ISI Web of Knowledge℠

Web of Science®

经检索《Web of Science》，何秋琴 (He, QQ)发表的下述论文被《SSCI》收录。(检索时间 2024/06/11)

发文刊 2022 年 JCR 影响因子: 5.6

经检索《Journal Citation Reports》 2022 年，期刊《International Entrepreneurship and Management Journal》JCR 中 MANAGEMENT(其中 SSCI 版本)学科排位在 Q2 区，BUSINESS(其中 SSCI 版本)学科排位在 Q2 区

发文刊 2023 年（升级版）中科院 JCR 学科大类分区： International Entrepreneurship and Management Journal 管理学 3 区

第 1 条，共 1 条

标题: Can family CEOs promote enterprises' digital transformation? An analysis based on ability-willingness paradox

作者: He, QQ (He, Qiuqin);Lassala, C (Lassala, Carlos);Curras-Mostoles, R (Curras-Mostoles, Rosa)

来源出版物: INTERNATIONAL ENTREPRENEURSHIP AND MANAGEMENT JOURNAL **DOI:** 10.1007/s11365-023-00941-7 **出版年:** 2024

入藏号: WOS:001152685700002

文献类型: Article; Early Access

地址: [He, Qiuqin] Hangzhou Normal Univ, Sch Econ, Hangzhou, Peoples R China
[Lassala, Carlos] Univ Valencia, Valencia, Spain
[Curras-Mostoles, Rosa] Univ Politecn Valencia, Business Sch, Valencia, Spain

通讯作者地址: [He, Qiuqin] (corresponding author), Hangzhou Normal Univ, Sch Econ, Hangzhou, Peoples R China

电子邮件地址: 20190090@hznu.edu.cn;carlos.lassala@uv.es;rcurras@upv.es

IDS 号: GK9R5

ISSN: 1554-7191

eISSN: 1555-1938

杭州师范大学图书馆 文献检索与检测 专用章

《SSCI》(收录情况)

杭州师范大学图书馆信息咨询部

经办人 李博雅 李春子

International Entrepreneurship and Management Journal
https://doi.org/10.1007/s11365-023-00941-7

Can family CEOs promote enterprises' digital transformation? An analysis based on ability-willingness paradox

Qiuqin He[1] · **Carlos Lassala**[2] · **Rosa Currás-Móstoles**[3]

Accepted: 28 December 2023

Abstract
It is crucial to investigate the characteristics of digital transformation strategy decision-making in family businesses. In this paper, the Chinese A-share listed family enterprises on the Shanghai and Shenzhen stock markets from 2008 to 2020 are used as a sample to analyze at how the CEO source affects the enterprises' digital transformation and how the CEO ability and family willingness affect the boundary conditions of the decision-making. According to the findings of the study, family CEOs are more capable of promoting the digital transformation of family businesses. Whether it is general human capital obtained through formal education or firm-specific human capital obtained through work experience, they all positively moderate the relationship between family CEOs and enterprises' digital transformation decisions. Surprisingly, family control and influence have no moderating effect, which may be due to the superimposition of the willingness to pursue growth, whereas the willingness to pursue transgenerational sustainability is a negative moderator, indicating that family businesses in China are still in the early stages of succession. This study not only uncovers the disparities in the impacts of different types of CEOs on the digital transformation of family businesses, but also provides empirical evidence and managerial implications for fostering the family businesses' digital transformation.

Keywords Family CEOs · Digital transformation · Human capital · Family willingness

Introduction

The world is going through a digital revolution; a lot of new business models in diverse industries and markets have emerged to adapt to digital challenges (Fernandes et al., 2022). Enterprises are the main body of the adoption of digital technology and the transformation of results (Gu & Yuan, 2024). Digital transformation (DT) in enterprise refers to the implementation of digital technology within an organization to enhance

Extended author information available on the last page of the article

operational performance by innovating processes, products, operations, business models, and changing individual skills, leadership styles, and managerial approaches (Zoppelletto et al., 2023). Successful DT has been found to help improve the production efficiency, economic profit, and market position of enterprises (Björkdahl, 2020).

Family firms make up two-thirds of all worldwide operations, which are dominated by traditional industries and are facing the pressure of profit growth with increasing competition. DT is gradually becoming an important breakthrough point for improving the operational efficiency of family firms (Wu et al., 2021). However, the current situation is that family firms appear unable to transform due to weak capabilities, unwilling to transfer due to the high cost, or dare not to transfer due to the long and "painful" process of transformation. The Swiss Lombard Odieyr private bank conducted a survey in 2019 and found that more than 60% of family businesses have acknowledged the digital revolution as a result of the progression of digital technology (Xie et al., 2022). However, less than 50% of these family businesses are ready to fully participate in digital innovation activities, and approximately 12% of these businesses have not yet taken any action. What is the key driver family businesses to make decisions regarding their digital transformation?

Research into the DT practices of family businesses is still in its infancy, and there is no clear consensus among the studies that have been conducted so far (Ano & Bent, 2021; Cannas, 2021; Ceipek et al., 2021a; Cucculelli et al., 2022; Liu et al., 2023; Soluk et al., 2021; Soluk & Kammerlander, 2021; Prügl & Spitzley, 2021; Xie et al., 2022; Zapata-Cantu et al., 2022). Some academics argue that DT is more likely to take place in family firms because they are more adaptable to a variety of scenarios and can swiftly adjust to new circumstances in accordance with their long-term vision, emotional attachment to the company (Ano & Bent, 2021), unique dynamic capabilities (Soluk et al., 2021), internal and external network relationships (Zapata-Cantu et al., 2022), learning mechanisms (Xie et al., 2022), and profit maximization strategy (Ferraro & Cristiano, 2021).

Another group of scholars believes that family management negatively affects the DT of enterprises due to non-economic goals centered on the family, involvement of family members, long-term tenure, emotional connection with existing assets, rigid psychological models, and paternalistic decision-making models (Ceipek et al., 2021a), and family identity and communication patterns make the convergence of knowledge among family members across generations unfavorable to DT (Prügl & Spitzley, 2021). Some studies believe that a lack of resources is the primary barrier for family businesses to adopt digital technology for business model innovation (Del Vecchio et al., 2019). Furthermore, under the guidance of the government, family businesses may disclose more symbolic descriptions of DT than substantive investment to satisfy legal requirements while avoiding risks (Liu et al., 2023).

This paper believes that such contradictory conclusions may be due to the neglect of the key decision-maker in the enterprise. Family businesses are highly dependent on family and business leaders, and the DT of family businesses in traditionally dominant industries is typically a top-down process launched by the top management team (Lu et al., 2022). The key leaders' decision-making ability and willingness to support decision-making are directly related to whether or not the enterprises are carring out digital revolution and, if so, which path to take.

Therefore, this paper focuses primarily on the decision-making behavior of the core position of the Chief Executive Officer (CEO), in contrast to previous research that studied the decision-making behavior of the DT of family enterprises, which treated enterprises and families as a whole. De Massis et al. (2021) found that family businesses usually tend to adopt a CEO-centered executive configuration. As the manager and operator of the enterprise, the CEO has the right to allocate enterprise resources and make decisions and is the primary person in charge of the enterprise's operating results. As pointed out by upper echelons theory, the personalities and preferences of CEOs are regarded as important factors affecting corporate strategic decisions (Alexiev et al., 2010; Gu, 2023). The most notable feature in the appointment of CEOs between family and non-family firms is whether the position is filled by a member of the family rather than an outsider, which will directly lead to differences in corporate strategic decision-making (Miller et al., 2014). Therefore, the first question to be answered in this study is: Can family CEOs be more capable of promoting the DT of businesses?

In conjunction with the decision-making framework of the family business ability-willingness paradox, this paper further explores the boundary conditions of the CEO's decision-making of DT by using the CEO human capital as a proxy for the CEO ability and the pursuit of SEW as a proxy for family willingness. On the one hand, the CEO's personal skills acquired through formal education or firm-specific tacit knowledge represent his/her ability to accept innovative ideas and activities and to process complex information, which can help he/she seize the opportunities brought by the digital era. On the other hand, it is well known that the decision-making process of family businesses often uses non-economic goals such as socio-emotional wealth (SEW) as a reference point. Investment in high-risk projects, like enterprise DT, responds quite differently depending on whether one prioritizes the short-term dimension of SEW, focused on corporate control and influence, or the long-term dimension, focused on transgenerational sustainability.

Therefore, this paper aims to analyze the impact of the CEO source on the DT of enterprises, by further analyzing the moderating effect of the CEO ability and family willingness. To this end, we adopt the upper echelons theory, the SEW theory and a theoretical framework based on the ability-willingness paradox, taking A-share listed family enterprises in China's Shanghai and Shenzhen stock markets from 2008 to 2020 as a sample. This study enriches the exploration of the antecedents of the family firms' DT strategy and contributes to a better understanding of the complicated interaction between family business features and DT decision-making.

Theoretical framework and research hypothesis

Family CEO and digital transformation

One of the biggest obstacles facing traditional family businesses is DT, which is essentially a corporate entrepreneurship activity since it entails a fundamental shift in the way businesses create value (Corvello et al., 2022). Because of the

non-linearity, duration, and uncertainty, DT is more challenging for businesses to forecast the return on their investments (Nambisan et al., 2019), which makes the DT of enterprises often accompanied by high risks. High levels of technical integration skills are necessary for DT, and organizational alignment may face major difficulties due to language, technology, and approach asynchronies (Horváth & Szabó, 2019). Faced with such a high-risk investment, family businesses often fall into the "ability-willingness" paradox (De Massis et al., 2015). On the one hand, they are more risk-averse and conservative in their investment strategies. On the other hand, family businesses own a unique bundle of resource capacities formed by the interaction of family members, family, and enterprise in the decision-making process. A recent study found that family businesses are better able to deal with the complexity and risk of DT because of their distinctive knowledge utilization, risk management, and marketing capabilities. This allows them to better meet the ever-evolving needs of consumers in the digital era and boosts the likelihood that businesses will adopt digital business models (Soluk et al., 2021).

Although family businesses are considered to have a strong ability to transform, whether the decision-making can be implemented depends on the extent to which the core executives can drive this ability. Family CEOs, whether the original CEO or his or her direct descendant, have an inherent advantage over their non-family counterparts because of their access to intangible assets like family tacit knowledge and social capital (Yang et al., 2021). Because of their one-of-a-kind learning and knowledge management mechanism (Chirico & Nordqvist, 2010), it is better equipped to integrate a wide range of resources, both internal and external to the family or organization, to swiftly adapt to shifting conditions. At present, the digital economy era of "winner takes all" is reshaping the market competition pattern. Once the market opportunities and competitive advantages brought about by DT are identified, driven by a strong sense of family mission, psychological belonging, and organizational identity, the family CEO can drive relevant capabilities and quickly form a consensus among the company to achieve high pragmatism, formulate appropriate digital strategies (Ano & Bent, 2021), and allocate resources to relevant areas.

Furthermore, family CEOs are often long-term oriented in the decision-making process, have strategic thinking, and set goals for the future; that is, they are more forward-looking (Kelleci et al., 2019), and they are more tolerant of DT failures (Duran et al., 2016). The key to a firm's future competitive advantage in today's digital economy is its ability to undergo DT. For businesses, it really is a matter of survival. Family CEOs who bear the pressure of transgenerational sustainability and long-term prosperity are more likely to implement DT.

Based on the evidence presented above, this study suggests Hypothesis 1:

H1: Compared to professional managers, family CEOs are better equipped to advance the DT of businesses.

The moderating effect of CEO ability

Corporate DT is also limited or supported by the CEO's personal capabilities. According to human capital theory and upper echelons theory, the CEO's knowledge, skills, and professional experience—that is, human capital attributes—are directly related to the CEO's risk attitude, cross-functional communication ability, and stance on resource acquisition and allocation (Ferreira & Sah, 2012), which in turn affects strategic decision-making. Human capital includes the formal education received before work and the formal or informal on-the-job training received after work. Usually, the former is called general human capital, and the latter is called firm-specific human capital. In this paper, we use the CEO education levels as a proxy for general human capital and the work experience in the current enterprise as a proxy for firm-specific human capital.

A CEO with more education has more curiosity, is more willing to make risky choices, and is more willing to accept innovative technology and business ideas, as well as invest more in innovation (Sarto & Saggese, 2022). Under the influence of the digital economy, the profound knowledge accumulation, broad vision, and higher comprehensive quality of highly educated CEOs will enable them to perceive the benefits of enterprise DT in terms of manufacturing operation enhancement, business process simplification, and data-driven decision-making. CEOs could then evaluate and rebuild the information and resources inside and outside the organization and make strategic decisions appropriate for the development of the enterprise, all while navigating a complicated and highly competitive market.

Based on the above analysis, this paper proposes Hypothesis 2a:

H2a: The CEO's general human capital positively moderates the relationship between the family CEO and the decision-making of the enterprise's DT.

As a CEO gains more work experience, he or she begins to acquire firm- and industry-specific expertise—a form of human capital that is inseparable from the context in which the business operates and that will ultimately result in an improvement in the performance of the company (Foss et al., 2007). An internally promoted CEO is more familiar with the organizational structure, culture, and resources, as well as the external competitive environment in which the firm operates, in comparison to an airborne CEO. As a result, an internally promoted CEO, regardless of whether it is a family CEO or a non-family CEO, is able to better integrate internal capabilities to match external opportunities (Boling et al., 2016). Internally promoted CEOs have more advantages in acquiring tacit knowledge of the enterprise, can use existing resources more effectively, choose a transformation path that suits the firm's situation, and ensure that the DT is better aligned with the existing capabilities.

Additionally, internally promoted CEOs tend to have close relationships with the company's major stakeholders and are less likely to encounter resistance from the existing executive team. If a CEO who was promoted from within has extensive expertise in a family business, he or she may even collaborate with members of the ruling family. Even if they are not connected by blood, in Chinese culture, he or she is regarded as the "family" of the "real controller" to a certain extent (Yeh & Liao,

2021). In this situation, internally promoted CEOs are frequently shielded by the governing family, giving them an advantage over externally airborne CEOs when it comes to driving family-specific assets. Even if their high-risk projects fail, internally promoted CEOs are not sacked immediately either.

Based on the above analysis, this paper proposes Hypothesis 2b:

H2b: CEO firm-specific human capital positively moderates the relationship between the family CEO and the decision-making of the enterprise's DT.

The moderating effect of family willingness

Another restriction for enterprises to carry out DT is the willingness of the family. One of the most notable characteristics of the strategic decision-making of family enterprises, according to the SEW theory, is that non-financial benefits such as SEW are used as reference points, and the willingness to pursue SEW will lead to special family-oriented behaviors in enterprises (De Massis et al., 2014). The CEO's allocation of personal and corporate resources and competencies is closely tied to the family's willingness.

The scope and depth of SEW span many dimensions (Berrone et al., 2012). The theory's connotation has been continually enriched and developed since it was first proposed by Gómez-Mejía et al. (2007) and now includes such concepts as family control and family influence, family members and corporate identity, binding social relations, emotional dependence of family members, family inheritance across generations, family image and reputation, etc. Several academics have defined the various aspects of SEW. The underlying family willingness can be roughly split into two groups: (1) short-term SEW dominated by family control and influence, and (2) long-term SEW dominated by family intergenerational sustainability. This paper mainly examines two types of family willingness: family control and influence and family transgenerational sustainability. Zhu and Zhou (2016) believe that family control intention measures short-term SEW, while family inheritance intention measures long-term SEW.

Whether the CEO has a kinship relationship with the controlling family, and how close the kinship relationship is, fundamentally determines the degree of his/her personal willingness to pursue SEW. The high level of trust, reciprocity, and closeness among family members with kinship relationships (Lumpkin et al., 2008) makes family members deeply influenced by family values, culture, etc., and then forms a common vision and goal. Therefore, family members are more likely to consistently practice SEW.

When the family pursues short-term SEW on the dimension of corporate control and influence, the firm tends to show a tendency to avoid risks, thereby avoiding high-risk investment decisions (Ceipek et al., 2021a). DT is a disruptive change in enterprise organizational structure, business model, products and services, business processes, etc. It has the characteristics of large capital investment, non-linear development of the project process, and high uncertainty of project return (Schneider, 2018; Nambisan et al., 2019).

Family businesses often face financial and human resource constraints (Ano & Bent, 2021). To successfully implement DT, there is a potential need for ongoing external financing and the entrance of strategic partners, which may lead to the dilution of controlling family equity. Then the power of control falls to others. Secondly, with the advancement of the DT of enterprises, the organizational governance structure will change from bureaucracy to flattening, which will allow the executive team to decentralize and enterprises to make more bottom-up decisions (Volberda et al., 2021). The decision-making pattern may be the concentration of power in the hands of a small number of digitally skilled professionals (Nell et al., 2021), which will challenge the control of the family. In addition, employees may feel threatened by a flat and decentralized organizational structure because it could lead to the elimination of the position of middle management (Ceipek et al., 2021a). Staff who have grown up in the company, or "members," have a special connection to the organization and may be resistant to change because of the digital revolution.

Based on the above analysis, this paper proposes Hypothesis 3a:

H3a: Short-term SEW negatively moderates the relationship between family CEOs and the decision-making of enterprises' DT.

The family firm is more likely to prioritize the company's long-term survival and growth when the family is committed to long-term SEW, such as intergenerational sustainability (Miller et al., 2014). On the one hand, in the digital economy era of "winner takes all," the DT of organizations has become the key to achieving a competitive advantage in the future, which is vital to the survival of enterprises. In order to maintain an edge in a competitive market, businesses need to focus on their customers, embrace digital technology to enhance their offerings, and be willing to adapt their business models frequently to meet the shifting demands of their clientele. On the other hand, the decision-making of family businesses is very congruent with the core ideals of DT, such as "openness" and "flexibility." Present studies have demonstrated that successful DT will change the existing business model, improve corporate governance, considerably reduce business risks, boost its own competitive advantage, and then improve corporate performance (Vial, 2019). The ruling family has shown a strong enthusiasm for DT, and the current era is one in which the DT of businesses is helpful to the long-term orientation of family development.

Based on the above analysis, this paper proposes Hypothesis 3b:

H3b: Long-term SEW positively moderates the relationship between family CEOs and the decision-making of enterprises' DT.

Through the above analysis, the theoretical framework of this study is obtained, as shown in Fig. 1.

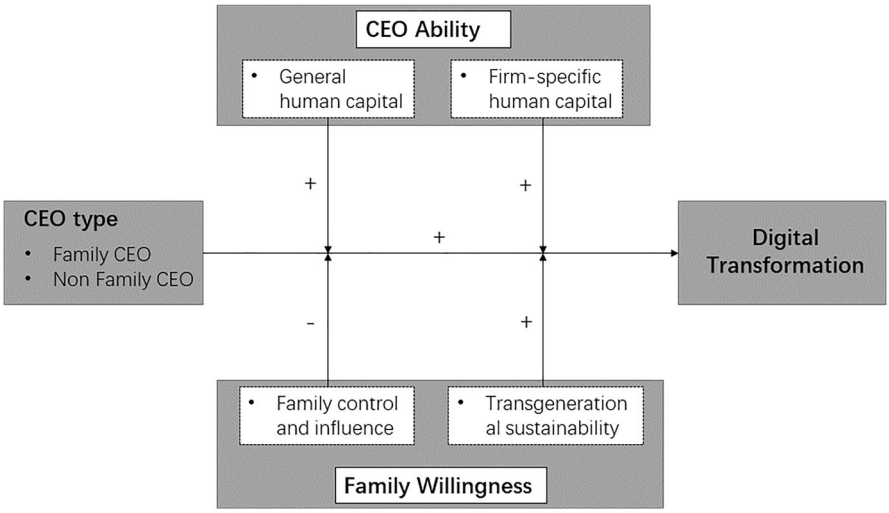

Fig. 1 Theoretical framework

Empirical strategy

Data sources

The family business studied in this paper is defined as having, in addition to the actual controller, at least one relative family member who holds shares, manages, or controls the listed company or the controlling shareholder company. Due to the availability of data, this paper selects the A-share-listed family enterprises in China's Shanghai and Shenzhen stock markets from 2008 to 2020. Due to different accounting treatments, we have deleted the samples that are marked special treatment, including *ST, S, S*ST, and SST, as well as those that belong to the financial industry. We have also deleted samples with missing observations and samples with abnormal indicators. Finally, this paper obtains 9014 year-firm observations.

The DT data in this paper uses the DT index measured by Guangdong University of Finance. This index refers to the method of Wu et al. (2021), which has been well used in the present research. Artificial intelligence (AI), big data (BD), cloud computing (CC), blockchain (Blockchain), and digital technology application (DTechApplication) are just the five dimensions tracked in the annual reports of publicly traded firms. The first four dimensions make up the backbone of a company's DT's technical architecture. The first four dimensions are the core underlying technical architecture of the enterprise's DT. Compared with a dummy variable to measure whether an enterprise is undergoing DT, the measurement of word frequency is feasible and scientific, and can reveal the strength of the enterprise's DT. The CEO's individual characteristics, family characteristics, and corporate financial data are second-hand data from the China Stock Market & Accounting Research Database (CSMAR).

In addition, to avoid the impact of extreme values on the empirical results, this paper performs winsorize processing on all continuous variables at the 1% and 99% quantiles.

Variable specification

Dependent variable This paper sums up the number of digital-related word frequencies in the five dimensions as a measure of the overall level of the DT of the enterprise and performs logarithmic processing.

Independent variable There is a wide variety of executive roles inside various organizations. In this article, CEO refers to the chief executive officer, general manager, or president of the listed company as detailed in the annual report. The value is 1, if the CEO is a family member, and 0 otherwise.

Moderating variable-CEO ability Following Ceipek et al. (2021b), this paper uses the CEO human capital as a proxy for the CEO ability. The CEO's human capital attributes will have an impact on the company's long-term strategic planning. In general, a person's ability to absorb and rebuild the information and resources inside and outside the firm and to make strategic decisions for business development improves in proportion to the number of years of schooling they have completed. In addition to formal education, the CEO's job experience is firm-specific human capital. CEOs have amassed a wealth of tacit knowledge crucial to running their businesses, including information about the company's stakeholders, operating mechanisms, internal resources, etc., all of which contribute significantly to the development of competitive advantages for their respective companies. Therefore, this paper divides the CEO ability into general human capital and firm-specific human capital. The former is measured by the CEO's educational background, and the latter is measured by whether the CEO is promoted internally.

Moderating variable-family willingness Referring to Zhu and Zhou (2016), this paper uses the proportion of family members involved to measure the willingness of family control and influence; whether the family business is in the intergenerational inheritance stage is used to measure the willingness of transgenerational sustainability. This paper believes that the participation of second-generation members in business management reflects the enterprise entering the inheritance stage, and this is recorded as 1, otherwise it is 0 (Huang et al., 2018).

Control variable Referring to the research of Wang and He (2020), this paper controls the CEO's personal characteristics such as tenure, gender, age, shareholding ratio, and concurrent position. Referring to Ceipek et al. (2021a); Soluk et al. (2021), this paper controls the variables at the firm level, such as firm size, firm age, firm performance, enterprise innovation ability, firm capital intensity, and firm leverage. We also control corporate governance variables such as the deviation in ownership and control ratios and equity balance. Finally, year dummy

variables, industry dummy variables, and province dummy variables are added to control the influence of different years, industries, and regions. Table 1 gives the specific variable descriptions.

Model specification

Due to the significant right-biased characteristics of enterprise DT, this paper uses the Tobit model to empirically test the impact of family CEOs on enterprise DT. The specific form of the model is as follows:

$$\ln DT_{it} = \alpha_0 + \alpha_1 FamilyCEO_{it} + \alpha_2 control_{it} + \epsilon_{it} \quad (1)$$

where $\ln DT_{it}$ is the DT level of firm i in year t; $FamilyCEO_{it}$ is the core independent variable, that is, whether the CEO is a family member; $control_{it}$ is the control variable listed in Table 1, which also includes year, industry and province dummy variables, ϵ_{it} is the error term.

In order to test the moderating effect of CEO ability and family willingness, this paper constructs the following model:

$$\ln DT_{it} = \beta_0 + \beta_1 FamilyCEO_{it} + \beta_2 FamilyCEO_{it} * \text{CEOabililty}_{it} + \beta_3 \text{CEOability}_{it} + \beta_4 control_{it} + \epsilon_{it} \quad (2)$$

$$\ln DT_{it} = \gamma_0 + \gamma_1 FamilyCEO_{it} + \gamma_2 FamilyCEO_{it} * \text{willingness}_{it} + \gamma_3 \text{willingness}_{it} + \gamma_4 control_{it} + \epsilon_{it} \quad (3)$$

where CEO abililty_{it} represents CEO ability of firm i in year t, including general human capital (GMDegree) and firm-specific human capital (AsGManPattern); willingness_{it} represents family willingness of firm i in year t, including family control and influence (FamRatio) and transgenerational sustainability (ManGenerations). Other variables are the same as model (1).

Empirical results

Descriptive statistics

Table 2 displays the descriptive statistics of the main variables. The results show: (1) DT can take on a value between 0 and 7.111, with an average of 2.790. The degree of DT of listed family enterprises in China varies greatly, and the level is generally low. (2) The average value of Family CEO (FamilyCEO) is 0.671, indicating that the CEOs of listed family enterprises in China are mainly held by family members, accounting for 67.1%; (3) The average value of CEO general human capital (GMDegree) is 3.304, and the average value of CEO firm-specific human capital (AsGManPattern) is 0.924, indicating that the average education level of the CEOs of listed family enterprises in China is a bachelor degree or above and that 92.4% of the CEOs are promoted through internal promotion; (4) The average value of family control and influence willingness (FamRatio) is 0.226, and that of family transgenerational sustainability willingness (ManGenerations) is 0.231. It shows that

Table 1 Variable specification

Variable type	Variable name		Short name	Measurement
Dependent variable	Digital transformation		lnDT	log(1 + DigitalTechApplication + AITechnology + BlockChainTechnology + CloudComputingTech + BigDataTechnology)
Independent variable	Whether the CEO is a family member		FamilyCEO	1: CEO is a family member;0: CEO is a non-family member
Moderate variable	CEO ability	General human capital	GMDegree	Measured by CEO education, 1: technical secondary school and below, 2: junior college, 3: undergraduate, 4: postgraduate, 5: doctoral research, of which EMBA/MBA is classified as 4
		Firm-specific human capital	AsGManPattern	1: internal promotion;0: airborne
	Family willingness	Family control and influence	FamRatio	Measured by the proportion of family members involved, that is, (number of family directors + number of family executives)/(number of board of directors + number of executives), the greater the index value, the stronger the willingness to control
		Transgenerational sustainability	ManGenerations	1: The second-generation members participate in enterprise management, indicating that the enterprise has entered the succession stage and has the willingness to transgenerational sustainability;0: The first-generation actual controller serves as the chairman or general manager, and no second-generation members participate in enterprise management;

Table 1 (continued)

Variable type	Variable name	Short name	Measurement
Control variable	CEO tenure	GManSer	(Statistical cut-off date -CEO's tenure start date)/ 365
	Concurrent Position	ConcurrentPosition	1: Chairman and CEO concurrently;0:Chairman and CEO not concurrently
	CEO gender	GMGender	1: male; 0: female
	CEO age	GMAge	Statistical cut-off year - year of CEO's birth
	CEO Shareholding ratio	HdirProp	The proportion of shares held by the CEO in the total share (%)
	Separation Rate	SeparationRate	Ownership ratio/control ratio (referring to the overall level of the family)
	Firm size	firmsize	Logarithm of total assets
	R&D intensity	rdintensity	R&D investment/operating income
	Capital intensity	capitalintensity	Capital expenditure/total assets
	Equity balance	BalanceIndicators	Total shareholding ratio of the 2nd to 5th largest shareholders/Shareholding ratio of the largest shareholder
	Firm age	firmage	(Statistic cut-off date - firm establishment date)/ 365
	Income Growth Rate	Growth	(operating income for the current period of the current year - operating income for the same period of the previous year) / (operating income for the same period of the previous year)
	Net Profit Margin of Total Assets	Profit	Net profit/total asset balance
	Debt to asset ratio	DOA	Total Liabilities / Total Assets

Table 2 Descriptive statistics

VarName	Obs	Mean	SD	Min	Median	Max
lnDT	9014	2.790	1.327	0.000	2.773	7.111
FamilyCEO	9014	0.671	0.470	0.000	1.000	1.000
GMDegree	9014	3.304	0.939	1.000	3.000	5.000
AsGManPattern	9014	0.924	0.265	0.000	1.000	1.000
FamRatio	9014	0.226	0.106	0.053	0.214	0.529
ManGenerations	9014	0.231	0.422	0.000	0.000	1.000
GManSer	9014	4.194	3.080	0.060	3.490	13.581
GMGender	9014	0.907	0.291	0.000	1.000	1.000
GMAge	9014	48.894	7.254	31.000	49.000	66.000
HdirProp	9014	11.504	15.484	0.000	3.000	58.660
ConcurrentPosition	9014	0.425	0.494	0.000	0.000	1.000
SeparationRate	9014	0.918	0.149	0.372	1.000	1.000
BalanceIndicators	9014	0.846	0.616	0.059	0.687	2.962
size	9014	21.602	0.957	19.831	21.486	24.407
rdintensity	9014	0.048	0.040	0.001	0.039	0.238
capitalintensity	9014	0.061	0.051	0.001	0.047	0.251
firmage	9014	15.910	5.519	3.759	15.726	29.962
Growth	9014	0.188	0.321	-0.421	0.139	1.703
Profit	9014	0.051	0.056	-0.212	0.050	0.211
DOA	9014	0.343	0.178	0.042	0.328	0.781

the level of family involvement of executives and boards of directors in listed family enterprises in China is relatively low, and only 23.1% of the enterprises have entered the succession stage.

Table 3 shows the correlation coefficients of dependent variables, core independent variables, and moderating variables. The results show that: (1) The maximum value of the correlation coefficient is the coefficient between family control and influence willingness and family CEO, which is 0.504, which is less than 0.8. It can be considered that there is no multicollinearity between variables; (2) the family CEO and CEO general human capital are significantly positively correlated with the

Table 3 Correlation coefficients of the main variables

	lnDT	*FamilyCEO*	GMDegree	AsGManPattern	FamRatio	ManGenerations
lnDT	1					
FamilyCEO	0.052***	1				
GMDegree	0.123***	-0.033***	1			
AsGManPattern	-0.024**	0.234***	-0.108***	1		
FamRatio	-0.016	0.504***	-0.083***	0.150***	1	
ManGenerations	-0.014	0.159***	0.024**	-0.009	0.127***	1

***$p<0.01$; **$p<0.05$; *$p<0.1$

level of the enterprises' digitalization, while the CEO firm-specific human capital shows a significant negative correlation. However, family control and influence and family transgenerational sustainability willingness are not statistically related to the level of the enterprise's digitalization.

Regression result

The effects of family CEOs on businesses' DTs are shown in Table 4. Stata 16 SE is used for all estimations, and robust standard errors are used to control for heteroscedasticity in all regressions. Columns (1) to (5) present the results of the hypothesis H1 with different control variables. All the coefficients of FamilyCEO are positive at a significance level of 1% or 5% (column 3). We use the results for analysis because all the control variables are listed in column 5. According to the result $\beta = 0.1144$ and $p < 0.001$, it indicates that family CEOs can significantly promote the DT of enterprises, and hypothesis H1 is verified.

Table 5 shows the regression results of the moderating effect of family CEO ability and family willingness on the DT of enterprises. Column (1) represents the moderating effect of the CEO's general human capital. In column (1), the coefficient of *FamilyCEO* * GMDegree is 0.0498 and positive at the 10% significance level, indicating that the CEO's general human capital positively moderates the relationship between family CEOs and the enterprises' DT decisions, and the hypothesis H2a is verified. Column (2) represents the moderating effect of CEO firm-specific human capital. The coefficient of is 0.1715 and positive at the 10% significance level, indicating that the CEO's firm-specific human capital positively moderates the relationship between the family CEOs and the enterprises'DT decisions, and the hypothesis H2b is verified. Column (3) is the moderating effect of family control and influence willingness. *FamilyCEO* * FamRatio has a coefficient of 0.0543, but it is not statistically significant, therefore H3a cannot be verified. Column (4) is the moderating effect of family transgenerational sustainability. The coefficient of FamilyCEO * ManGenerations is -0.1565 and negative at the 5% significance level, which is contrary to hypothesis H3b.

To confirm the accuracy of the findings, this paper uses two methods for robustness checks. First, by using propensity score matching (PSM) to mitigate the effects of bias in sample selection, and second, by employing alternate measures of DT as proxy variables for the explanatory factors, measurement bias can be mitigated.

PSM results. This study finds a control group identical to the treatment group for pair analysis, lessens the effect of control variables and other observable factors on treatment variables, and reduces endogeneity using the PSM approach. First, using the logistic model, the independent variable FamilyCEO (1 = family CEO, 0 = non-family CEO) is regressed on the control variables; next, three matching approaches are used: 1:1 and 1:3 nearest neighbor matching and kernel matching; Finally, the average treatment effect (ATT) estimates the impact of family CEOs on corporate DT. Table 6 provides PSM ATT results. The 1:1 matching result reveals the ATT average treatment effect after matching is 0.1857, the 1:3 matching result is 0.1663, and the kernel matching result is 0.1590. All three are significant at the 1% level.

Table 4 The impact of family CEOs on digital transformation of enterprises

	(1)	(2)	(3)	(4)	(5)
VARIABLES	lnDT	lnDT	lnDT	lnDT	lnDT
FamilyCEO	0.1558***	0.0715***	0.0739**	0.1232***	0.1144***
	(0.0315)	(0.0244)	(0.0327)	(0.0377)	(0.0371)
GManSer			0.0329***	0.0316***	0.0196***
			(0.0039)	(0.0039)	(0.0040)
GMGender			-0.0146	-0.0177	-0.0344
			(0.0385)	(0.0386)	(0.0383)
GMAge			-0.0042**	-0.0036*	-0.0044**
			(0.0017)	(0.0019)	(0.0019)
GMDegree			0.0781***	0.0761***	0.0578***
			(0.0127)	(0.0127)	(0.0126)
HdirProp			-0.0007	-0.0007	0.0006
			(0.0009)	(0.0009)	(0.0009)
AsGManPattern			-0.0297	-0.0244	0.0307
			(0.0465)	(0.0465)	(0.0461)
ConcurrentPosition			-0.0260	-0.0362	-0.0254
			(0.0334)	(0.0341)	(0.0337)
FamRatio				-0.4203***	-0.1203
				(0.1275)	(0.1276)
ManGenerations				0.0158	-0.0117
				(0.0319)	(0.0315)
SeparationRate					-0.0935
					(0.0809)
BalanceIndicators					0.0209
					(0.0184)
rdintensity					3.0036***
					(0.3726)
capitalintensity					-0.7953***
					(0.2330)
size					0.1849***
					(0.0156)
firmage					-0.0024
					(0.0024)
Growth					0.1391***
					(0.0409)
Profit					0.2797
					(0.2248)
DOA					-0.0505
					(0.0837)
Constant	2.6651***	0.1000	0.0905	0.1200	-3.5074***
	(0.0262)	(0.2380)	(0.2629)	(0.2648)	(0.4189)
Year		Control	Control	Control	Control
Industry		Control	Control	Control	Control
Province		Control	Control	Control	Control
Observations	9,014	9,014	9,014	9,014	9,014
r2	0.001	0.159	0.164	0.164	0.172

Robust standard errors in parentheses ***$p<0.01$; **$p<0.05$; *$p<0.1$

Table 5 The moderating effect of CEO ability and family willingness on enterprise digital transformation' decision

VARIABLES	(1) lnDT	(2) lnDT	(3) lnDT	(4) lnDT
	CEO ability		Family willingness	
	General human capital	Firm-specific human capital	Family control and influence	transgenerational sustainability
FamilyCEO	-0.0492	-0.0419	0.1047*	0.1504***
	(0.0957)	(0.0960)	(0.0634)	(0.0401)
FamilyCEO ∗ GMDegree	0.0498*			
	(0.0267)			
FamilyCEO ∗ AsGManPattern		0.1715*		
		(0.0961)		
FamilyCEO ∗ FamRatio			0.0543	
			(0.2929)	
FamilyCEO ∗ ManGenerations				-0.1565**
				(0.0663)
GMDegree	0.0224	0.0568***	0.0579***	0.0591***
	(0.0229)	(0.0126)	(0.0126)	(0.0126)
AsGManPattern	0.0201	-0.0209	0.0306	0.0311
	(0.0465)	(0.0551)	(0.0462)	(0.0461)
FamRatio	-0.1106	-0.1291	-0.1618	-0.1105
	(0.1275)	(0.1278)	(0.2600)	(0.1277)
ManGenerations	-0.0137	-0.0115	-0.0119	0.0986*
	(0.0314)	(0.0315)	(0.0315)	(0.0558)
Control variables	Control	Control	Control	Control
Year	Control	Control	Control	Control

Table 5 (continued)

VARIABLES	(1) lnDT	(2) lnDT	(3) lnDT	(4) lnDT
Industry	Control	Control	Control	Control
Province	Control	Control	Control	Control
Observations	9,014	9,014	9,014	9,014
r2	0.172	0.172	0.172	0.172

Detailed regression results for the control variables can be obtained from the authors if required

Robust standard errors in parentheses ***$p<0.01$; **$p<0.05$; *$p<0.1$

Table 6 PSM results

LnDT	1:1 neighbor matching		1:3 neighbor matching		Kernel matching	
	ATT	t-value	ATT	t-value	ATT	t-value
Unmatched	0.1474 ***	4.96	0.1474***	4.96	0.1474***	4.96
Matched	0.1857 ***	4.65	0.1663***	4.84	0.1590***	5.09

***$p<0.01$; **$p<0.05$; *$p<0.1$

Family CEOs outperform non-family CEOs in DT. After accounting for sample selection bias, the results remain robust.

Alternative Measures for Enterprise DT. Using the measurement of DT of listed companies in the CSMAR database as a substitute proxy for the independent variable, the results are shown in Table 7. The CSMAR database also measures word

Table 7 The impact of family CEOs on digital transformation of enterprises

VARIABLES	(1) lnDT	(2) lnDT	(3) lnDT	(4) lnDT	(5) lnDT
FamilyCEO	0.3004***	0.0677	-0.0728	0.3435***	0.3016***
	(0.0543)	(0.1454)	(0.1427)	(0.0937)	(0.0586)
FamilyCEO ∗ GMDegree		0.0704*			
		(0.0407)			
FamilyCEO ∗ AsGManPattern			0.4112***		
			(0.1449)		
FamilyCEO ∗ FamRatio				-0.2422	
				(0.4383)	
FamilyCEO ∗ ManGenerations					-0.0050
					(0.0995)
GMDegree		0.0211	0.0692***		
		(0.0351)	(0.0192)		
AsGManPattern		-0.1653**	-0.2728***		
		(0.0686)	(0.0788)		
FamRatio				-0.4895	-0.6750***
				(0.3913)	(0.1903)
ManGenerations				-0.2468***	-0.2442***
				(0.0472)	(0.0847)
Control variables	Control	Control	Control	Control	Control
Year	Control	Control	Control	Control	Control
Industry	Control	Control	Control	Control	Control
Province	Control	Control	Control	Control	Control
Observations	9,014	9,014	9,014	9,014	9,014
r2	0.186	0.186	0.186	0.186	0.186

The digital transformation is measured by CSMAR. Detailed regression results for the control variables can be obtained from the authors if required

Robust standard errors in parentheses ***$p<0.01$; **$p<0.05$; *$p<0.1$

frequency for DT, as described above. The caliber of subdivision indicators overlaps with that of Guangdong University of Finance, but they are not completely consistent. The correlation coefficient between the two measurements is 0.8050. Column (1) shows that the coefficient of FamilyCEO is 0.3004, which is significant at the 1% level, which indicates that family CEOs can significantly promote the DT of enterprises. Column (2) shows that the coefficient of *FamilyCEO* ∗ GMDegree is 0.0704, and it is significant at the 10% level, which indicates that CEO general human capital can positively moderate the relationship between family CEO and enterprise DT decisions. Column (3) shows that the coefficient of *FamilyCEO* ∗ AsGManPattern is 0.4112, which is significant at the 1% level, which indicates that the CEO's firm-specific human capital can positively moderate the relationship between family CEOs and enterprise DT decisions. Columns (4) and (5) show that the coefficients of *FamilyCEO* ∗ FamRatio and *FamilyCEO* ∗ ManGenerations are not statistically significant. Except for the results in column (5), other results show strong robustness. The sign of the moderating effect of family inheritance willingness is consistent with the above but not significant.

Discussion

Theoretical implications

Without a doubt, DT is the primary tactic used by family businesses to maintain their competitive advantages and generate revenue in the upcoming wave of industrial transformation. However, family businesses still implement DT in relatively small amounts. Although existing studies have made efforts to investigate the driver of DT in family businesses (Ano & Bent, 2021; Ceipek et al., 2021a; Liu et al., 2023; Soluk et al., 2021; Prügl & Spitzley, 2021; Xie et al., 2022; Zapata-Cantu et al., 2022), most of them start from the enterprise or family, ignoring the role of individual heterogeneity of core executives in corporate strategic decision-making. This study uses the A-share listed family enterprises in China's Shanghai and Shenzhen stock markets from 2008 to 2020 as a sample to empirically study the impact of family CEOs on the implementation of DT in enterprises and explore the boundary conditions for decision-making from the perspectives of CEO ability and family willingness.

We find that family CEOs can drive the DT of organizations more than professional CEOs, contrary to the beliefs of Ceipek et al. (2021b), who found that family-managed companies would be harmful to exploratory IoT innovation due to risk aversion. Family firms can effectively control the innovation process and have tacit knowledge such as unique corporate external network connections, human capital, and routines, allowing them to invest less in innovation than non-family firms while producing significantly more (Duran et al., 2016). Our results indicate that this finding holds true for the DT of enterprises as well (Soluk et al., 2021). And the family CEO's intimate familiarity with the business, its culture, and its tacit knowledge will improve resource allocation and coordination during the DT process (Le Breton-Miller & Miller, 2015). Furthermore, family CEOs are extremely unlikely to

be replaced due to bad performance, which may lead to a heightened motivation to expand the business (Miller et al., 2011). In the era of the digital economy, obtaining a competitive edge and attaining long-term success depend on the extent to which businesses have undergone a DT.

The relationship between family CEOs and DT is positively moderated by CEOs' ability generated from general and firm-specific human capital. CEOs with more education correlates to a greater capacity for processing, absorbing, and integrating new information (Kato et al., 2015). This is especially important in today's highly uncertain business environment, where traditional enterprises need to maintain their competitive advantages through strategic transformation (Hu et al., 2022). Highly educated CEOs are better able to understand and grasp the latest trends and technologies of the digital age, perceive the importance of digital technology to the strategic transformation of enterprises, and make informed decisions. Internally promoted CEOs have relatively rich knowledge of family business culture, routines, and stakeholders, but due to the natural emotional connection between family members and the family, the degree of accumulation of relevant tacit knowledge is higher for external CEOs (Duran et al., 2016). As a result, the family CEO is in a stronger position to utilize the company's in-house resources to recognize DT possibilities, make strategic decisions in line with those prospects, and implement resource allocation and restructuring (Soluk et al., 2021).

The moderate effects of family willingness are complex. It is not statistically significant. One possible explanation is that a family business's primary objective of keeping family control is layered with a strong desire for business success (Miller et al., 2011). When the business cannot maintain growth, the willingness of the family to control and influence cannot be realized. The family CEO is responsible for the success or failure of the family and for the longevity of the enterprise. It is possible that, for now, the company's desire to expand will take priority over the family's desire to maintain control.

The moderate effect of family transgenerational sustainability is contrary to assumptions. A possible explanation is that this study does not differentiate between the stages of inheritance but rather checks if a second generation is involved. Even though the engagement of the second generation represents the enterprise's readiness to inherit over the long term, several studies have demonstrated that the venture capital of firms at various stages of succession exhibits distinct features. Due to paternalism, in the initial phase of inheritance, to establish the authority of the second generation and set the way for a smooth succession, the parents will allocate more innovative resources to low-risk areas to balance short-term performance with long-term planning. In the later stages of succession, after the legitimacy of the successor has been established, companies examine longer-term strategic choices (Zhu et al., 2021; Grundström et al., 2012). Currently, most listed family businesses in China are still led by their founders, and there are very few businesses in the final phase of inheritance. To evaluate the willingness to inherit, it may be essential to further split the inheritance phases.

The DT of traditional enterprises is often carried out from top to bottom, and the role of the core leaders of enterprises is crucial. This paper focuses on the characteristics of whether a family member holds the core executive position of the CEO as an entry point and provides new ideas for a better understanding of the DT behavior of family

enterprises. Previous research has yielded contradictory results about whether family businesses are better suited for DT, and it is possible that this is because the distinctive decision-making method of family businesses has been disregarded (De Massis et al., 2014). Therefore, this paper considers the CEO's individual ability and the family SEW's willingness to pursue a unified analysis framework, investigates the boundary conditions for family CEOs to make DT decisions, and offers new empirical evidence and understanding for the analysis and comprehension of the differences in existing conclusions. It also enriches the research on the influence of family members on the DT of enterprises.

Managerial implications

The conclusion of this paper draws on various managerial implications for DT in family businesses. First, the results show that family CEOs are more able to promote the digital transformation of family enterprises compared with non-family CEOs. Family tacit knowledge and less pressure to perform in the short term are key factors that make family CEOs more inclined to implement DT. To make full use of family knowledge and professional managers' ability to launch DT, the family business should work to build the cultural identity and psychological belonging of professional managers within the family business. Meanwhile, the family firm needs to allow for some trial and error on the part of its professional management to reduce its shortsighted decision-making behavior.

Second, the results show that the impact of the family CEO's advocacy for DT grows in tandem with the CEO's personal ability. For family businesses, it is necessary to select "talented" individuals as much as possible, no matter whether a family CEO or a non-family CEO. And it is best to be polished and experienced in different positions within the firm. Personal skills or firm-specific tacit knowledge help him/her to accept innovative ideas and activities, process complex information, and seize opportunities brought about by the digital age.

Third, the willingness to inherit is a negative moderator. Family businesses in China have just entered the initial stage of inheritance. Family intergenerational inheritance and corporate transformation strategies are two major challenges that family businesses face at the same time. Reasonable planning and the allocation of resources to appropriate fields will promote the longevity of the enterprise. Policymakers can enact targeted interventions to help family businesses prepare for DT and intergenerational inheritance. For example, a government could help build an advisory board to provide talent support, DT consulting services, family governance consulting, and heritage counseling, which would better equip family businesses to integrate a wide range of resources, both internal and external to the family or organization, to implement DT.

Limitations and future research directions

Although this study provides an in-depth discussion of the DT behavior of enterprises by different types of CEOs, there are still the following limitations: (1) It only distinguishes whether the CEO is a family member or not. In fact, even if the

family member is the CEO, the founder and other member CEOs, or the relationship between the core family members, it will affect their decision-making behavior. In the future, different family member traits can be further explored; (2) This study only investigates the moderating effect of the CEO's personal ability. The interaction between family ability and enterprise ability can be further explored in the future. (3) It only examines whether the family has the willingness to inherit and does not distinguish the inheritance stages. Different inheritance stages will affect the innovation resource allocation of family enterprises, and further exploration is necessary.

Funding This research was supported by Zhejiang Provincial Philosophy and Social Science Planning Project under Grant No. 24NDQN009YB & No. 23LLXC036YB, Zhejiang Provincial Natural Science Foundation of China under Grant No. LQ23G020004, Hangzhou Municipal Philosophy and Social Science Planning Project under Grant No. 2023QNRC13.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

References

Alexiev, A. S., Jansen, J. J., Van den Bosch, F. A., & Volberda, H. W. (2010). Top management team advice seeking and exploratory innovation: The moderating role of TMT heterogeneity. *Journal of Management Studies, 47*(7), 1343–1364.

Ano, B., & Bent, R. (2021). Human determinants influencing the digital transformation strategy of multigenerational family businesses: A multiple-case study of five French growth-oriented family firms. *Journal of Family Business Management*, (ahead-of-print).

Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional wealth in family firms: Theoretical dimensions, assessment approaches, and agenda for future research. *Family Business Review, 25*(3), 258–279.

Björkdahl, J. (2020). Strategies for digitalization in manufacturing firms. *California Management Review, 62*(4), 17–36.

Boling, J. R., Pieper, T. M., & Covin, J. G. (2016). CEO tenure and entrepreneurial orientation within family and nonfamily firms. *Entrepreneurship Theory and Practice, 40*(4), 891–913.

Cannas, R. (2021). Exploring digital transformation and dynamic capabilities in agrifood SMEs. *Journal of Small Business Management*, 1–27.

Ceipek, R., Hautz, J., De Massis, A., Matzler, K., & Ardito, L. (2021a). Digital transformation through exploratory and exploitative internet of things innovations: The impact of family management and technological diversification. *Journal of Product Innovation Management, 38*(1), 142–165.

Ceipek, R., Hautz, J., Petruzzelli, A. M., De Massis, A., & Matzler, K. (2021b). A motivation and ability perspective on engagement in emerging digital technologies: The case of internet of things solutions. *Long Range Planning, 54*(5), 101991.

Chirico, F., & Nordqvist, M. (2010). Dynamic capabilities and trans-generational value creation in family firms: The role of organizational culture. *International Small Business Journal, 28*(5), 487–504.

Corvello, V., De Carolis, M., Verteramo, S., & Steiber, A. (2022). The digital transformation of entrepreneurial work. *International Journal of Entrepreneurial Behavior & Research, 28*(5), 1167–1183.

Cucculelli, M., Dileo, I., & Pini, M. (2022). Filling the void of family leadership: Institutional support to business model changes in the Italian industry 4.0 experience. *The Journal of Technology Transfer, 47*(1), 213–241.

De Massis, A., Di Minin, A., & Frattini, F. (2015). Family-driven innovation: Resolving the paradox in family firms. *California Management Review, 58*(1), 5–19.

De Massis, A., Eddleston, K. A., & Rovelli, P. (2021). Entrepreneurial by design: How organizational design affects family and non-family firms' opportunity exploitation. *Journal of Management Studies, 58*(1), 27–62.

De Massis, A., Kotlar, J., Chua, J. H., & Chrisman, J. J. (2014). Ability and willingness as sufficiency conditions for family-oriented particularistic behavior: Implications for theory and empirical studies. *Journal of Small Business Management, 52*(2), 344–364.

Del Vecchio, P., Secundo, G., Rubino, M., Garzoni, A., & Vrontis, D. (2019). Open innovation in family firms: Empirical evidence about internal and external knowledge flows. *Business Process Management Journal, 26*(5), 979–997.

Duran, P., Kammerlander, N., Van Essen, M., & Zellweger, T. (2016). Doing more with less: Innovation input and output in family firms. *Academy of Management Journal, 59*(4), 1224–1264.

Fernandes, C., Ferreira, J. J., Veiga, P. M., Kraus, S., & Dabić, M. (2022). Digital entrepreneurship platforms: Mapping the field and looking towards a holistic approach. *Technology in Society, 70*, 101979.

Ferraro, O., & Cristiano, E. (2021). Family business in the digital age: The state of the art and the impact of change in the estimate of economic value. *Journal of Risk and Financial Management, 14*(7), 301.

Ferreira, D., & Sah, R. K. (2012). Who gets to the top? Generalists versus specialists in managerial organizations. *The RAND Journal of Economics, 43*(4), 577–601.

Foss, K., Foss, N. J., Klein, P. G., & Klein, S. K. (2007). The entrepreneurial organization of heterogeneous capital. *Journal of Management Studies, 44*(7), 1165–1186.

Gómez-Mejía, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative Science Quarterly, 52*(1), 106–137.

Grundström, C., Öberg, C., & Rönnbäck, A. (2012). Family-owned manufacturing SMEs and innovativeness: A comparison between within-family successions and external takeovers. *Journal of Family Business Strategy, 3*(3), 162–173.

Gu, W. (2023). Impact of managers' overconfidence upon listed firms' entrepreneurial behavior in an emerging market. *Journal of Business Research, 155*, 113453.

Gu, W., & Yuan, W. (2024). Research on the influence of chain shareholder network on enterprise green innovation. *Journal of Business Research, 172*, 114416.

Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change, 146*, 119–132.

Hu, D., Peng, Y., Fang, T., & Chen, C. W. (2022). The effects of executives' overseas background on enterprise digital transformation: Evidence from China. *Chinese Management Studies*, (ahead-of-print).

Huang, H., Lv, C., & Zhu, X. (2018). Second generation involvement and corporate Innovation: Evidence from Chin. *Nankai Business Review (in Chinese), 21*(01), 6–16.

Kato, M., Okamuro, H., & Honjo, Y. (2015). Does founders' human capital matter for innovation? Evidence from Japanese start-ups. *Journal of Small Business Management, 53*(1), 114–128.

Kelleci, R., Lambrechts, F., Voordeckers, W., & Huybrechts, J. (2019). CEO personality: A different perspective on the nonfamily versus family CEO debate. *Family Business Review, 32*(1), 31–57.

Le Breton-Miller, I., & Miller, D. (2015). The paradox of resource vulnerability: Considerations for organizational curatorship. *Strategic Management Journal, 36*(3), 397–415.

Liu, Z., Zhou, J., & Li, J. (2023). How do family firms respond strategically to the digital transformation trend: Disclosing symbolic cues or making substantive changes? *Journal of Business Research, 155*, 113395.

Lu, B., Yin, Z., & Zhang, Y. (2022). An exploratory study of the processes and mechanisms of the digital transformation of traditional companies. *Science Research Management (in Chinese), 43*(04), 83–93.

Lumpkin, G. T., Martin, W., & Vaughn, M. (2008). Family orientation: Individual-level influences on family firm outcomes. *Family Business Review, 21*(2), 127–138.

Miller, D., Breton-Miller, L., & Lester, R. H. (2011). Family and lone founder ownership and strategic behaviour: Social context, identity, and institutional logics. *Journal of Management Studies, 48*(1), 1–25.

Miller, D., Le Breton-Miller, I., Minichilli, A., Corbetta, G., & Pittino, D. (2014). When do non-family CEO s outperform in family firms? Agency and behavioural agency perspectives. *Journal of Management Studies, 51*(4), 547–572.

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy, 48*(8), 103773.

Nell, P. C., Foss, N. J., Klein, P. G., & Schmitt, J. (2021). Avoiding digitalization traps: Tools for top managers. *Business Horizons, 64*(2), 163–169.

Prügl, R., & Spitzley, D. I. (2021). Responding to digital transformation by external corporate venturing: An enterprising family identity and communication patterns perspective. *Journal of Management Studies, 58*(1), 135–164.

Sarto, F., & Saggese, S. (2022). Board industry expertise and innovation input: Evidence on the curvilinear relationship and the moderating effect of CEO. *European Journal of Innovation Management, 25*(6), 775–803.

Schneider, P. (2018). Managerial challenges of industry 4.0: An empirically backed research agenda for a nascent field. *Review of Managerial Science, 12*(3), 803–848.

Soluk, J., & Kammerlander, N. (2021). Digital transformation in family-owned Mittelstand firms: A dynamic capabilities perspective. *European Journal of Information Systems, 30*(6), 676–711.

Soluk, J., Miroshnychenko, I., Kammerlander, N., & De Massis, A. (2021). Family influence and digital business model innovation: The enabling role of dynamic capabilities. *Entrepreneurship Theory and Practice, 45*(4), 867–905.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144.

Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J. (2021). Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms. *Long Range Planning, 54*(5), 102110.

Wang, M., & He, Q. (2020). Are insiders more Conservative in Innovation activities? Evidence from R&D investment of Chinese listed family firms. *Foreign Economics & Management (in Chinese), 42*(12), 104–118.

Wu, F., Hu, H., Lin, H., & Ren, X. (2021). Enterprise digital transformation and capital market performance: Empirical evidence from stock liquidity. *Journal of Management World (in Chinese), 07*, 130–144.

Xie, X., Zhang, H., & Blanco, C. (2022). How organizational readiness for digital innovation shapes digital business model innovation in family businesses. *International Journal of Entrepreneurial Behavior & Research*, (ahead-of-print).

Yang, X., Liu, J., & Tang, Y. (2021). CEO Category, strategic choice and family business performance: An empirical research of Chinese family listed companies. *Business and Management Journal (in Chinese), (11)*, 89–103.

Yeh, Y. H., & Liao, C. C. (2021). Are non-family successors all the same? Inside-promoted vs. outside-sourced. *Journal of Corporate Finance, 71*, 102122.

Zapata-Cantu, L., Sanguino, R., Barroso, A., & Nicola-Gavrilă, L. (2022). Family business adapting a new digital-based economy: Opportunities and challenges for future research. *Journal of the Knowledge Economy*, 1–18.

Zhu, K., & Zhou, Y. (2016). Does social emotional wealth inhibit the innovation investment of Chinese family enterprises? *Journal of Management World (in Chinese), 3*, 99–114.

Zhu, Z., Li, X., & Zhao, Y. (2021). Co-governance and Innovation decision: Paternalism and foresight effect in the intergenerational succession of Chinese family firm. *Journal of Management World (in Chinese), 9*, 191–207232.

Zoppelletto, A., Orlandi, L. B., Zardini, A., Rossignoli, C., & Kraus, S. (2023). Organizational roles in the context of digital transformation: A micro-level perspective. *Journal of Business Research, 157*, 113563.

Authors and Affiliations

Qiuqin He[1] · Carlos Lassala[2] · Rosa Currás-Móstoles[3]

✉ Qiuqin He
20190090@hznu.edu.cn

Carlos Lassala
carlos.lassala@uv.es

Rosa Currás-Móstoles
rcurras@upv.es

[1] School of Economics, Hangzhou Normal University, Hangzhou, China

[2] University of Valencia, Valencia, Spain

[3] Business School, Universitat Politècnica de València, Valencia, Spain