees' day salaries are open on the whiteboard in every workshop (B3). |
| | | | How much work employees have done every day and how much money they can gain could be known the next day based on the data from the intelligent manufacturing process (A3). |
| Opportunity empowerment | Participating in intelligent manufacturing | Every employee has their work data | With the information system, Shangshang Cable uses objective data to evaluate individual work results (B4). |
| | | | According to detailed quality-based data, we could intuitively determine the cause of the problem and trace the responsibility to the employees (B2). |
| | | Every employee benefits from intelligent manufacturing | From top-level managers to front-line workers, every employee had corresponding rewards made by smart manufacturing (A5). |
| | | | Based on intelligent manufacturing, we have extra money to reward the children of employees admitted to universities (B2). |

### Redesigning the performance appraisal system

The ultra-high-voltage CIMS provided a large amount of data and supported Shangshang Cable to redesign the performance appraisal and salary management system based on the data.

*Measurable performance appraisal:* Data from the ultra-high-voltage CIMS system supported the measurable performance appraisal. Shangshang Cable had a four-level quality assessment system and set objectives for top management, directors of branch factories, team leaders, and front-line employees. For example, the directors of branch factories were evaluated monthly with more than 10 indicators on crucial quality, process supervision, and quality improvement, among others. The front-level employees were assessed daily using the indicators of raw materials, working hours, costs, field management, and quality of products. In this mode of 'digitizing quantitative indicators and quantifying qualitative indicators', employees could gain a clear understanding of their functional responsibilities.

*Traceable salary:* Through the ultra-high-voltage CIMS system, Shangshang Cable monitored the employees' operating procedures and the running state of the machines and equipment, among others, in real time. Based on this scenario, Shangshang Cable established a performance database for jobs at different levels, and more than 230 indicators were directly related to employees' salaries. For example, performance-related salary for front-line employees was calculated according to working hours, raw material consumption, and outputs on the production line. Shangshang Cable also implemented the 'daily wage on the wall' system. Employees' daily salary and specific basis were displayed on the 'wage wall'. Accordingly, the employees could manage their salary and stay positively motivated.

### Participating in intelligent manufacturing

Intelligent manufacturing has primarily changed the production mode of the traditional manufacturing industry. To actively cope with the change, Shangshang Cable provided various opportunities for employees to participate.

*Every employee has their work data:* Based on the data collection and feedback of the ultra-high-voltage CIMS, Shangshang Cable established a quality-based database for each employee. All the first-level managers and front-line employees had files on quality-based performance data, which kept records of production efficiency, equipment operation status, and operating procedures by on-site Kanban management. All the middle- and top-level managers had a matrix of strengths and weaknesses regarding product quality, work errors, and innovation, which is the crucial basis for promotion and annual award evaluation.

*Every employee benefits from intelligent manufacturing:* To ensure that every employee can participate in the operation and management of intelligent manufacturing, Shangshang Cable designed 35 indicators closely related to the strategic goals. It decomposed the indicators among branch factory directors, deans of departments, team leaders, and front-line employees. Based on a decomposition of goal-related indicators, everyone could benefit from intelligent manufacturing. For example, the output of a workshop was decomposed as 80% of the total reward for the directors of the branch factory and 50% for the dean of departments. In addition, to make employees share the results of intelligent manufacturing, Shangshang Cable has developed the 'Reward for Children of Employees Admitted to Universities'. The children of employees admitted to universities could receive rewards of 5000 yuan, 4000 yuan, and 3000 yuan. More than 100 children of employees have received the rewards until now.

At this stage, the digital transformation of Shangshang Cable was a process of refinement and the realisation of intelligent manufacturing. It primarily aimed to let employees improve with higher quality based on an intelligent manufacturing system. Shangshang Cable empowered employees with specific knowledge and skills in intelligent manufacturing and motivated employees to redesign the data-based performance appraisal system. Meanwhile, Shangshang Cable established intelligent manufacturing data files for employees and shared the benefits of intelligent manufacturing, which enabled employees to participate deeply in intelligent manufacturing.

## Stage 3: Digital transformation of the whole process (2017 to now)

Shangshang Cable applied the Manufacturing Execution System (MES) 2017 to integrate ERP, CIMS, and Supervisory Control and Data Acquisition (SCADA) in 2021 to achieve total data management. On the production side, employees were required to control the whole production process and ensure coordination among the system, materials, and equipment. On the management side, all level managers must fully communicate and cooperate for the comprehensive coordination of men, machines, materials, methods, environments, and measurements (5M1E). At this stage, Shangshang Cable focussed on building employees' digital collaborative abilities by improving collective abilities, building growth mechanisms, and total involvement in digitalisation to achieve 'doing their best in the long run'. Table 4 shows the employee empowerment code.

### Improving collaboration abilities

To comprehensively improve the collaborative ability in production, management, and operation sections, Shangshang Cable established a learning ecology supported by the digital platform for employees. It cultivated a collaborative learning organisation for the enterprise's and employees' long-term development.

*Building a learning ecosystem:* Shangshang Cable has built an enterprise digital learning ecosystem for employees. Shangshang Cable and Jiangsu Cloud Course Network

**TABLE 4:** Digital transformation of the whole process.

| Aggregate dimensions | Second-order themes | First-order terms | Illustrative responses |
|---|---|---|---|
| Ability empowerment | Improving collaboration abilities | Building a learning ecosystem | The manager of the cloud courses introduced the functions and operations of each module of the 'Shangshang Cloud Academy' (A5). |
| | | | 'Shangshang Cloud Academy' is a college without walls; we take learning as a daily matter and create a learning atmosphere where 'everyone learns at anytime and anywhere'; learning ability is competitiveness, and we move into the future by learning (B1). |
| | | | Our company paid attention to the collaboration abilities and carried out activities for front-line employees and all-level managers to improve their cooperating and communicating skills (B3). |
| | | | The average annual training courses for collaborating abilities were more than 42 (A2). |
| | | Cultivating a learning organisation | An atmosphere of trust existed between the employees and the managers (A1). |
| | | | When something goes wrong, the first thing for us is to resolve the problem cooperatively but not shift the blame (A2). |
| Motivation empowerment | Construction of growth mechanism | Multiple paths for careers | Three career paths exist for front-line employees, R&D employees, and administrators (B1). |
| | | | Employees are evaluated by their performance, abilities, and cooperation (B3). |
| | | Multiple types of commendation | Shangshang Cable evaluated honorary titles such as 'Shangshang Craftsman' and 'Chief Technicians' every year (A5). |
| | | | Owing to the outstanding work performance, Li Bo was awarded Meritorious figures in 2017 and was rated as Chief Technician of Technician of Changzhou in 2018 (B1). |
| Opportunity empowerment | Involvement in digitalisation | Engaging through contests | Zhang Dongjie participated in the race of Flame Retardant Cable for Lightweight Anti-creep Tower Drum and achieved the 'Top Ten Scientific and Technological Innovation Award' (B2). |
| | | | In the manufacturing skills contest, Cen Yongbiao ranked first in the country (B1). |
| | | All-involved innovation | Shangshang Cable designed a series of reward mechanisms for innovation and good suggestions (A4). |
| | | | Our company has 133 QC groups to implement all staff improvement and innovation activities, with more than 3000 reasonable suggestions every year (B3). |

R&D, research and development.

Technology Co., Ltd. jointly constructed the digital learning platform called Shangshang Cloud Academy. Employees can learn with Shangshang Cloud Academy anytime and anywhere. Through online and offline learning project settings, expert counselling, and grinding courses, Shangshang Cable has developed a series of high-quality activities to improve work skills and collaboration abilities. Shangshang Cable used the digital learning platform to link the whole chain of pre-testing, training, practice, evaluation, and feedback to improve work efficiency and collaboration.

*Cultivating a learning organisation:* In Shangshang Cable, all employees recognised the vision of 'not seeking the largest scale, but seeking the best quality' and attempted to achieve the best quality through collaboration or teamwork. In the digital context, Shangshang Cable focussed more on cooperation based on the digital process than individual contributions.

### Construction of growth mechanism

Shangshang Cable paid attention to the growth and development of employees and built a comprehensive growth mechanism supported by MES and SCADA.

*Multiple paths for careers:* Based on data from MES and SCADA, Shangshang Cable evaluated the skills, competencies, and collaborations of front-line employees, administrators, and R&D employees. Front-line employees evaluated as intermediate technicians, senior technicians, technologists, and chief technologists could have an additional monthly allowance of 300 yuan, 800 yuan, 1200 yuan, and 2000 yuan. Administrators and R&D employees could have a monthly title-based allowance of 500 yuan to 8000 yuan.

*Multiple types of commendation:* Shangshang Cable provided employees with excellent performance, various titles, and benefits. Shangshang Cable also developed the 'Shangshang Craftsman Developing Plan'. This plan conducted theoretical and practical skills training for front-line employees with senior technicians and above titles, which included theory learning, skill display, and experience sharing. The employee rated as 'Shangshang Craftsman' could have additional paid leave credits, annual bonuses, and individual parking spaces. In addition, many employees achieved provincial- and national-level honours, indicating they were approved and supported.

### Involvement in digitalisation

To better integrate employees into digital transformation, Shangshang Cable provided employees with various contests and encouraged employees' innovation behaviours.

*Engaging through contests:* Shangshang Cable annually holds micro-lesson and digital skill contests to develop employees' digital knowledge and skills. For micro-lesson contests, employees make and share videos on lessons such as the operation of a digital fine drawing machine and the payment method of online international trade. For digital skill contests, in 2019, Shangshang Cable carried out annual digital skills contests on the theme 'Digital Transformation and Upgrading'. Among such skill contests, the project 'Super flexible, torsion-resistant, bent-resistant cable for industrial robots' won the 'Liyang City Employees Top Ten Scientific and Technological Achievement Award'. The contest-style engagement highly motivated employees and enabled employees to integrate into the digital transformation.

*All-involved innovation:* Shangshang Cable has established an innovation mechanism covering all employees and all aspects of innovation in equipment, tools, production processes, management methods, and quality management.

Employees with excellent achievements in innovation would have the corresponding branch- and company-level rewards. The maximum one-time reward could reach 200 000 yuan. The all-involved innovation mechanism allowed employees to contribute their ideas to the improvement and innovation of the enterprise in all aspects. It actively integrated employees into the whole process of digital transformation.

In this stage, the digital transformation of Shangshang Cable upgrades from fine intelligent manufacturing to the entire life cycle of digital manufacturing construction. It required employees' capability of collaboration and continuous learning to 'do their best in the long run'. Shangshang Cable empowers employees with digital-based collaboration skills and then motivates employees through the mechanism of multi-path careers and various commendations. Furthermore, Shangshang Cable empowers the employees with opportunities and multiple activities. Thus, the latter is an employee empowerment mode of full collaboration in digital manufacturing.

## Discussion

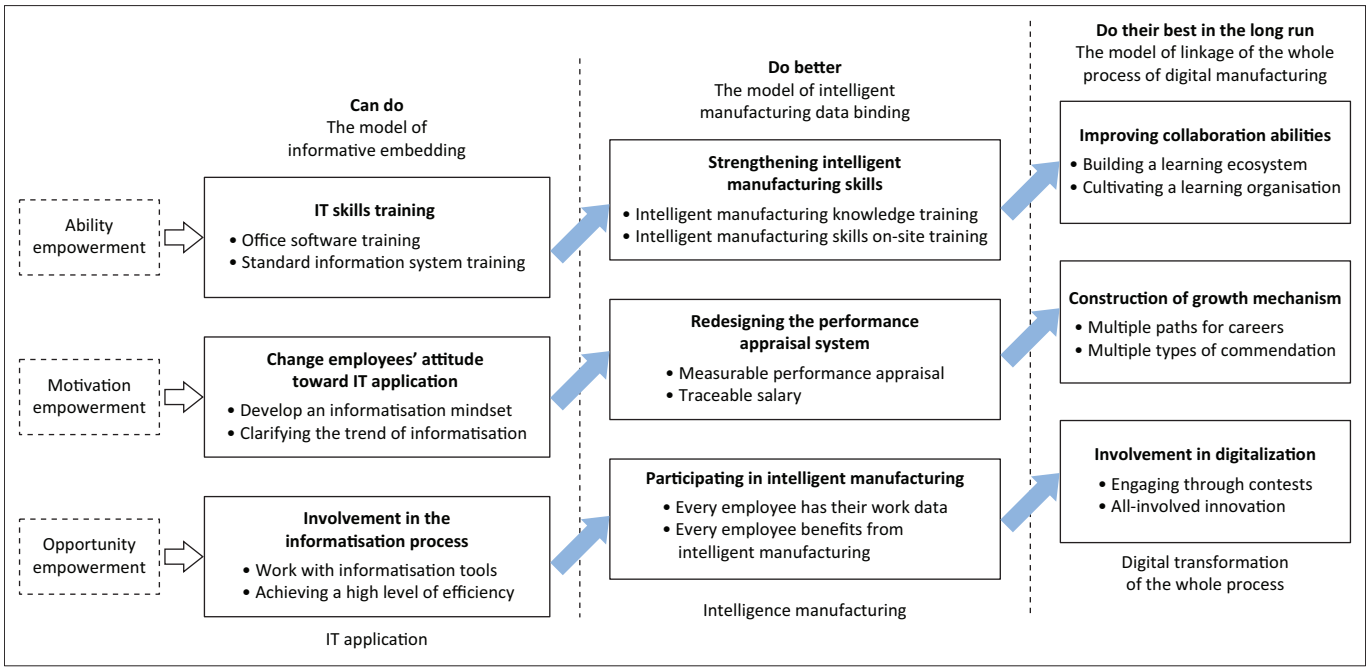
The objective of the study is to illustrate how manufacturing enterprises can effectively promote digital transformation by empowering employees at different stages. Some research indicates that employees may feel nervous about applying digital technology (Carlson et al., 2017). For example, employees feel their privacy is violated because of digital technology-based data collection (Arnaud & Chandon, 2013). Technology role overload may increase the burden of learning new knowledge and skills, which leads to increased job tension (Carlson et al., 2017), reduced job satisfaction (Holland et al., 2015), and even uncooperative behaviour to resist digital management (Kellogg et al., 2020). The studies above have illustrated the negative aspects of practical implementation. The greatest challenge for enterprises is finding methods to effectively engage employees in digital transformation (Cetindamar et al., 2021).

We provide an in-depth discussion on how manufacturing companies can empower their employees to participate actively in digital transformation, which is a response to the call of Gilbert and Teglborg (2021), Rocha et al. (2023), and Cetindamar et al. (2021) to focus on the positive role of employees and their engagement in digital transformation.

The research aims to explore a three-dimensional, evolving model of employee empowerment to promote the digital transformation of manufacturing enterprises (Narasimhan et al., 2018). This study shows that in different stages of digital transformation, employees have different skill requirements, work motivation, and development opportunities. Enterprises should construct an evolving model of can-do and want-to-do, do better, and do their best in the long run by empowering employees with abilities to do (Eden et al., 2019), motivation to do (Jakovljevic et al., 2018), and opportunities to do. Figure 2 shows the model of employee empowerment.

### Can do and want to do in the stage of information technology application

In the stage of IT application, manufacturing enterprises should start the digital transformation through the application of information systems and may face problems that employees do not have the skills and willing to use the information systems. Firstly, manufacturing enterprises should train employees with IT knowledge and skills to strengthen the




IT, information technology.

**FIGURE 2:** A three-dimension evolving model of employee empowerment to promote the digital transformation of manufacturing enterprises.

employees' abilities. Secondly, manufacturing enterprises need to change the employee mindset and let the employees accept the IT application and motivation (want to do) (Solberg et al., 2020) to reduce the negative impacts as mentioned by Kellogg et al. (2020), Carlson et al. (2017) and Holland et al. (2015). Thirdly, manufacturing enterprises need to provide every opportunity for employees to be in touch with information systems and obtain efficiency from information systems. These activities stand up for the suggestion of Fareri et al. (2023) that to fill in the digital skill gaps to meet the renewed demands of digital work environment. Therefore, employees can be fully empowered in IT applications, and the informatisation process will be promoted.

### Do better in the intelligence manufacturing stage

In the application stage of intelligent manufacturing, enterprises aim to transform from IT applications to intelligent manufacturing. Encouraging employees to do better than they can do is essential in the IT application stage. Firstly, through skills and knowledge training on intelligent manufacturing and intelligent production management, enterprises could update employees' abilities toward intelligent manufacturing (Murawski & Bick, 2017). Secondly, performance and salary management based on data from the intelligent manufacturing process could motivate employees to do better with the intelligent manufacturing system. Furthermore, the profit-sharing system based on data could bind employees with the outcome of intelligent manufacturing and promote intelligent manufacturing transformation. These respond to Hansen et al. (2021) and Khwakhali et al. (2023) that enterprises should widen the lens of employee empowerment from technology training to motivation practices in Industry 4.0.

### Do their best in the long run in the stage of digital transformation of the whole process

In the stage of digital transformation of the whole process, enterprises need to realise digital-based cooperation on the whole value chain (Cai et al., 2020). Firstly, enterprises should create a learning-oriented ecosystem and cultivate a learning organisation to provide employees with knowledge and skills for adapting and promoting the comprehensive digital collaboration of enterprises for a long time. Secondly, enterprises should construct multiple career paths and a commendation system for front-line technical staff, management staff, and R&D employees to form a comprehensive growth mechanism for employees. Thirdly, an all-involved innovation mechanism could let employees be fully involved in the whole process of digital transformation and promote a comprehensive digital-based connection. Such practices are in line with Rocha et al. (2023) that collaborations are at the centre of digital transformation.

## Implications of the study

### Theoretical contribution

This study contributes to employee empowerment in the digital transformation process for manufacturing enterprises. Firstly, this study explored the three-dimensional evolving employee empowerment model to promote manufacturing enterprises' digital transformation. Distinct from many studies that focussed on the influence and driving factors (Reischauer, 2018), transformation path (Xiao et al., 2021), and transformation results (Sun et al., 2019) in the digital transformation of manufacturing enterprises, this study focussed on the critical role of 'employees' in the digital transformation and discussed how to empower employees for manufacturing enterprises in the different stages of digital transformation. Secondly, this study indicated the details of employee empowerment by focussing on the characteristics and requirements of each stage in the digital transformation of manufacturing enterprises, which enriches the research on employee empowerment of manufacturing enterprises in the digital economy era. Thirdly, in the prior studies, AMO has been widely used in high-performance human resource management practices (Li et al., 2021) and strategic human resource management practices. This study introduced AMO into the research of employee empowerment in the process of enterprise digital transformation, which widened the application field of AMO.

### Practical significance

This study offers practical advice to enterprises for digital transformation. In the digital transformation process, manufacturing enterprises could empower employees according to the goals and requirements in the different stages. This study recommends three practices for these enterprises. Firstly, in the stage of IT application, enterprises should train employees with IT knowledge and skills, develop their cognition, and let employees experience the efficiency brought by IT application. Such practices would build a solid foundation for the next digital transformation upgrade. Secondly, in intelligent manufacturing, enterprises should strengthen their intelligent manufacturing skills and implement performance and salary management based on intelligent manufacturing data, which can motivate employees to promote intelligent manufacturing transformation. Thirdly, in the stage of whole-process digital transformation, enterprises should build a comprehensive employee growth mechanism and allow employees to establish rigorous involvement in the whole process of digitisation to realise the comprehensive digital transformation of manufacturing enterprises.

## Limitations and future research

To interpret the findings of this study, limitations and future studies require consideration. Firstly, describing the three stages in digital transformation is based on a single enterprise covering a narrow scope. In the future, a multi-case study or extensive sample test should be used to verify the research conclusions. Secondly, this study emphasises employees' vital role in digital transformation in manufacturing enterprises. Moreover, the role of leadership has a clear significance in promoting the digital transformation of enterprises (AlNuaimi et al., 2022). Hence, this study from a leadership perspective should be carried out to study senior managers' influence mechanisms on enterprises' digital transformation.

## Conclusion

This study focusses on the critical role of employees and constructs a three-dimensional evolving model of how to empower employees in the digital transformation of a manufacturing enterprise. The different stages of IT application, intelligent manufacturing, and the whole digital transformation process have differentiated employee requirements. The evolving model based on AMO theory can provide other employee empowerment methods and contexts to improve employees' digital work capability and motivate and involve employees in the digital workplace. Hence, manufacturing enterprises can purposefully empower employees based on their actual situation.

## Acknowledgements

The authors would like to acknowledge the participants who participated and provided help in this study.

### Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

### Authors' contributions

M.Z. instructed W.D. to complete the writing of the manuscript and was responsible for the improvement of the concept and framework.

### Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

### Funding information

This study was funded by Humanities and Social Science Fund of Ministry of Education of China (20YJA840021) and Research Program for Graduate Students of Jiangsu University (Y21C047).

### Data availability

The authors confirm that the data supporting the findings of this study are available within the article.

### Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors, and the publisher.

## References

AlNuaimi, B., Singh, S.K., Ren, S., Budhwar, P., & Vorobyev, D. (2022). Mastering digital transformation: The nexus between leadership, agility, and digital strategy. *Journal of Business Research, 145*, 636–648. https://doi.org/10.1016/j.jbusres.2022.03.038

Appelbaum, E. (2000). *Manufacturing advantage: Why high-performance work systems pay off*. Cornell University Press.

Arnaud, S., & Chandon, J.L. (2013). Will monitoring systems kill intrinsic motivation? An empirical study. *Post-Print, 90*(4), 35. https://doi.org/10.3917/grhu.090.0035

Bennedsen, M., Tsoutsoura, M., & Wolfenzon, D. (2019). Drivers of effort: Evidence from employee absenteeism. *Journal of Financial Economics, 133*(3), 658–684. https://doi.org/10.1016/j.jfineco.2018.12.001

Bryman, A., & Bell, E. (2007). *Business research methods* (2nd ed.). Oxford University Press.

Butschan, J., Heidenreich, S., Weber, B., & Kraemer, T. (2019). Tackling hurdles to digital transformation – The role of competencies for successful IIoT implementation. *International Journal of Innovation Management, 23*(4), 1–34. https://doi.org/10.1142/S1363919619500361

Cai, W., Khapova, S., Bossink, B., Lysova, E., & Yuan, J. (2020). Optimizing employee creativity in the digital era: Uncovering the interactional effects of abilities, motivations, and opportunities. *International Journal of Environmental Research and Public Health, 17*(3), 1–19. https://doi.org/10.3390/ijerph17031038

Carlson, J.R., Carlson, D.S., Zivnuska, S., Harris, R.B., & Harris, K.J. (2017). Applying the job demands resources model to understand technology as a predictor of turnover intentions. *Computers in Human Behavior, 77*, 317–325. https://doi.org/10.1080/00207450390162290

Cetindamar, D., Abedina, B., & Shirahada, K. (2021). The role of employees in digital transformation: A preliminary study on how employees' digital literacy impacts use of digital technologies. *IEEE Transactions on Engineering Management, PP*(99), 1–12. https://doi.org/10.1109/tem.2021.3087724

Chen, G.Q., Wang, J.Y., & Lin, Y.L. (2021). A study on the process model of organizational digital transformation and corporate case analysis. *Management Review, 33*(11), 28–42. https://doi.org/10.14120/j.cnki.cn11-5057/f.2021.11.007

Colbert, A., Yee, N., & George, G. (2016). The digital workforce and the workplace of the future. *Academy of Management Journal, 59*(3), 731–739. https://doi.org/10.5465/amj.2016.4003

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology, 11*, 100. https://doi.org/10.1186/1471-2288-11-100

Eden, R., Burton-Jones, A., Casey, V., & Draheim, M. (2019). Digital transformation requires workforce transformation. *MIS Quarterly Executive*, *18*(1), 1–17. https://doi.org/10.17705/2msqe.00005

Eisenhardt, K.M., & Graebner, M.E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25–32. https://doi.org/10.5465/amj.2007.24160888

Fareri, S., Apreda, R., Mulas, V., & Alonso, R. (2023). The worker profiler: Assessing the digital skill gaps for enhancing energy efficiency in manufacturing. *Technological Forecasting and Social Change*, *196*, 1–14. https://doi.org/10.1016/j.techfore.2023.122844

Gilbert, P., & Teglborg, A. (2021). The symbiotic relationship between digital transformation and renewed employee empowerment in the industrial sector: A case study. *Revue de Gestion des Ressources Humaines, 122*, 29–43. https://doi.org/10.3917/grhu.122.0029

Gioia, D.A., Corley, K.G., & Hamilton, A.L. (2013). Seeking qualitative rigor in inductive research: Notes on the gioia methodology. *Organizational Research Methods, 16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Gu, F.J., & Zhang, W.F. (2020). The digital transformation strategy for Chinese catering chain enterprise based on value chain theory. *China Soft Science, 11*, 134–142. Retrieved from http://qikan.cqvip.com/Qikan/Article/Detail?id=7103467707

Hansen, A.K., Stoettrup Schioenning Larsen, M., & Lassen, A.H. (2021). The role of absorptive capacity and employee empowerment in digital transformation of SMEs. In *Proceedings of the Conference on Learning Factories (CLF) Austria, 01–02 July 2021* (pp. 1–6). https://doi.org/10.2139/ssrn.3859277.

Helian, Z.W. (2023). Dynamic capabilities, employee innovation behavior, and digital transformation. *Enterprise Economy*, *42*(01), 104–114. https://doi.org/10.13529/j.cnki.enterprise.economy.2023.01.012

Holland, P.J., Cooper, B., & Hecker, R. (2015). Electronic monitoring and surveillance in the workplace: The effects on trust in management, and the moderating role of occupational type. *Personnel Review, 44*(1), 161–175. https://doi.org/10.1108/PR-11-2013-0211

Jakovljevic, M., Zupan, J., & Coleman, A. (2018). Model of incentive system for employees: A case of a manufacturing company in Croatia. *South African Journal of Business Management*, *49*(1), 1–10. https://doi.org/10.4102/sajbm.v49i1.191

Kellogg, K.C., Valentine, M.A., & Christin, A. (2020). Algorithms at work: The new contested terrain of control. *Academy of Management Annals, 14*(1), 366–410. https://doi.org/10.5465/annals.2018.0174

Khwakhali, U.S., Nguyen, T.N., Dinh, M., Nguyen, L., Pham, T., & Tran, Q. (2023). Leverage Smart Production for Opportunities Seizing and Employee Empowerment. In *2023 International Conference on System Science and Engineering (ICSSE), 27–28 July 2023* (pp. 559–564). IEEE.

Kimery, K.A. (1999). Digital empowerment: Modeling the relationship between information technology use and employee empowerment. *Atlantic Schools of Business*, 1–13. Retrieved from https://library2.smu.ca/handle/01/25765

Kretschmer, T., & Khashabi, P. (2020). Digital transformation and organization design: An integrated approach. *California Management Review, 62*(4), 86–104. https://doi.org/10.1177/0008125620940296

Kuhn, C., & Lucke, D. (2021). Supporting the digital transformation: A low-threshold approach for manufacturing related higher education and employee training. *Procedia CIRP*, *104*, 647–652. https://doi.org/10.1016/j.procir.2021.11.109

Lanzolla, G., Pesce, D., & Tuucci, C.L. (2020). The digital transformation of search and recombination in the innovation function: Tensions and an integrative framework. *Journal of Product Innovation Management, 38*(1), 90–113. https://doi.org/10.1111/jpim.12546

Li, L., Liu, Y., & Feng, Y.C. (2020). *Case studies on management: Methods and applications*. Peking University Press.

Li, Q., Cai, F.R., & Zhang, H.R. (2021). Research on the effect and its influencing factors of manufacturing employees' craftsman spirit on their job well-being. *Chinese Journal of Management, 18*(06), 864–872. https://doi.org/10.3969/j.issn.1672-884x.2021.06.008

Ma, J., & Guo, M.J. (2022). Enterprise digital transformation, employees' digital cognition and innovation performance: Is technology the knife, while I am the lamb to slaughter? *Science & Technology Progress and Policy*, 1–11. Retrieved from http://kns.cnki.net/kcms/detail/42.1224.G3.20221205.1054.010.html

Mao, J.Y. (2020). Conducting rigorous qualitative research by using a structured data analysis method: Review of the forum on case-based and qualitative research in business administration in China (2019). *Journal of Management World*, *36*(3), 221–227. https://doi.org/10.19744/j.cnki.11-1235/f.2020.0043

Marion, T.J., & Fixson, S.K. (2021). The transformation of the innovation process: How digital tools are changing work, collaboration, and organizations in new product development. *Journal of Product Innovation Management*, *38*(1), 192–215. https://doi.org/10.1111/jpim.12547

Murawski, M., & Bick, M. (2017). Digital competences of the workforce–a research topic? *Business Process Management Journal*, *23*(3), 721–734. https://doi.org/10.1108/BPMJ-06-2016-0126

Narasimhan, R., Vazhayil, J.P., & Narayanaswami, S. (2018). Employees' provident fund organization: Empowering members by digital transformation. *Journal of Public Affairs*, *18*(4), e1844. https://doi.org/10.1002/pa.1844

Peterson, N.A., Lowe, J.B., Aquilino, M.L., & Schneider, J.E. (2005). Linking social cohesion and gender to intrapersonal and interactional empowerment: Support and new implications for theory. *Journal of Community Psychology, 33*(2), 233–244. https://doi.org/10.1002/jcop.20047

Qiu, X.P. (2022). Research on organizational structure innovation of data-enpowering manufacturing enterprises. *Enterprise Economy*, *41*(01), 84–93. https://doi.org/10.13529/j.cnki.enterprise.economy.2022.01.009

Reischauer, G. (2018). Industry 4.0 as policy-driven discourse to institutionalize innovation systems in manufacturing. *Technological Forecasting and Social Change*, *132*, 26–33. https://doi.org/10.1016/j.techfore.2018.02.012

Rocha, C., Quandt, C., Deschamps, F., Philbin, S., & Cruzara, G. (2023). Collaborations for digital transformation: Case studies of industry 4.0 in Brazil, *EEE Transactions on Engineering Management, 70*(7), 2404–2418. https://doi.org/10.1109/TEM.2021.3061396

Selimović, J., Pilav-Velić, A., & Krndžija, L. (2021). Digital workplace transformation in the financial service sector: Investigating the relationship between employees' expectations and intentions. *Technology in Society*, *66*, 1–8. https://doi.org/10.1016/j.techsoc.2021.101640

Shang, H.B., Yang, X.L., & Li, W.N. (2022a). How does the strategic human resource management strategy influence organizational routine updating? Interpretation from the perspective of employees' affective response. *Journal of Management World, 38*(03), 162–182. https://doi.org/10.19744/j.cnki.11-1235/f.2022.0038

Shang, Y.Y., Jiang, J.F., & Wang, X.L. (2022b). Mechanism of data empowerment driving manufacturing enterprise service: An exploratory analysis based on grounded theory of multi-cases. *Journal of Systems & Management*, *31*(4), 721. https://doi.org/10.3969/j.issn.1005-2542.2022.04.010

Siachou, E., Vrontis, D., & Trichina, E. (2021). Can traditional organizations be digitally transformed by themselves? The moderating role of absorptive capacity and strategic interdependence. *Journal of Business Research, 124*, 408–421. https://doi.org/10.1016/j.jbusres.2020.11.011

Singh, A., & Hess, T. (2017). How chief digital officers promote the digital transformation of their companies. *MIS Quarterly Executive*, *16*(1), 1–17. https://doi.org/10.4324/9780429286797-9

Solberg, E., Traavik, L.E.M., & Wong, S.I. (2020). Digital mindsets: Recognizing and leveraging individual beliefs for digital transformation. *California Management Review, 62*(4), 105–124. https://doi.org/10.1177/0008125620931839

Srivastava, A., Bartol, K.M., & Locke, E.A. (2006). Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *Academy of Management Journal*, *49*(6), 1239–1251. https://doi.org/10.5465/amj.2006.23478718

Sun, X.B., Qian, Y., Zhang, M.C., & Li, J.Z. (2019). A study on the implementation mechanism of enterprise supply chain agility driven by big data. *Journal of Management World, 9*, 133–151. https://doi.org/10.19744/j.cnki.11-1235/f.2019.0123

Sun, X.B., Su, Z.H., Qian, Y., & Zhang, D.P. (2020). Research review and prospects of data empowerment. *R&D Management*, *32*(2), 155–166. https://doi.org/10.13581/j.cnki.rdm.20181503

Sun, X.B., Zhou, M.J., & Zhang, M.C. (2023). Implementation mechanism of enabling organizational structure innovation in the context of digital drive: Based on the case of Nanjing Iron and Steel. *Communication of Finance and Accounting*, *22*(1), 3–13. https://doi.org/10.1108/RAF-01-2022-0020

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., & Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, *122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Wang, S.M. (2021). Research on the incentive mechanism of enterprise employees based on the core competence of enterprises. *China Soft Science*, (S1), 253–259. Retrieved from https://goo.su/bfuoMiu

Wang, X.L., & Ma, L. (2015). An exploratory study of high performance HRM practice model of China leading enterprises. *Chinese Journal of Management, 12*(11), 1598–1606. https://doi.org/cnki:sun:glxb.0.2015-11-004

Wen, H.W., & Wang, S.Y. (2022). Research on the effect of digital technology application on enterprise innovation. *Science Research Management*, *43*(04), 66–74. https://doi.org/10.19571/j.cnki.1000-2995.2022.04.008

Wu, Y.H., Zhang, H., & Yu, X.O. (2021). The land of opportunity: Social mobility and firm productivity. *Journal of Management World*, *37*(12), 74–93. https://doi.org/10.19744/j.cnki.11-1235/f.2021.0183

Xiao, J.H., Wu, X.L., Xie, K., & Wu, Y. (2021). IT-driven transformation of Chinese manufacturing: A longitudinal case study on leap-forward strategic change of Midea intelligent manufacturing. *Journal of Management World*, *37*(03), 161–225. https://doi.org/10.19744/j.cnki.11-1235/f.2021.0041

Xiao, S.S., Sun, R.Q., Yuan, C., & Sun, J. (2022). Digital transformation, human capital structure adjustment and labor income share. *Journal of Management World, 38*(12), 220–237. https://doi.org/10.19744/j.cnki.11-1235/f.2022.0174

Yang, F., Liu, J., Wang, T., Wen, D.P., & Yu, H.P. (2019). The mechanism of 'Boundary Paradox' in the process of employee career development in Chinese organizational context: A perspective of job insecurity. *Nankai Business Review*, *22*(06), 176–187. https://doi.org/cnki:sun:lkgp.0.2019-06-016

Yin, K., Zhao, J., Hou, N., & Nei, Q. (2022). The effects of employee empowering expectation and leader empowering behavior congruence: Based on the relational identification theory. *Journal of Industrial Engineering and Engineering Management*, *36*(05), 75–85. https://doi.org/10.13587/j.cnki.jieem.2022.05.007

Yin, R.K. (2009). *Case study research: Design and methods* (Vol. 5). Sage.

Zhang, X.X., & Hao, X.L. (2022). Induction and alleviation of employees' digital transformation resistance from the perspective of configuration. *Studies in Science of Science, 41*(11), 2050–2061. https://doi.org/10.16192/j.cnki.1003-2053.20220831.001

Zhou, W.H., Deng, W., & Chen, L.Z. (2018). Digital empowerment on value co-creation process in platform enterprise of DiDi Chu Xing. *Chinese Journal of Management, 15*(08), 1110–1119. https://doi.org/10.3969/j.issn.1672-884x.2018.08.002

Zhu, X.M., Lin, X.Y., & Wang, T.D. (2022). The impact of enterprise digital transformation strategy and capability on product service system. *Foreign Economics & Management, 44*(04), 137–152. https://doi.org/10.16538/j.cnki.fem.20211220.401