


On the Use of ICT by Enterprises to Activate Industrial Heritage: A Case Study of Taoxichuan in China

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ABSTRACT

Despite the increasing use of information and communications technology (ICT) by enterprises engaged in industrial heritage, the academic community lacks sufficient understanding of how ICT enables the sustainable development of industrial heritage. This article fills this gap by analyzing the application of ICT by Taoxichuan Ceramic Art Avenue (the Company) to promote its organizational innovation and achieve the sustainable development of industrial heritage. To start with, the authors conceptualized the two stages, adaptive change, and breakthrough change, of ICT-induced organizational changes in industrial heritage. Secondly, they extended the research of affordance from the technical field to the social theory field and proposed the concept of organizational affordance. Finally, the authors provided suggestions for future research to employ organizational affordance to deepen our understanding of relevant fields.

KEYWORDS

Affordance Theory, ICT, Industrial Heritage, Organization

INTRODUCTION

Industrial heritage is a collective term for the production relics, skills, and culture left over from past industrial production. These infrastructures, which have lost the production function, are not only a source of knowledge of past industrial production but also important evidence of the development of human technology (Buiok et al., 2014). It has always been an important topic for mankind to activate the value of industrial heritage. After entering the digital era, more and more enterprises in the industrial era have found the integration and utilization of digital technology can bring opportunities to them (Yoo et al., 2010). In particular, some enterprises with cultural genes generally believe that culture is a valuable strategic asset that can strongly support their digital transformation (Downes and Nunes 2013; Therefore, more and more enterprises engaged in industrial heritage have used ICT and other digital technologies

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frequently, trying to use digital technologies to reactivate the value of industrial heritage and realize their digital transformation (Magnusson et al., 2021; Morton et al., 2022). For instance, many organizations engaged in industrial heritage have set up publicity websites, developed WeChat mini programs, and opened We-media accounts to promote and expand the impact of industrial heritage. The application of these digital technologies is mostly the functional transformation of cultural heritage (Hawkins and Muecke, 2002), with the aim of employing ICT to support existing business models of enterprises (Berente et al., 2016; Gregory et al., 2015). However, the existing studies focus on the application of digital technologies, seldom paying attention to the organizational change (Hartl & Hess, 2017) required for the digital transformation of enterprises engaged in industrial heritage. In fact, the effective application of digital technology needs to be guaranteed by the corresponding organizational change. The lack of corresponding organizational change may lead to the successful short-term application of digital technologies, but enterprises engaged in industrial heritage cannot truly realize the digital transformation, thus failing to achieve sustainable development of industrial heritage.

We selected Taoxichuan Ceramic Art Avenue (the Company) that uses ICT to facilitate organizational change and activate its industrial heritage for the following reasons: 1) as an organization engaged in industrial heritage that lacks digital genes, the Company is unique and typical in terms of employing ICT to achieve organizational changes, especially the drastic changes in the core dimensions of the organizational system (Pan and Tan, 2011); 2) it lacks research on the application of ICT by enterprises engaged in industrial heritage to make organizational changes and achieve sustainable development; and 3) enterprises engaged in industrial heritage should consider the economic benefits of reusing, the protection and inheritance of heritage culture, and other practical issues. All of these are quite different from the digital transformation of ordinary enterprises. Moreover, few companies have achieved digital transformation in a real sense (Tilson et al., 2010). Therefore, this study not only has theoretical significance but also has strong practical significance.

This study adopts the affordance theory, as enterprises engaged in industrial heritage are typical bureaucratic organizations generated in the industrial manufacturing context. Existing research focuses on digital technologies and organizational capabilities, without fully considering the changes in the new digital context. The stimulation of industrial heritage values requires consideration of how organizations use digital technologies to change existing business models in new contexts (Tim et al., 2020). Therefore, this study requires a theoretical perspective that takes into account the interaction between technology, organizational ability, and context. The affordance theory is used to explain how the same technology induces different outcomes based on different contexts and organizational abilities (Gibson, 1986). This theory has been widely used in information management to interpret why people or organizations using the same technology may present different work practices (Treem and Leonardi, 2013, Strong et al., 2014; Du et al., 2019).

In this regard, we took Taoxichuan Ceramic Art Avenue as the Company and explored **how ICT promotes the organizational innovation of the Company and activates the industrial heritage**, from the perspective of affordance theory. It not only has theoretical value in explaining how ICT changes the enterprises engaged in industrial heritage at the organizational- and system-level, but also has far-reaching practical significance in guiding enterprises to activate the value of industrial heritage. We mainly explored the following two aspects: 1) In the context of the digital economy, after ICT activates industrial heritage, what changes have taken place in the organization; 2) What is the role of ICT in influencing organizational changes?

THEORETICAL BACKGROUND

The Application of ICT in Industrial Heritage

As industrial heritage has the dual attributes of tangible and intangible cultural heritage, scholars have proposed to reuse industrial heritage resources and culture based on their characteristics

(Pipan, 2018), and strongly advocated the use of digital technologies and culture to achieve it (Glorius and Manz, 2018). That is, traditional industrial heritage projects can be transformed into online ones, and innovative industrial heritage projects using digital technologies can enlarge resources infinitely and integrate users and heritage resources under the online context. In this way, the transformation of industrial heritage using digital means has become a research hotspot (Klempa et al., 2016). As the products offered by industrial heritage cannot be tried before purchase (Cristobal-Fransi et al., 2020), in the context of the digital era, industrial heritage adopts numerous ICT technologies to establish appropriate communication channels to convey the necessary information to customers.

Although ICT is widely used in industrial heritage, there are few discussions on ICT in the research of industrial heritage. Most studies probe into industrial heritage in the discussion of cultural heritage (Liang, 2021). The few studies on ICT mainly focus on the following aspects: 1) They explore the use of the participatory nature of ICT to help related personnel access real-time information and participate in planning, thus stimulating the innovation potential of industrial heritage (Spruce and Leaf, 2017). For example, the Paper Museum in Fabriano, Italy, adopts ICT to help community members, and local entrepreneurs to innovate the use of landscape resources for the sustainable development of industrial heritage (Chiapparino and Galli, 2016); 2) They explore the use of ICT's ease-of-use feature to allow easy access for all Internet users to publish, read, and facilitate the dissemination of information about industrial heritage at low cost (Magro, 2012). For example, ICT can be used to spread knowledge regarding heritage culture through simple games and storytelling (López and Cruz, 2021); 3) They examine the use of the responsive nature of ICT to allow users to post information and receive feedback in near real-time (Tzouganatou, 2018). For example, the research indicates that websites related to industrial heritage tourism are helpful for rapid communication with the target audiences (Cristobal-Fransi et al., 2020).

The Affordance Theory of ICT

The concept of affordance comes from the research by ecological psychologist James Gibson. It refers to all action possibilities with an object based on users' physical capabilities (Gibson, 1977). In the field of ICT, affordance denotes the possibilities of organizational actions or changes provided by the technical function of ICT for organizations (Leonardi and Vaast, 2017) and the process of realizing these possibilities (Strong et al., 2014; Du et al., 2019). With more and more enterprises using ICT (Kane, 2017), scholars have studied the technological affordance of ICT and observed the functional properties of ICT and its role in organizations. It is found that ICT plays a role in communication (Kane et al., 2014), collaboration (Razmeita, 2014), knowledge sharing (Kwahk and Park, 2016), and other aspects of the organization through the outside-in (Gallagher and Ransbottham, 2010), bottom-up (Razmerita et al., 2014), and leisure-work (Skeels and Grudin, 2009) approaches.

Later, scholars realized that the deep embedding of IT technologies represented by ICT in organizations would facilitate organizational changes (Volkoff et al., 2007). Hence, they categorized the study according to the impact phases of ICT on the organization (Baptista, 2020). When the embedding of ICT in the organization is low, the organizational affordance focuses more on the direct and surface effects of the technology (Butler, 2003), such as the impact of ICT applications on the organizational framework of perceptions, interpretations, and actions of organizational actors (Bartunek and Moch, 1987). When the embedding of ICT in the organization is high, the organizational affordance pays more attention to the impact of technology on the organization (Majchrzak et al., 2016; Hutter et al., 2017), such as the fundamental values and governance structure of the organization (Silva and Hirschheim, 2007). For example, it is found that the deep embedding of ICT in the organization impacts and interferes with the core structure of the organization, rebuilds the fixed human-technology configuration (Wakeford, 2012), and achieves organizational transformation (Vial, 2019).

Research Review

Existing ICT studies in industrial heritage as most of them are discussed in the context of cultural heritage(e.g., Wincott et al.,2020). They focus on how to use the cultural characteristics of heritage to raise awareness of conservation or how to redevelop it for use (Pardo, 2019). However, these digital applications are mostly based on the enhancement of the value proposition advocated by the original organizations engaged in industrial heritage, ignoring the changes caused by the application of ICT to these organizations. In fact, for organizations engaged in industrial heritage that lack digital genes, if they want to use ICT to achieve digital transformation (Weill and Ross, 2004), they have to understand the institutional changes within the organization and establish new business models based on ICT (Weill and Woodham, 2002). Due to the lack of research on ICT-induced organizational changes in industrial heritage, we attempted to figure out the intrinsic mechanism of using ICT by organizations engaged in industrial heritage to achieve sustainable development.

METHODOLOGY

We adopted the longitudinal single case study (Eisenhardt, 1989; Yin, 2014) to explore the ICT-induced organizational changes in industrial heritage. As the organizational changes in industrial heritage involves many stakeholders, and other complex factors influencing the process, and need to undergo a complex dynamic process (Siggelkow, 2007), we adopted an interpretive research approach (Nag & Gioia, 2012), to present the data structure by using a theoretical sampling process of first-order concepts - theoretical categories - aggregate dimensions. The first-order analysis is based primarily on first-hand interview data and is subsequently coded in the second-order analysis (Gioia et al., 2013). Finally, it forms an original theory based on the unique contextual factors of the case and the existing literature (Corley & Gioia, 2011).

Case Setting

This study not only examines the process and role of ICT in organizations engaged in industrial heritage but also reveals how enterprises transform the organizational structure of bureaucracy to achieve sustainable development of industrial heritage. Therefore, the selected case should highlight the essential attributes and key features of the research problem. Given the typicality, traceability, and data affordance of the case, we selected Taoxichuan Cultural and Creative Street, an enterprise engaged in industrial heritage in Jingdezhen, the porcelain capital in China, as the research subject to explore in depth the behavior and process of ICT in organizational changes and to summarize and refine the theory.

The predecessor of Taoxichuan Ceramic Art Avenue (the Company) was Cosmos Ceramic Factory. Founded in the 1950s, the factory had good performance in the era of the planned economy. After the 1990s, the original state-run porcelain factories were phased out by the times, and numerous porcelain industrial plants were left idle. In 2012, the Company was taken over by the government and restarted its operation. In 2015, many ceramic enthusiasts began to share their experiences of visiting the renovated industrial heritage sites of the Company through various ICTs, which stimulated the attention and participation of more enthusiasts and tourists. The company also uses various social media apps to promote and participate in operations. In 2020, the Taoxichuan Live Streaming Base was officially established, and the business model changed from Taoxichuan's independent production and operation to a new e-commerce model where Taoxichuan provides the platform and ICT is responsible for the production and operation. Taoxichuan's revenue grew from RMB580 million (more than \$80 million) in 2017 to RMB5.534 billion (close to \$800 million) in 2021.

Data Collection

The research team began to explore the Company in 2019 and visited Taoxichuan Cultural and Creative Street four times. By the end of 2022, the research team had collected and sorted out a wealth of primary and secondary data (see the appendix for details), based on 23 interviews and nearly 1869 minutes of interview recordings. The summary of interviewees and other relevant information is also listed in detail in the appendix.

Initially, the research team focused on the use of ICT by the Company to activate the industrial heritage, and designed interview questions accordingly. For example, “What online publicity technologies did the Company use in the early stage?” and “What impact did the use of digital technology have on the Company?”. Later, the research team found that with the application of ICT, the organizational structure of the Company changed significantly. After that, the research team adjusted the interview outline and added interview questions such as: “Can the previous customer department cope with the emergence of a large number of Tik Tok users?” “What improvements have the department of enterprise made in response?”.

Secondary materials mainly include news reports, website publicity materials, WeChat official accounts, company documents, archives, etc. For example, we collected 42 TikTok videos related to the research topic from 526 videos posted in the official TikTok account and 18 WeChat articles related to the research topic from 639 articles posted in the official WeChat account. Additionally, the research team paid special attention to the various rules and regulations issued by the Company, as well as the external speeches and reporting materials of senior leaders. To avoid retrospective bias during the interviews, the research team compared first-hand data with secondary data from multiple sources to ensure the reliability and validity of the findings.

Data Analysis

Data analysis involves three stages. Firstly, the research team sorted out the data sources (archives, field observations, media files, etc.), classified the core data (semi-structured interview materials) of the research team at this stage, and coded them in an open manner according to the statements of specific ICT applications (Gioia et al., 2013). To avoid the researchers’ individual cognitive bias and ensure the consistency of coding, the research team checked the coding results several times (Klein and Myers, 1999). With open coding, the research team obtained a series of first-order constructs. For example, constructs such as “social media attract fans”, “using TikTok to participate in activities”, and “participating in activities through Moments” (see Figure 1 for details).

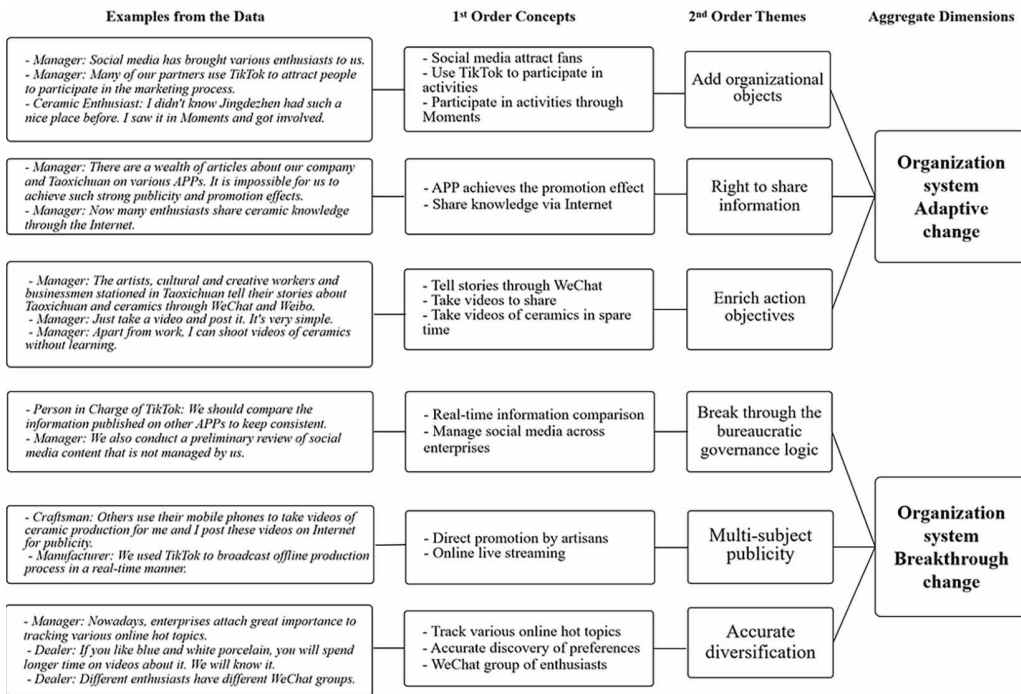
In the second stage of coding, the research team found the similarities and differences between categories in the first-order construct and described them with categories, tags, or phrases. The purpose is to abstract the theme and dimension of the second-order theory (Gioia et al., 2013). For example, “social media attracts fans”, “using TikTok to participate in activities”, and “participating in activities through Moments” in the first-order constructs were abstracted as “adding organizational objects”.

In the third stage, the research team double-checked the first-order constructs and second-order themes and further refined these constructs into a simplified and complementary grouping, and eventually merged the same themes to form two aggregate dimensions (Gioia et al., 2013). It is found that ICT promotes organizational changes and activates industrial heritage through the realization of “ICT-induced adaptive change” and “ICT-induced breakthrough”, thus achieving the sustainable development of enterprises.

FINDINGS

Organizational change requires new institutional logic and business models that respond to the challenges of the organization’s internal and external environment (Hanelt et al., 2021; Hinings et al., 2018). ICT-induced organizational change is a new phenomenon in the old organization. With regard to

Figure 1. Data analysis and coding example



the theoretical innovation caused by ICT, scholars have proposed to use classical theories to elaborate on new situations (Zhu et al., 2023). Therefore, based on the typical bureaucratic characteristics of the Company, we analyzed the ICT-induced changes in organizations engaged in industrial heritage according to the three core dimensions (rules, power, and actions) of the organizational system proposed by Max Weber (Weber, 2009).

The Adaptive Change in the Organizational System Caused by the Technical Function of ICT

From the biological point of view, adaptation refers to changes in the genetic or behavioral characteristics of an individual or system to better adjust to changes (Futuyma, 1998). From the perspective of organizational theory, it refers to the appropriate response of organizations to environmental changes (Stieglitz, 2016). Adaptive change is reflected and embodied in the mode or result of the change (Girod and Whittington, 2015). Adaptive change refers to the improvement of the organizational system in response to environmental changes in the three aspects of rules, power, and actions.

Rules: In the past, organizations under the bureaucracy of the industrial economy relied on strict and stable rules to operate. Rules are the management basis of the bureaucracy. In these organizations, organizational rules are implemented internally to departments or personnel within the organization, and externally to the organization's partners. In this study, due to the bankruptcy of the Company, it had no suppliers, dealers, or clients. Under the circumstances, the Company could not achieve sustainable development.

The initial embedding of ICT into the organization brings external objects to the organizational rules. Based on the participatory nature of ICT (Spruce and Leaf, 2017), it offers the possibility for many ceramic enthusiasts to enter into enterprises (Gallaughar and Ransbotham, 2010), bringing in external objects of organizational rules. For example, ceramic enthusiasts who purchased ceramic

products through secondary distribution channels in the past learned about Taoxichuan's product information through Moments and social software such as Xiaohongshu, and went directly to Taoxichuan to visit or buy products. In such a situation, the Company does not need any secondary distributors. As the general manager (ID: L2-1) mentioned in the interview, *social media has brought various enthusiasts to the enterprise*. The supplement of external objects of the organizational rules brings customers to the Company and provides the possibility for its sustainable development.

Power: Some of the organizational power comes from the right to formulate and interpret the rules of the organization, and some come from the information right obtained from the organization's unique position in the industrial structure or the professional power derived from the professional monopoly. In this study, before the embedding of ICT, the Company formulated and interpreted the system. However, the Company had no clients or consumers (external objects of rules), hence it lacked the information power obtained from a unique position.

After the embedding of ICT, the new external objects of rules change the position of the enterprise in the industrial structure. Additionally, the knowledge-sharing function of ICT (Kwahk and Park, 2016) shares the knowledge or information held by participants within the organization. In this way, it not only spreads expertise but also provides the possibility for ICT users to gain organizational information or professional power. For example, the widespread of links related to Taoxichuan's stories via Moments and TikTok has transferred the information power to various users. As the chairman (ID: L1-2) stated in the interview, *we found that in the absence of any commercial investment, there are a wealth of articles about our company on various APPs. It is impossible for us to achieve such strong publicity and promotion effects with conventional practices*. The transfer of organizational information and professional power makes it possible for the Company to implement organizational actions.

Actions: Under the bureaucracy, internal organizational actions always start from the internal construction of the organization due to the low cost. In this study, before the embedding of ICT, the organizational actions of the Company were implemented centered on internal rules. As the chairman (ID: L1-1) mentioned in the interview: *instead of over-hyping our company, we first build the project well, then consider marketing promotion, project investment, commercial operation etc*. These internal organizational actions generally do not create direct benefits for the Company.

The ease of use of ICT makes it possible to fulfill the organization's external actions. As ICT is embedded in enterprises in a bottom-up way (Razmerita et al., 2014), most ICT users are fans or clients of products (ceramics). These ceramic enthusiasts are not professionals in publicity, but they conduct lots of "self-creation, self-dissemination, self-operation" activities due to the ease of use of ICT. The behaviors implemented by these new objects of rules have become organizational behaviors that publicize the enterprise. As the manager of the corporate publicity department (ID: M7) stated in the interview: *while engaging in innovation, creative workers stationed in Taoxichuan tell their stories about their works, Taoxichuan, and ceramics to the world outside of Jingdezhen through various social media such as WeChat and Weibo*. External cultural promotion enriches organizational behaviors. To some extent, it seems that enterprises adapt to the digital age, which demands a variety of marketing activities.

Summary: Through the analysis of the rules, power, and actions, it can be seen that before the embedding of ICT, the organization engaged in industrial heritage operates according to the rules formed in the context of the industrial economy. However, in the digital era, this organizational change can no longer support the sustainable development of enterprises, and organizations have a strong willingness to adapt to changes. Meanwhile, the Company is short of information technology to support innovation and lacks customers and users. After the initial embedding of ICT in the organization, ICT not only provides the path function for ceramic enthusiasts and other relevant personnel but also offers knowledge-sharing channels (Bharati et al., 2015). ICT is easy to use and requires no complex installation and formulation (EI Ouiridi et al., 2015). It allows organizations to have objects of rules, partially realizing the change in organizational power. As a result, the organization operates according

to the changed organizational power. The changes in these organizations are realized using the methods, paths, and easy operations provided by ICT. It can be seen that due to the direct use of the technical functions provided by ICT, organizations have adaptive changes such as the addition of new objects of rules, the transfer of organizational knowledge and information power, and the completion of organizational publicity by new objects of rules. However, the purpose of these changes still reflects the organization’s desire to enhance the original value propositions of business-oriented production and maintain the existing business models (Besson & Rowe, 2012) (see Table 1 for specific cases).

The Breakthrough Change in Organization Caused by the Technical Application of ICT

The breakthrough change refers to the process of implementing radical changes in technologies, markets, management, and business models to construct an innovation system, strategic thinking, and market positioning, to better satisfy customers and adapt to the environment (Christensen, 2013). The breakthrough change is made by reconstructing the rules, power, and actions of the existing organizational system. It has become an important force driving the strategic change of the existing organization. Breakthrough change emphasizes the subversion of existing technological achievements and business models, and the redefinition of new value propositions (Wessel et al., 2021).

The difference between adaptive change and breakthrough change is mainly reflected in the degree of change in the organizational system. In other words, the former is based on the existing knowledge used by the organization and it continuously improves the methods or products used to achieve the enterprise objectives; while the latter includes new methods or products for enterprises. These novel methods or products either come from completely different knowledge bases or the recombination of enterprises’ existing knowledge bases and new knowledge. The breakthrough change affects the governance logic of the organization (Silva and Hirschheim, 2007), the re-combination of organizational power, and subverts the original technology trajectory and market paradigm. It is characterized by high uncertainty and great destructiveness.

Rules: In the initial embedding of ICT in the organization, the impact of ICT on the organization is mainly brought by the characteristics of technology and surface effects (Butler, 2003). It does not affect the governance logic and core structure of the organization (Silva and Hirschheim, 2007). The organization still follows the empirical rules of time and space under the bureaucracy of the industrial economy. Although the Company has made adaptive changes, such as adding objects of

Table 1. The adaptive change in the organizational system caused by the technical function of ICT

Technical Features	Direct and surface effects that technology can produce (Damsgaard and Scheepers, 2000)
Rules	ICT provides the participation path and organizations add objects of rules
	L2-1: <i>Social media has brought various enthusiasts to us.</i> L3-2: <i>Many of our partners use TikTok to attract people to participate in the marketing process.</i> T5-2: <i>I didn't know Jingdezhen had such a nice place before. I saw it in Moments and got involved.</i>
Power	ICT provides channels for knowledge sharing and empowers participants with organizational information.
	L1-2: <i>we found that in the absence of any commercial investment, there are a wealth of articles about our company on various APPs.</i> M6-1: <i>Now many enthusiasts share ceramic knowledge through the Internet.</i>
Actions	The ease of use of ICT allows users to conduct dissemination and communication.
	M7: <i>The artists, cultural and businessmen stationed in Taoxichuan tell their stories about Taoxichuan and ceramics through WeChat and Weibo.</i> W1-3: <i>Sometimes we just take a video and post it. It's very simple.</i> P1-2: <i>You don't need to learn to shoot ceramics. Just play it.</i>

organizational rules, it manages the objects of rules in a simple way according to the governance logic under the bureaucracy, failing to make fundamental changes in the operation. The objects of rules are still the executors of the enterprise rules and regulations. The Company tries to incorporate new objects of rules into the management system. However, due to the high independence of ICT users, the rules and measures of the Company have not been implemented. There have been times when the information released by the Company is inconsistent with that released by ICT users. As the deputy general manager (ID: L2-2) mentioned in the interview, *to ensure the effectiveness of management, we ask fans and users to comply with some basic requirements on the release time, frequency, etc. But it does not work well.*

With the deep embedding of ICT, the communication function of ICT (Kane et al., 2014) enables the organization to achieve a high degree of information sharing and coordination inside and outside the organization. In this way, it breaks the management logic of time and space and brings the organization the possibility of gradually forming a rule system with technology and data as the core. For example, the enterprise breaks through the formulation of different internal and external rules, builds an information-sharing platform, and promotes real-time communication among the enterprise, partners, and numerous third-party participants on the information platform. Adequate communication makes the release time and frequency of major enterprise information efficient and consistent, which is difficult to achieve in the previous bureaucratic organization. With the establishment of data logic, the boundary of organizational rules is increasingly blurred, providing conditions for the decentralization of organizational power.

Power: Under the traditional bureaucracy of the industrial economy, the implementation of the original organizational power is performed through the guarantee of organizational rules, and the organizational power is certain and stable. Due to the initial embedding of ICT, new objects of rules require to exercise more organizational power, which destroys the power structure under the previous rulemaking and causes organizational conflicts. For example, after the introduction of ICT, the Company still concentrated its organizational power according to the bureaucracy. The power of each department was delegated by the superior, and the objects of the organizational rules were subject to the arrangement of the superior. However, the organization's external publicity and other information rights were owned by various ICT users, and the organizational power of these users was not given by the superior. Therefore, many organizational conflicts occurred when multiple subjects performed organizational power.

The deep embedding of ICT changes the position of organizations in the industrial chain, and the collaboration function of ICT (Razmerita et al., 2014). Organizational power gradually shifts from enterprises to Internet celebrities with numerous followers and social platforms with a host of users. The emergence of the digital logic of rules has brought about the decentralized transformation of organizational power. For example, in the Kiln Festival, enterprises exercise offline organizational power to organize and ensure the smooth implementation of activities, while Internet celebrities exercise online organizational power to broadcast and introduce the Kiln Festival. The Company partnered with Internet celebrities through ICT to broadcast the entire process of the Kiln Festival. As the ceramic manufacturer (ID: P3-3) mentioned in the interview, *we used TikTok to broadcast the offline production process in a real-time manner, not only publicizing Taoxichuan, but also selling our products.* With the decentralization of power, organizational power is increasingly performed by multiple subjects, such as the Company, ICT platforms, and Internet celebrities.

Actions

In the initial embedding of ICT, the organization undergoes adaptive changes, and the information publicity is completed by other goals of rules. However, organizational actions under the bureaucracy require the consistency of work, with a view to improving work efficiency and reducing operating costs or maintaining continuity after employee turnover. In the digital context, the mobility of ICT users has increased, and the advantage of consistency of organizational actions under the bureaucracy

no longer exists, leading to a situation in which the goals of the organizational actions are confused. For example, in the early stage, the enterprise sets the goals regarding project construction, business operations, etc., and does not pay much attention to corporate communications. However, ICT users frequently release various information about Taoxichuan out of their interests.

With the deep embedding of ICT, ICT brings the possibility of more accurate and diversified organizational actions. On the one hand, ICT has formed a wealth of small communities with specific interests or topics as the core, and each interest or topic is accurately matched based on ICT functions. The individualized needs formed by ICT become a key driver of organizational actions. Under the data rules, organizational actions are data-based, showing a high degree of adaptiveness and increasing precision. For example, TikTok accurately analyzes customers based on how long they spend on the page and then pushes relevant videos. On the other hand, as ICT moves from the leisure field to the work field (Skeels and Grudin, 2009), some topics or people get rapid and large-scale dissemination and attention, such as events and phenomena related to Internet celebrities. The involvement of emotional behaviors enriches organizational behaviors, and the introduction of ICT leads to new behaviors. For example, the Double 11 Shopping Festival and so on have become new marketing behaviors. As the live streaming service provider (ID: P5-2) mentioned in the interview, *the current technologies push relevant videos to you according to your preferences and hot topics*. With the enrichment and increasing accuracy of organizational actions, enterprises have formed the characteristics of multi-subject cooperation and co-creation of the digital organization. In this way, ICT has caused breakthrough changes in enterprises.

Summary: Through the analysis of the rules, power, and actions, it can be seen that the organization has made adaptive changes in the initial embedding of ICT. Adaptive changes have solved the issues of the lack of customers and publicity approaches that the organization encounters in the new situation, and the enterprise can better meet the needs of the times. However, the “false prosperity”, caused by the improvement that caters to changes and maintains the original business model of the organization, fails to achieve the successful transformation of an enterprise. With the deep embedding of ICT, it has caused the deep transformation of enterprises. The logic of rules centered on bureaucracy gradually shifted to the new logic of rules with technology and data as the core, achieving the decentralization of organizational power and changing the value proposition from enterprise-oriented in the past to cooperation by enterprises and customers (see Table 2 for specific examples). Enterprises also present new paradigms such as platformization, ecologization, modularization, and virtualization (Vial, 2019).

Table 2. The breakthrough changes in organization caused by the technical application of ICT

Technical application	Changes in basic values and governance structure caused by technologies (Silva and Hirschheim, 2007)
Rules	Technology provides information sharing and organization changes the logic of rules
	L2-2: <i>We ask fans and users to comply with some basic requirements on release time, frequency, etc. But it does not work well.</i> L2-1: <i>We should compare the information published on other APPs to keep consistent.</i>
Power	Technology provides interactive collaboration and decentralizes organizational power.
	P3-3: <i>We used TikTok to broadcast the offline production process in a real-time manner.</i> W2-2: <i>I'm not adept at online operations. Others use their mobile phones to take videos of ceramic production for me and I post these videos on the Internet for publicity.</i>
Actions	Technology achieves accurate classification and various organizational actions.
	P5-2: <i>The current technologies push relevant videos to you according to your preferences</i> P2: <i>If you like blue and white porcelain, you will spend longer time on videos about it. We will know it.</i> P3-1: <i>Different enthusiasts have different WeChat groups.</i>

ICT Affordance Mechanism that Affects Organizational Changes

In the previous section, this paper starts with the two embedding stages of ICT in the organization, and elaborate on the organizational changes caused by ICT from the three dimensions of rules, power, and actions. In this section, it comprehensively analyzes the mechanism of organizational changes caused by ICT from the perspective of affordance. To maintain the consistency of the research, we have explored the two stages of organizational changes caused by ICT.

First of all, it can be seen that in the initial embedding of ICT, the organization engaged in industrial heritage operates according to the rules formed in the context of the industrial economy. However, in the context of the digital economy, this organizational system no longer facilitates the sustainable development of the enterprise, and the organization has a strong willingness to adapt to changes. Meanwhile, the Company is short of information technology to support innovation and lacks customers and users. ICT not only provides the path function for ceramic enthusiasts and other relevant personnel but also offers knowledge-sharing channels (Bharati et al., 2015). The ease of use without complex installation and formulation (EI Ouiridi et al., 2015) and the initial embedding of ICT allow the organization to have objects of rules, partially realizing the changes in organizational power. As a result, the organization operates according to the changed organizational power. The changes in these organizations are realized with the methods, paths, and easy operations provided by ICT. It can be seen that the initial embedding of ICT affects the changes in the organization to some extent. From the perspective of affordance, it achieves the functional affordance of ICT (Leonardi, 2013).

Second, when using ICT, it requires radical organizational changes to enable enterprises to succeed in new scenarios (Nambisan et al., 2019). During the initial embedding of ICT, the organization is partially changed with the support of technical functions provided by ICT, but the enterprise still suffers the centralized management power and poor departmental collaboration under the traditional bureaucracy, resulting in unclear goals of organizational actions. At this time, ICT plays a vital role as an important catalyst for organizational progress and transformation (Majchrzak et al., 2012). Specifically, as many of the contents shared via ICT are generated by users, it means that ICT users gain more and more voice and power in the organization. With the deep embedding of ICT, the communication function (Miles and Mangold, 2014) and collaboration function (Razmerita et al., 2014) provided by ICT solve the problem of poor departmental collaboration due to the centralization of power in the original organization. As a result, ICT empowers organizational changes (Leonardi and Vaast, 2017), promotes the logic and boundaries of organizational rules, realizes the decentralization of organizational power, and implements diversified and accurate organizational actions. It is worth mentioning that these changes are not the direct manifestation of functions of technology, but the social phenomena generated based on affordances in practice (Zheng and Yu, 2016). The deep embedding of ICT is the social application realization of the organization using the functional affordance of ICT. From the perspective of affordance, it realizes the socialization function of ICT, which we define as the organizational affordance.

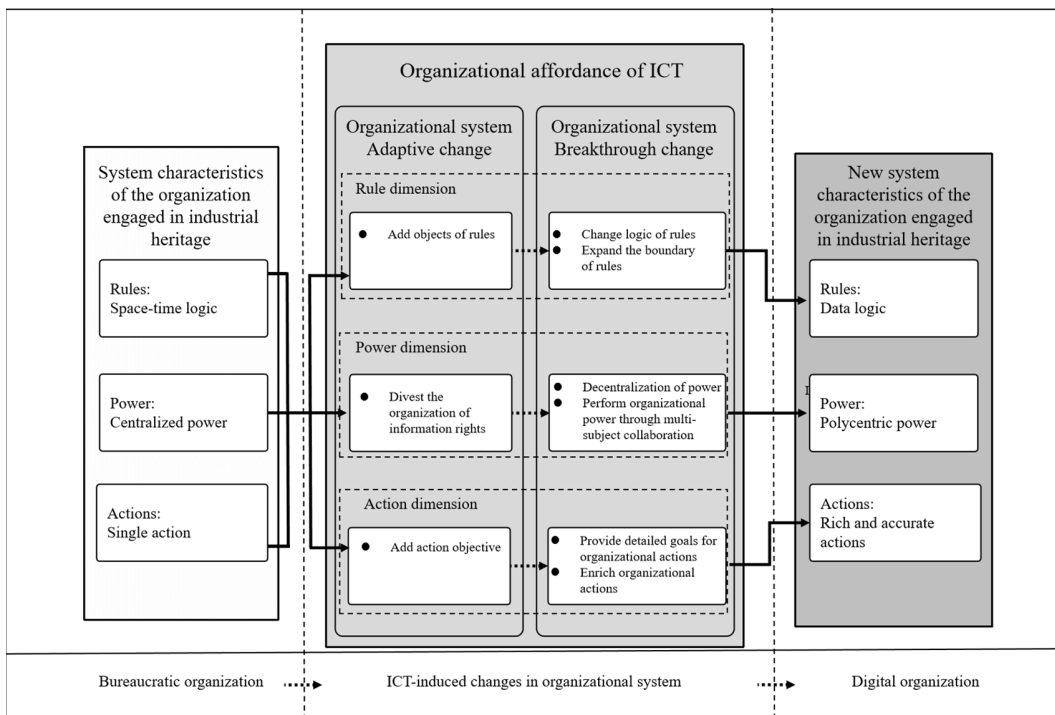
Process Mechanism of ICT in Promoting Organizational Changes in Industrial Heritage

The embedding of ICT is the process in which technology triggers the organization to respond, change its structure, boundary, and value creation path, and then realize the evolution of the enterprise (Vial, 2019). Existing studies have fully explored the role of ICT in organizational changes (e.g., Volkoff et al., 2007). The current research lacks a dynamic description of the embedding of ICT in the organization because the selected research samples are all enterprises with digital genes. For organizations without digital genes, such as enterprises engaged in industrial heritage, the key to using ICT for organizational purposes lies in the organization's ability to proactively employ ICT to achieve breakthrough changes. This paper classifies the affordances of ICT into technical affordance and organizational affordance, depending on the embedding degree of ICT in the organization.

Additionally, it conducts a detailed analysis of rules, power, and actions and discussed the detailed embedding process of ICT in the organization (see Figure 2 for details).

First of all, bureaucratic organizational rules are formed in the context of the industrial economy and are managed and operated by trained professionals according to the regulations (Weber, 2009). They are restricted by the objective boundary conditions of time and space and follow the logic of time and space. After the embedding of ICT, it produces many functions to change the rules of the organization engaged in industrial heritage, such as adding objects of organizational rules, changing the implementation boundary of rules, etc. The organization produces scattered objects of rules (Murray et al., 2021) and loose boundaries of rules (Davidow and Malone, 1992), forming data logic with technology and data as the core (Gol et al., 2019). Secondly, limited by the untimely and discontinuous characteristics of organizational information, bureaucratic organizational power requires organizational control and decision-making through bureaucratic governance and centralized power (Thatcher et al., 2018). However, with the embedding of ICT, the information power of the organization is replaced by ICT users with timeliness and continuity (Ghasemaghahi and Calic, 2019), and the organizational power undergoes changes in decentralization and multi-subject collaborative performance, which ultimately forms a multi-center organizational power structure. Finally, bureaucratic organizational actions are based on the goals set by the organizational rules, the division of labor, and the realization of highly specialized established standards (Weber, 2009). However, ICT has changed the characteristics of the single action of bureaucratic organizations by providing unstable, transient, and flexible goals for organizational actions (Biedenbach and Söderholm, 2008). The new organizations engaged in industrial heritage manifest the multiple and precise characteristics of actions (Robey and Boudreau, 1999).

Figure 2. Process model of ICT in promoting organizational changes in industrial heritage



DISCUSSIONS

Firstly, we have established a mechanism for changes in organizations engaged in industrial heritage in the context of the digital economy to achieve sustainable development of industrial heritage. According to the actual contexts in the context of the digital economy, this study focused on the application of ICT in industrial heritage and started with the actual production and operation to sort out the mechanism of ICT embedding in organizations engaged in industrial heritage that cause organizational changes, namely, adaptive change and breakthrough change. Among them, adaptive change is the result of an organization's passive adaptation to the environment (Girod and Whittington, 2015), with the goal of achieving good performance (Chan and Reich, 2007; Gerow et al., 2014) while maintaining the structure and business model of its core value creation activities (Henderson and Venkataraman, 1999). Breakthrough change is the result of the organization's initiative to redefine the value proposition, with enterprises presenting radically different business models (Ravasi and Schultz, 2006) and new paradigms of organizational systems (Silva and Hirschheim, 2007). The new features of digital organizations with decentralized organizational power and organizational platform generated by change mechanisms (Vial, 2019) open the black box where ICT is embedded in traditional hierarchical organizations (enterprises engaged in industrial heritage), causing organizational changes (Colbert et al., 2016).

Secondly, Summarize the process model of organizational changes for ICT to activate the industrial heritage value in the context of the digital economy. Previous studies have long acknowledged the critical importance of ICT for organizations (Kiron et al., 2012) and analyzed how organizations use ICT (Leonardi and Vaast, 2017) to achieve innovative development. However, they focus on the use of ICT to achieve technological innovation (Carayannis et al., 2006; Narula and Santangelo, 2009), business model innovation (Zott and Amit, 2010), and ecological innovation (Jha et al., 2016), etc., lacking the exploration of the impact of ICT on organizations. The conclusion of this study fills this gap and finds that the change of organizations engaged in industrial heritage is a gradual process, which consists of two stages, namely passive adaptation and proactive breakthrough. Passive adaptation is a prerequisite for proactive breakthroughs. Organizations engaged in industrial heritage cannot make proactive breakthroughs. Even if organizations realize the need for change, they cannot reasonably apply digital technologies such as ICT to achieve organizational change. Only when organizations engaged in industrial heritage passively adapt to the changes brought about by ICT can they have the opportunity to recognize that they can use ICT to establish new logic of rules centered on technology and data, implement decentralization of organizational power, and ultimately activate the value of industrial heritage.

Finally, we have enriched the affordance theory and proposed the organizational affordance of ICT. Previously, the research on the impact of ICT on organizations mainly explored the mechanisms and logic of organizational changes from the perspective of technological characteristics (Volkoff et al., 2007), resulting in the affordance of ICT being limited to the field of technology theory (Gholami et al., 2017; Tsokota et al., 2017) and contributing little to the field of social theory (Waizenegger et al., 2020). In this study, we have explored the affordance of ICT at the existing technical level according to the core dimensions of the organization, thus forming the organizational affordance of ICT. Based on ICT's technological affordance and organizational change mechanisms, organizational affordance ultimately realizes the goal of socializing the organization, that is, organizational change. The refinement of organizational affordance also extends the research on the organizational affordance of ICT from the technical field to the social field.

RESEARCH LIMITATIONS AND PROSPECTS

Firstly, due to the resumption of production and operation of the sample in this study. Therefore, the findings of this paper may not provide theoretical insight into the transformation and upgrading

of enterprises without the production function, such as the mineral enterprises that have completed resource extraction and smelting enterprises that have no commercial significance, etc.

Additionally, the study was performed during the COVID-19 pandemic. The pandemic has reduced human mobility and shifted many of the offline consumption scenarios to online shopping. However, the Company undertook the transfer of offline consumption to some extent due to the early use of ICT. In this regard, the special research situation can be perceived as the limitation of this paper.

Given the above limitations, We suggest that in the future, more attention should be paid to industrial heritage organizations that are far away from cities and lack the foundation for developing Creative industries or tourism. They also have precious and scarce industrial culture. The protection and utilization of these valuable industrial cultural heritage and the sustainable development of enterprises engaged in industrial heritage should be the focus of future research.

COMPETING INTERESTS

The authors of this publication declare there are no competing interests.

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APPENDIX A. FIRST-HAND INFORMATION

Internal interviewers

Informant	Number of Interviews	Transcript ID
Chairman: Formulate the organizational system	2	L1-1,2
General Manager: Formulate and implement the organizational system	3	L2-1,2,3
Deputy General Manager: Responsible for coordination, organization, and cooperation	2	L3-1,2
Assistant to General Manager: Manage organizational actions	3	L4-1,2,3
Chief Financial Officer: Perform financial management	1	L5
Manager of IT Department: Perform ICT-related construction and operation	2	M6-1,2
Manager of Publicity Department: Establish and implement standards for corporate publicity	1	M7
Office Director: Manage corporate partners	1	M8
Manager of Archives Department: Record important corporate events and materials	1	M9

Corporate partners

Informant	Number of Interviews	Transcript ID
Ceramic Dealer A: Use ICT to sell ceramic tea sets	3	P1-1,2,3
Ceramic Dealer B: Use ICT to sell ceramic artwork	1	P2
Ceramic Manufacturer A: Use ICT to promote traditional handmade ceramic products	4	P3-1,2,3,4
Ceramic Manufacturer B: Use ICT to promote improved handmade ceramic products	3	P4-1,2,3
Live Streaming Service Provider A: TikTok	2	P5-1,2,3
Live Streaming Service Provider B: Xigua Video	1	P6
Live Streaming Service Provider C: Kuaishou	2	P7-1,2
Ceramic Artist A: Provide online teaching of ceramic glaze painting	2	A1-1,2
Ceramic Artist B: Display online demonstration of ceramic modeling	3	A2-1,2,3
Craftsman C: Perform ceramic firing through live streaming	4	W1-1,2,3,4
Craftsman D: Display ceramic firing via the official account	3	W2-1,2,3

Tourists

Informant	Number of Interviews	Transcript ID
Tourist A: A design student	1	T 1
Tourist B: An art student	1	T 2
Tourist C: A local resident of Jingdezhen	1	T3
Tourist D: A retired employee of a ceramic factory	1	T4
Tourist E: A ceramic enthusiast who likes short video recording and sharing	2	T5-1,2

APPENDIX B. SECONDARY INFORMATION

Corporate reporting

Corporate Reporting	Number of Interviews	Transcript ID
Chairman's Report: Report on the establishment of the live streaming base, etc.	7	R1-1,2....7
General Manager's Report: Report on the establishment of new departments in Taoxichuan, etc.	5	R2-1,2....5
Corporation Annual Report: 2018-2021	4	R3-1,2,3,4
Report to Cultural Authority: Application Report on the Sharing of Live Streaming	1	R4

Others

Type	Number of Interviews	Transcript ID
Corporate Technical Standards and Norms: Provisions for information release	2	D1
Description of Department Responsibilities: Regulations on the responsibilities of the IT Department and Publicity Department	1	D2
Corporate Yearbook: 2013-2021	1	D3
News report A: News about the live streaming base in Taoxichuan	37	N1-1,2....37
News Report A: News concerning seminars in Taoxichuan	12	N2-1,2....12
News Report C: News concerning the sustainable development in Taoxichuan	89	N3-1,2....89
We-Media A: Taoxichuan WeChat official account, etc.	18	M1-1,2....18
We-Media B: Taoxichuan TikTok official account, etc.	42	M2-1,2....42

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