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Digital transformation of the interior design industry: selected case studies from South Africa, China and Canada

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1. Digital Technology
2. Digital Transformation
3. Interior Design

Abstract

In the context of the fourth Industrial Revolution, a series of digital technologies were derived. The emergence of these digital technologies has greatly promoted the industry's reform and innovation, among which the interior design industry is one. This paper mainly discusses the digital transformation of the interior design industry and studies the influence of digital technology on the operation of interior design enterprises, core design process, interior design products and users during the transformation process. This study is based on the feedback of interior design companies, designers and users in South Africa, Canada and China. By selecting different research objects of different digital infrastructure level, this study explores the role and effectiveness of digital technology in the process of the digital transformation of the interior design industry. By comparing the comprehensive data of different countries, this paper makes a comprehensive analysis of the interior design industry from the perspective of the digital transformation of interior design enterprises, core digital design process and interior design products and services to explore the importance and inevitability of digital transformation.

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Declaration

I declare that this research is completely done by myself. During the research process, my supervisor participated in the theoretical guidance and supervision of research. It is submitted as part of the requirements for the Master of Management in the field of Digital Business at UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG. It has not been submitted before obtaining any degree or exam at any other university. I further declare that I have obtained the necessary authorization and consent to conduct this research. Jun Zhou Xiao 12/02/2021

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CHAPTER 1. INTRODUCTION

1.1 Purpose of the study

After the fourth Industrial Revolution, new digital technology has been coming into people's vision. Interior design industry is one of the carriers of digital technology in this era. The main objective of this study is to explore the digital transformation of interior design industry in South Africa, compare with the advantages and disadvantages of other countries in the world, and discuss the importance of digital transformation to interior design industry in South Africa and its future development trend.

1.2 Context of the study

“The interior design is to create an ideal indoor living space for customers by using appropriate techniques and artistic techniques according to the characteristics, environment and corresponding standards of the building (Liu Y, 2005).” Interior Design is an emerging industry (Liu Y, 2005). Although it is only a matter of recent decades. As early as in ancient times, people began to organize and consciously arrange their lives and participate in production activities. They used available materials around them to build and decorate their homes and surrounding environment.

“It can be traced back to the prehistoric Stone Age. People built their own residences through primitive stone, wood and other basic materials, and gave these materials different functions (Mike, 2013).” The traditional interior design process is mainly divided into measurement, drawing, and construction (Liu Y, 2005). Traditional interior design require more time and labor costs to complete different stages of work and are susceptible to more complex and diverse uncertainties. “For instance, there is a measurement deviation in the measurement room size, the rationality of the customer's wishes during the design process, and the deviation between the rendering and the final construction effect (Wang, 2020).”

At the same time, the digital management system can better improve the operational efficiency and work quality of various departments within the enterprise. From the company's back-end system and core operations to the company's front-end system, RPA and the use of Artificial Intelligence (AI) have narrowed the distance between departments, improved the efficiency of cooperation between departments, and provided more authority for core business and processes. The solution replaces the high-risk work in the traditional work model; and provides managers and related departments with safer and more effective digital data through digital tools to control risks; or can replace departments that require a large number of paper documents and manual operations, to save the comprehensive cost of the enterprise and improve the work efficiency of the enterprise.

"At the same time, the emergence of 3D, Augmented Reality (AR), AI and other digital technologies has completely overturned the traditional interior design industry (Bahareh, 2014)." Traditional interior design will face the problems of measurement accuracy and low measurement efficiency in the early stage of measuring the size, but the emergence of 3D scanners perfectly solves this difficulty. "By placing the 3D scanner in the center of the room reasonably, depending on the room size, the scanner can complete a complete indoor size scan within 3-5 minutes and draw a 3D model (Schwab, 2016)."

In the construction of design drawings and the later stage of product delivery, traditional interior design may face the problem of inconsistent physical objects and hand-drawn renderings, or ultimately fail to meet customer needs. The application of AR-augmented reality technology also perfectly solves this dilemma. "AR technology refers to the combination of virtual images and reality through technical means, and the creation of images that combine virtual and reality, mostly using mobile phones or tablets as carriers (Chang, 2020)." Before the product is delivered, the user can intuitively obtain the post-construction image, and can modify the overall design scheme on the device instantly, which increases the efficiency of the overall design schedule and reduces the rework rate.

The emergence of these digital technologies has subverted the development of the entire interior design industry to a certain extent, but even so, not all countries' interior design industries have a unified operating mode, design process and design standards. "The final result of interior design is subject to a series of factors such as the delivery party, the design company's operation mode, the degree of digitization, cultural factors, geographic factors and psychological factors that will directly affect the development and progress of the industry (Liu Y, 2005)."

The emergence of these digital technologies has brought disruptive changes to the operation management process, design process and final products of interior design companies. Digital technology has brought a disruptive impact on the development, operation, core design process, products and customers of the South African interior design industry.

1.3 Problem Statement

The main challenge is to use the digital technology brought about by the Fourth Industrial Revolution to identify the changes and disruptive innovations brought about by the ongoing digital transformation of the interior design industry in South Africa and other parts of the world. In the enterprise, how does the application of digital technology affect the internal management and operation process of the enterprise? Compared with the past operation mode, does embedded digital technology improve the efficiency and quality of internal management and operation, in contrast to traditional operation management Modes, back-end systems, core business processes, and front-end systems, in which respects bring corresponding improvements for enterprises, and digital transformation into the advantages and development prospects of the interior design industry. Is digital transformation necessary for interior design companies? Can all business processes and work processes be replaced by digital technology? On the other hand, in the core design process, has the application of digital technology overturned the traditional interior design model? Can the highly intelligent and efficient digital technology replace the transmission design model? Does the core design process bring a broader space for development? What changes and

effects does the new design process have on designers and products? Finally, digital technology will bring innovation and impact on product performance and user experience. Will consumers Is it acceptable to present interior design works in digital mode? In addition, at what level does the application of digital technology in interior design products and services affect user experience and what users expect from products and services? Will this impact provide more possibilities for customer needs?

1.4 Research Questions

“This academic paper is to explore the digital technology brought about by the fourth industrial revolution, which has brought many opportunities and challenges to different industries (Xu, David & Kim, 2018).” In the interior design industry, digital technology has also brought corresponding opportunities and industrial innovation to South Africa and the global interior design industry.

This research intends to discuss the changes and innovations that digital technology has brought to South Africa and the global interior design industry. The research questions are:

1) To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?

- How does the back-end system maintain the development of the enterprise and the operation of core business processes?
- What role does the application of enterprise system and digital platform play in enterprise development ?
- What is the impact of digital maturity in the enterprise digitization process ?

2) In what aspects has digital technology changed the core service offering of the interior design industry?

-How has digital technology changed the performance of core service offering in the interior design industry?

-What problems does the application of digital technology solve for the design process?

-What advantages does the application of digital platform bring to the design process?

3) How does digital technology, as applied with regard to (1) and (2) above, improve user experience ?

-How does digital technology affect product performance?

-What is the impact of digital technologies used in interior design products and processes on users?

1.5 Significance of the study

The digital technology brought to the world by the Fourth Industrial Revolution will completely change the world's industrial structure. The interior design industry is no exception. “Digital technology has completely changed the relationship between companies and employees and customers (Daniel B, 2018).”

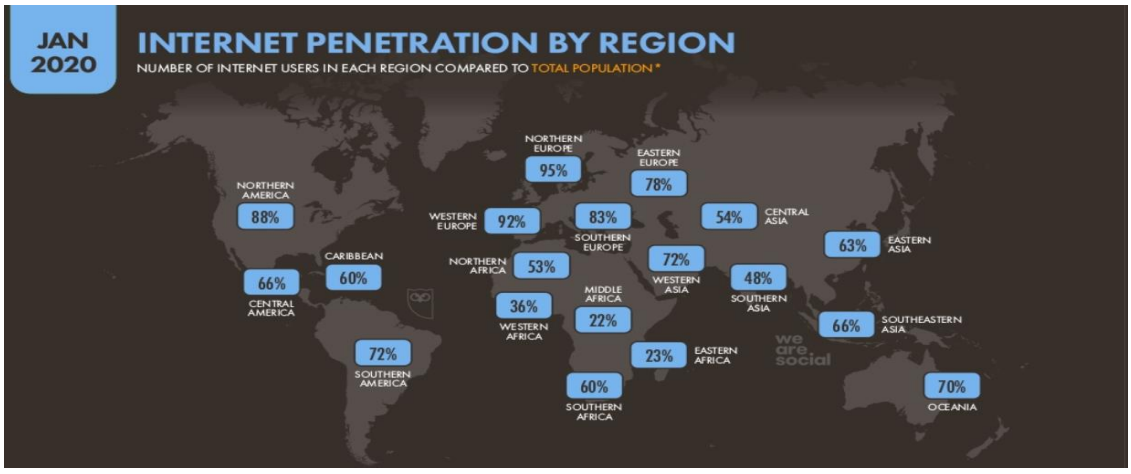


Figure 1: South Africa: Number of internet users ineach region compared to total population .(Source frome Digital 2020: South Africa).

“According to the survey results, by 2020, Internet users in South Africa will account for 60% of the total population, ranking first in Africa (Kemp, 2020).” This provided a stable foundation for the subsequent digital development of South Africa.

Under the background and conditions of this era, the main research significance of this article is to promote enterprise digital transformation and innovation. What these changes and innovations mean for the South African and global design industry. In addition, in the process of digital transformation of the interior design industry, the emergence of digital technologies such as artificial intelligence, RPA, AR, and 3D has changed the internal business management model, core business process, design process and product performance. Whether the optimization brought about by the digital transformation of design products and services can further meet the needs of users, improve user experience and experience the new value that digital technology brings to interior design products.

1.6 Delimitations of the study

This paper mainly studies the changes and innovations brought by digital transformation to interior design industry in South Africa and around the world. The first aspect is the internal operation and management system of the enterprise, which involves the back-office system, the core business process and the front-office system of the enterprise. The second aspect is the application of digital technology in the core design process of interior design enterprises, the change of design methods, and the improvement of the performance of design tools. The third aspect mainly studies the performance of digital technology on the performance and quality of interior design products and services, as well as the impact on user demand and user experience.

1.7 Definition of terms

Inrerior design

Interior design is the secondary design of architectural space. By integrating architectural, technological, environmental and visual factors, it finally provides people with a comfortable and comfortable living environment that meets their personal needs (Liu Y, 2005).

Digital technologies

AI- (Artificial intelligence) By simulating human intelligence on machines and programming, human behavior and way of thinking can be realized on different carriers (Frankenfield J,2020).

AR- Augmented reality is achieved by combining the two scenarios.A sensor is used to scan an object and an AR program is used to generate a set of 3D images in the first scene of U.At the same time, the location and scene details are determined in the second scene through the sensors in the mobile device (gyroscope, camera, etc). After the process is over, the first scene and the second scene are combined to complete the augmented reality (Balaban D,2019).

RPA- Robotic Process Automation, RPA is a digital technology that is managed by business logic and structured inputs to automate business processes.With RPA tools, companies can configure software or "robots" to handle transactions, manipulate data, trigger responses, and communicate with other digital systems (Boulton, 2018).

3D Scaner- A professional measuring device used to measure the shape, size and appearance of an object. The collected data is consolidated and calculated, and a digital model of the object is generated (Joseph P, 2004).

IOT-The Internet of Things (IOT) refers to a network of intelligent identification, location, tracking and supervision through information sensing devices such as RADIO frequency identification, infrared sensors, global positioning, laser scanning and so on, which can be connected to any object according to the

agreed protocol for information exchange and communication (Kong, 2009). In the field of interior design application and intelligent home connectivity.

3DS MAX & CAD-By inputting building data information into CAD, accurate design drawings can be generated, and accurate scheme drawings, plans and construction drawings can be provided for the design scheme. Then, the generated CAD drawings are imported into 3DS MAX software to generate 3D three-dimensional models for rendering three-dimensional renderings.

3D Printing -3D Printing is a manufacturing process, according to the requirements of different industries, can use different raw materials for printing, through the digital 3D model by superimposing manufacturing into tangible 3D objects, break through the traditional manufacturing in material, shape, the structure of the restrictions, can according to the actual demand, print out the data precision of 3D objects (Lacoma, 2020). In the field of interior design, it is mainly used in the production of some special-shaped homes and architectural structures.

1.8 Assumptions

The digital technology brought by the fourth Industrial Revolution can effectively promote the development of interior design industry in South Africa and the whole world.In the interior design enterprise, by building stable and efficient front and back office systems, the core business process inside the enterprise can run more efficiently and smoothly.Mainly aimed at the interior design industry, it can effectively improve the internal work efficiency and work output. On the other hand, the application of AR, 3D and other technologies can effectively improve the operation quality of design tools and provide more extensive functions for design works and services. Secondly, it will also improve the quality and performance of the design products, further meet the needs of consumers and improve the user experience.

In this research report, interviewees will be accurately classified according to different research objectives. In terms of studying the internal operation and

management of enterprises and the application of digital technology in the internal system of enterprises, the internal core staff design enterprises will be interviewed to discuss the necessity and mode of digital transformation of the interior design industry. In this part of the core design process, through interviews with professional designers in the industry, from a professional perspective, discuss the application of digital technology in interior design. Study the core design process, design mode and design technology, and study the improvement and transformation of the core design process by digital technology. In terms of product performance and services, through questionnaire surveys, the consumer groups who have purchased or experienced interior design products and services are surveyed. This article studies the corresponding positive effects of digital technology applications on product performance and user experience.

1.9 Chapter Outline

The whole research report covers a total of three chapters

Chapter 1 outlines the overall research direction and explores the impact of digital transformation on the interior design industry in South Africa and other parts of the world. Summarized the purpose, background and significance of the research.

The second chapter mainly discusses all the documents and theories that support this paper. Starting from the perspective of digital transformation, supported by digital technology, from a professional and academic perspective, it provides a theoretical basis for digital transformation and the application of digital technology.

The third chapter mainly introduces the main research methods. Through targeted selection of research samples, the data is integrated and analyzed. To combine theoretical literature and practical research results for academic discussion.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

The impact of the fourth Industrial Revolution on business was devastating.The emergence of digital technologies have created a new direction for the future development of enterprises. The new digital platform management architecture has brought more excellent solutions for the management and distribution of enterprise internal information and data, improved the management system, and optimized the core business processes within the enterprise. In the process of digital transformation, some departments or processes with traditional working mode are replaced by digital technologies, such as logistics department, customer service department and internal database of the company.On the one hand, the application of AI and RPA technology can make the company's background and front end system more efficient and tacit cooperation.Secondly, the application of digital technology can replace the business process that originally needs a lot of manual or paper documents to improve the overall operation and management efficiency within the company. Provide technical support for the digital transformation of enterprises.

“In the interior design process, certain processes are necessary and cannot be replaced. For example, the measurement of indoor various size data, rendering of renderings, etc (Kang, 2009).” However, digital technology has greatly improved the scalability and performance of these traditional design steps. The main wisdom of interior designers is to solve problems when designing products according to customer standards (Mortezapour, 2014). Then, the technological upgrading brought about by digital technology can largely solve the obstacles faced in the interior design process. For example, 3Dmax software can present design schemes more vividly and accurately, and 3D printing technology makes it possible to model interior design that was impossible before.

The application of digital technology in interior design as a medium can enhance the interaction and participation of participants with design works at the visual and sensory levels. In this way, design works can give participants a more

intuitive, clear feeling and enhance the experience (Hajji, 2017). On the other hand, digital technologies have improved the performance and effects of interior design products, which can increase users' benefits while increasing people's attention to the interior design industry. Thereby improving the status of South Africa's interior design industry in the industry chain. It also has a positive impact on the image of interior designers in people's hearts.

2.2 Definition of topic

2.2.1 Enterprise system and digital platform

"In today's fierce market competition, how to maximize enterprise resources and how to integrate digital technology into the enterprise's resource allocation is the key to maintaining its market competitiveness (Sedera, Lokuge, Grover, Sarker, Sarker S, 2016)."

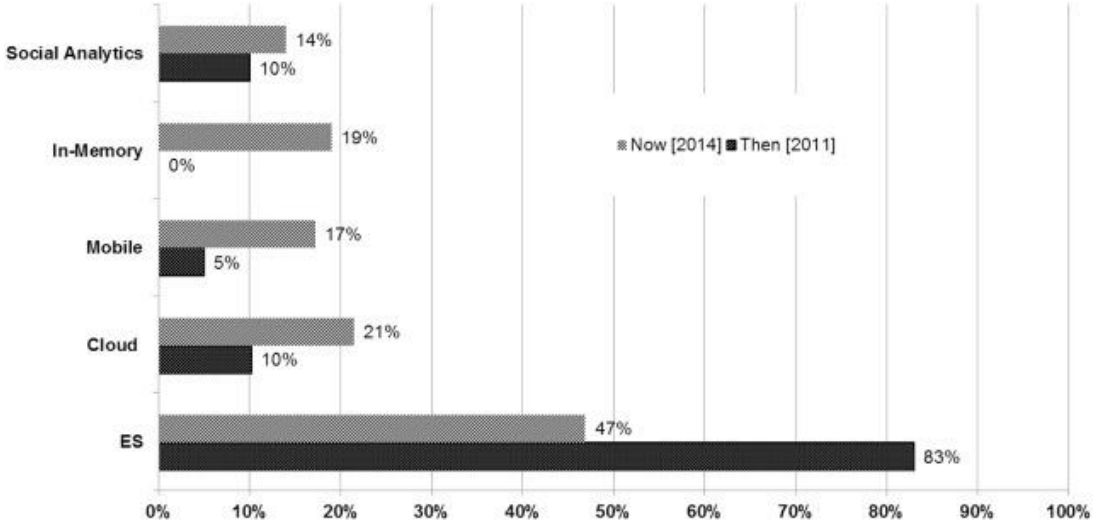


Figure 2 : The investment of enterprises in enterprise digital construction is different from 2011 and 2014 .(Sedera, Lokuge, Grover, Sarker, Sarker S, 2016).

It can be seen from Figure 2 that enterprises are gradually shifting their development and operation focus from enterprise systems to digital technologies. Therefore, in the current era, how to more effectively and rationally combine digital technologies with enterprise systems is an inevitable trend for enterprise development.

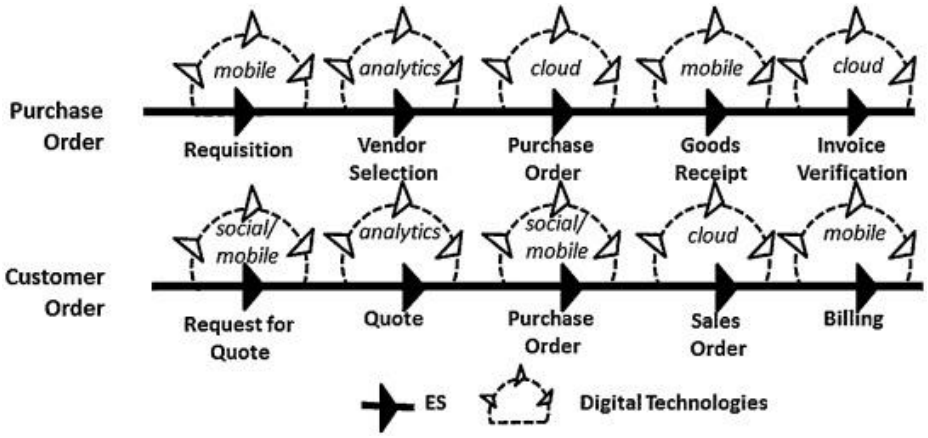


Figure 3: Integration of enterprise systems and digital platforms(Sedera, Lokuge, Grover, Sarker, Sarker S, 2016).

Compared with the traditional business process of enterprise systems, the introduction of digital technology has undoubtedly solved the obstacles and difficulties faced by enterprises in the development process to a great extent (Sedera, Lokuge, Governor, Sarker, Sarker S, 2016). For example, cloud technology can improve the storage capacity and transmission efficiency of enterprise internal information. Due to the emergence of mobile digital platforms, product reservations and other services provide customers with more choices. The development model is also suitable for interior design companies. Through the customized enterprise system and digital platform, the operation efficiency of the enterprise is improved, and the interaction between the enterprise and the customer is strengthened.

2.2.2 The enterprise efficiency Assessment framework helps interior design firms monitor their departments' real-time digital development .

“The performance evaluation system can effectively measure and monitor the development status of various departments in the organization, and obtain the problems in the enterprise operation process and the gap with the core development strategy of the enterprise from the feedback data (Folan & Browne, 2005).” In the performance appraisal system, according to the core of the company's development strategy, the corresponding indicators are set for the project and development goals, and the indicators are completed in a timely and continuous manner and the problems in the operation process are monitored.

Based on this, provide corresponding solutions to ensure the innovative development of the enterprise.

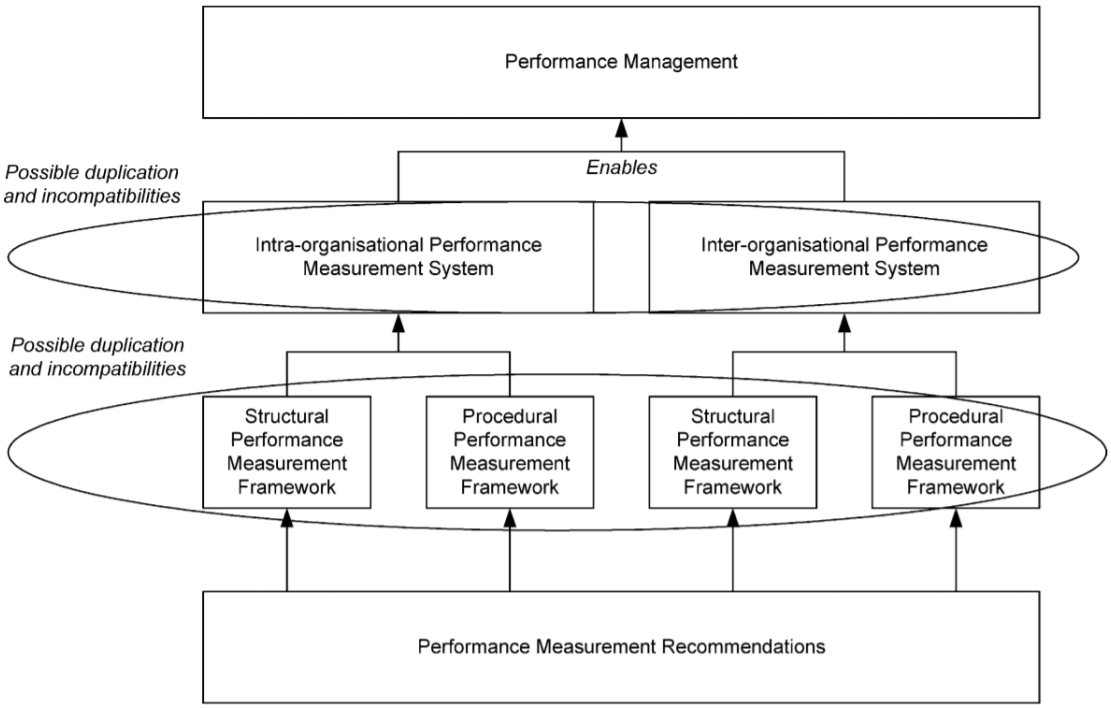


Figure 4: Performance measurement system working framework.

In the interior design industry, the main departments that need to set indicators and monitor the performance in real time are the design department, the sales department, and the user experience department related to after-sales service. As shown in Figure 3, different departments set different performance standards, but all performance standards are designed according to the core development strategy of the enterprise itself.For example, the performance index of the design department should focus on the design period, design budget and utilization rate of designers. The performance evaluation of after-sales and user experience departments should focus on user feedback, scheme rework rate and other factors. On a monthly or quarterly basis, check the performance information of each department from the company's background management system, analyze and regulate the generated data, and implement appropriate solutions to ensure the stable operation of each department.

2.2.3 Digital maturity

“There are two main functional divisions in digital maturity. They are "Leadership & Strategy" and "Digital Enablement & Adoption" (Armstrong, 2019).” The main function of this model is to analyze the digital maturity of an enterprise from a multi-dimensional perspective. By continuously deepening the understanding of digitalization of enterprises and leaders, discover the problems of enterprises themselves and establish digital solutions. From an overall perspective, strengthen the company's digital transformation. Build a digital development direction for the enterprise to complete the digital transformation of the enterprise (Armstrong, 2019).

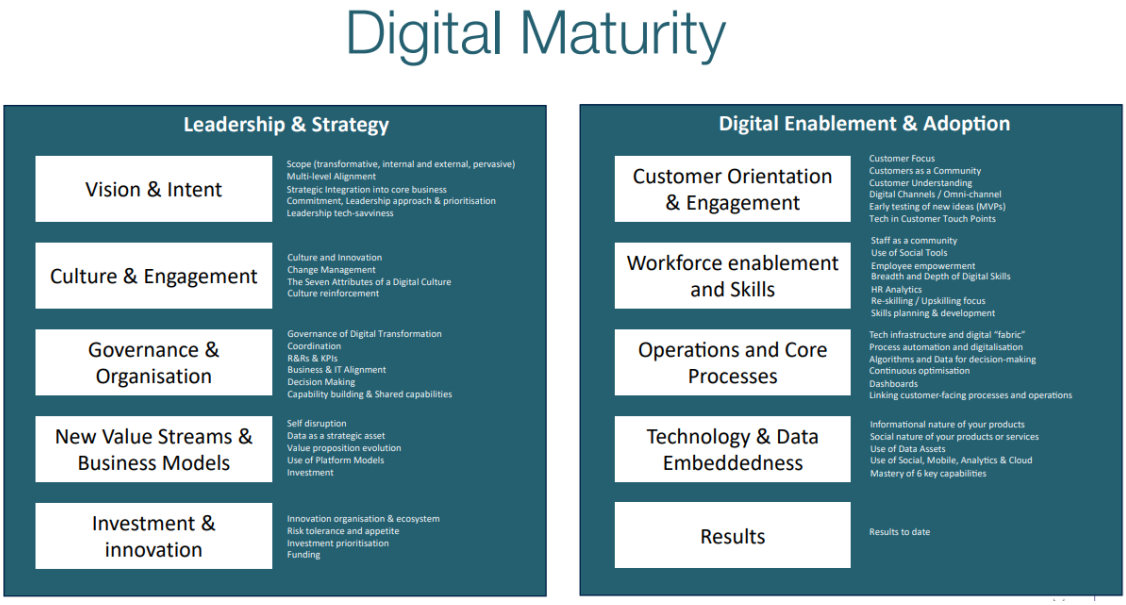


Figure 5: Digital Maturity Model(Armstrong, 2019).

In this research, we will use digital maturity as a model to compare the digital maturity of South Africa interior Design industry and other countries. Finally, analyze the gaps and differences between the digitalization of South Africa interior design industry and other countries.

2.2.4 Digital Transformation Model

The emergence of digital technologies, for instance social networking, cloud technology, and mobile internet are all boosters that influence the rise of business in current environment. The digital transformation model can let us know of how

it works and how to use these digital technologies to create maximum efficiency for enterprises operation.

“Building digital capabilities and transforming the customer experience are at the center of digital transformation (McAfee, Bonnet and Westerman, 2014).” Especially for the interior design industry where customer experience is the core development project, through the application of the digital transformation model (Figure 6), explore the gap between the company itself and the highly digitalized company, and use technical means to digitally train employees and improve Digital strategy, process optimization, etc, promote the company's digital transformation projects, and continue to move closer to highly digital enterprises. Ultimately, it will enhance the overall strength and competitiveness of interior design companies in the digital age.



Figure 6: Digital Transformation Model (McAfee, Bonnet & Westerman, 2014).

2.2.5 *Core elements of digital transformation*

The enterprise's business process digitization, Enablement of workers and a full-fledged digital performance management system will facilitate the enterprise's digital transformation.” Companies are not only transforming the way processes

work, they are redefining the interactions between functions and even changing the boundaries and activities of the company (McAfee, Bonnet & Westerman, 2014).” In the process of enterprise digital transformation, we should pay attention to the following points:

1. Digitalization of core business processes

The application of emerging digital technologies, such as RPA, AI and other technologies, can enable companies to focus their employees on more strategic tasks. The rational application of digital technology can enable employees to focus on challenges and innovations instead of consuming time on a single task.

2.Worker Enablement

The work process is completely separated from the work location. Borrow the network, cloud technology and other carriers to realize the virtual working mode. Employees can complete required tasks at any place and any time. With powerful network tools and cloud technical support, you can communicate with anyone in the enterprise at any place, and get the work resources you need at any time.

3.Performance Management

The high-quality performance detection system enables managers to understand the core business process of the enterprise and the efficiency of each department from a deeper perspective. According to the overall effectiveness of the situation, timely adjustment of strategic deployment and work arrangements.

4.Digitally Modified Businesses

Through digital technology, to transform the core business model of the enterprise. Use digital technology to support the core business process of the enterprise and provide it with more comprehensive solutions and development space.

5.New Digital Businesses

Enterprises enrich their product chain by launching digital products as a supplement to their products.

6.Digital Globalization

Through the combination of digital technology and integrated information, the company's development strategy is transformed into globalization. Make the development, operation and management of the enterprise share the income from the whole world. On the other hand, the global sharing effect can also effectively enable enterprises to improve transformation efficiency and reduce risks in the process of digital transformation.

2.2.6 *The application of KPI in Digital Transformation*

KPI (Key Performance Indicator) is a tool to decompose enterprise strategic objectives into operational work objectives, which is the foundation of enterprise Performance management. KPI enables the department head to define the main

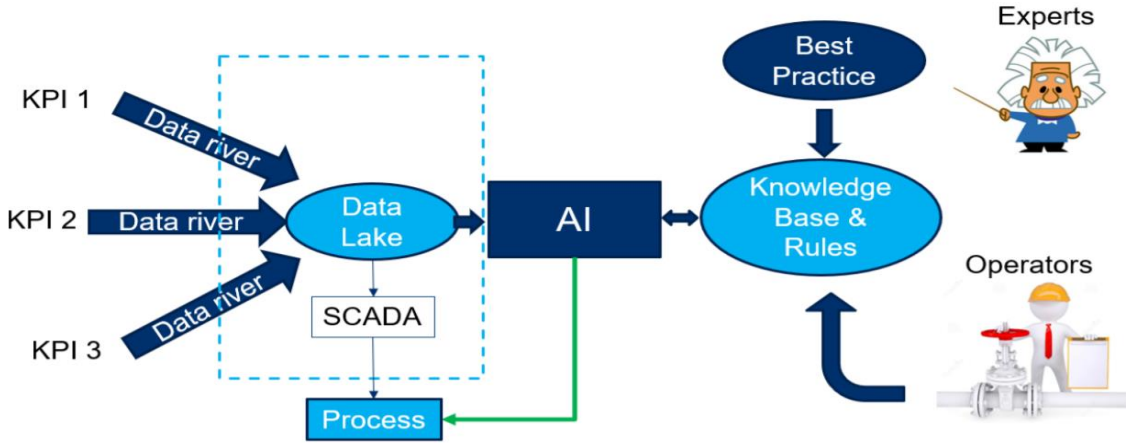


Figure 7 : KPI data process

responsibilities of the department and, on this basis, to define the performance measurement indicators of the department personnel. By designing a KPI with associated attributes, you can evaluate these attributes for the business model. Enter all known factors or KPIs into it. “By comparing rules and formulas with the knowledge base, the output guides the company on what to do at any given time to prevent business decline (Jordan, 2020).”

Set different digital indicators for different departments, observe the comprehensive work situation of each department in the enterprise from the background system, and constantly adjust the business and management mode of the department according to the reverse data. Digital KPI index can also intuitively show the digital transformation status of each department, and facilitate the management to constantly modify and strengthen the digital development strategy of the enterprise in the process of digital transformation.

2.2.7 Digital technology to improve the performance of the core design process

By the sustaining developing of digital technology, some digital technologies developed for interior design are also widely used. For example, 3DS MAX, CAD and VR, are software designed for design (Yildirima & Yavuz, 2012). These

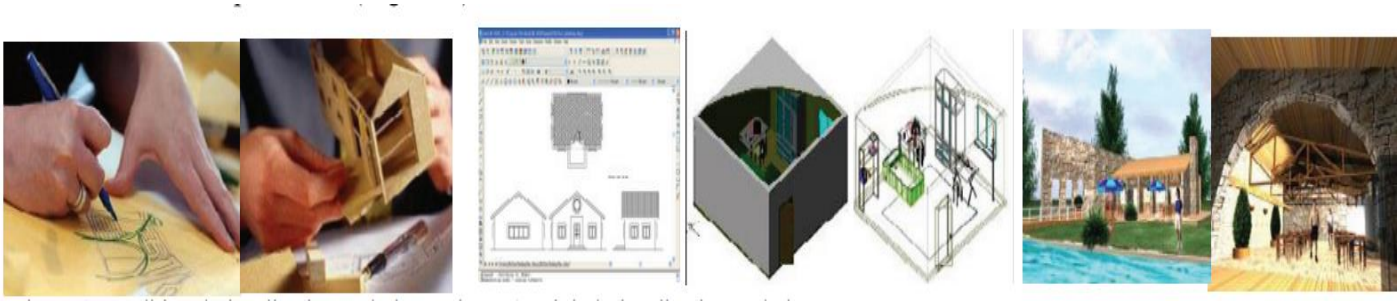


Figure 8 : Traditional modeling techniques and 3D modeling techniques(Yildirim & Arzu, 2012)

softwares have greatly improved the reliability and operational efficiency of the design scheme. The precise drawing of the design plan through the computer reduces the error caused by the original hand-drawn form (Figure 7). “At the same time, the design plan is presented in a 3DS stereoscopic form, which enables meticulous observation of the design project from multiple angles, and more intuitively sees the problems of the design plan itself, and can provide more suitable solutions (Mortezapour,2014).”

Compared with traditional design methods, digital design software can enable designers to complete design work more efficiently, and provide customers with more products commensurate with their design standards according to different structures of buildings. The performance of delivered design works is better than traditional design works (Table 1).

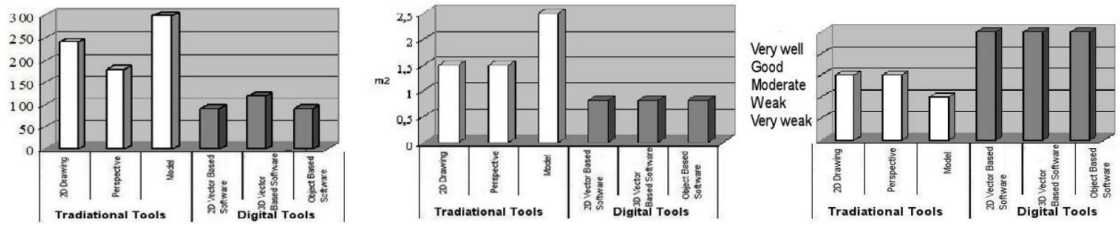


Table 1 : The advantages of digital software compared with traditional design methods(Yildirim & Arzu, 2012).

2.2.8 The application of digital technology is beneficial to enhance user experience and improve product performance

The process of applying digital technologies to interior design must have a certain pertinence, and use corresponding technology according to the requirments of customers in different design processes. The three main aspects that can improve the user experience are motivation, engagement and happiness. “According to the unique needs of different customers, based on these three aspects, the design scheme is set according to the different functions and characteristics of digital technology to meet customer needs from a full range of perspectives and enhance user experience (Peters, Calvo & Ryan, 2018).”



Figure 9 : The scope that affects the user experience(Peters,Calvo & Ryan, 2018).

“There are four main steps in how digitalization gradually affects user experience from the shallower to the deeper. 1. interface, a part of the interaction between the terminal interface and the user. 2. Tasks, users themselves are part of the technical implementation. 3. behavior, the user initiates the behavior of

supporting technology. 4. Life, the field involved in technology is part of the user's life (Calvo & Peters, 2014).” (Figure 9) Therefore, when formulating the actual indoor plan, it is necessary to consider from different angles to improve the interaction and participation of users with the involved plan as much as possible.

2.2.9 Explore the user value proposition from a digital perspective

“To successfully drive digital transformation, companies should focus on two complementary activities: reshaping customer value propositions and using digital technologies to improve operations to better interact and collaborate with customers(Berman, 2012).”

The application of digital technology in interior design products should not be limited to improving the performance and quality of products, but should pay more attention to the interaction with customers. In this strategy, the main focus is 1. Discover the user's value proposition. 2. Change the operation mode. Apply the advantages of digital technology to activities that provide insight into user needs, meet user expectations, and enhance interaction with users. Digital technology is used to continuously explore, enhance, integrate and expand users' value propositions (Table 2) to gradually improve user experience, create greater development space for products and services, and complete the digital transformation of products and services.

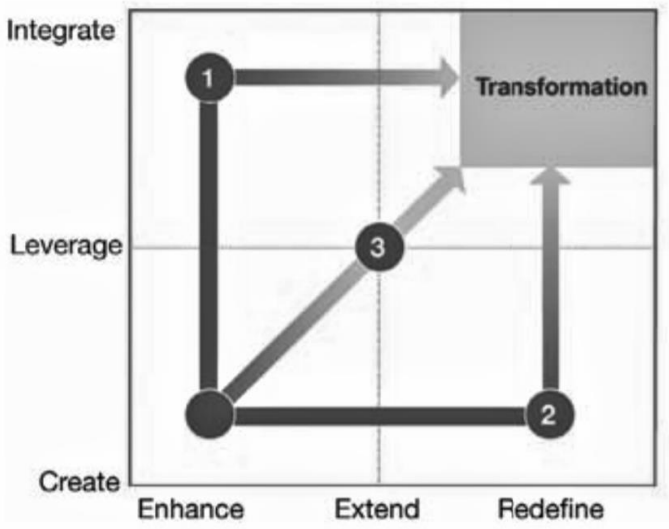


Table 2 : Explore the user value proposition.

2.3 To what extent has digital technology changed the enterprise internal operation platform and core business processes of the enterprise?

Through the combination of digital management technology and enterprise system, improve the overall operation efficiency of interior design enterprises and increase output.In addition, regular evaluation of the digital maturity of interior design enterprises can ensure the sustainable competitiveness of enterprises in the development process, find out the deficiencies reflected in the process of enterprise digital transformation, and can make timely strategic adjustment.

2.3.1 A stable and efficient digital back-office and front-office system are the foundation of a company's digital transformation

A strong digital enterprise requires a strong enough back-office and front-office system to support the operation and innovation of the entire enterprise. Its core business processes and front-office services are supported by a complete and efficient back-office business. For example, user data, enterprise internal data, process operation mode, enterprise management and other core business are stored, transmitted and fed back by the background operating system.As shown in the figure, the ultimate direction of enterprise digital transformation is a complete enterprise digital back-office system to maintain the development of enterprise digital. For interior design companies, perfect back-office sysytem

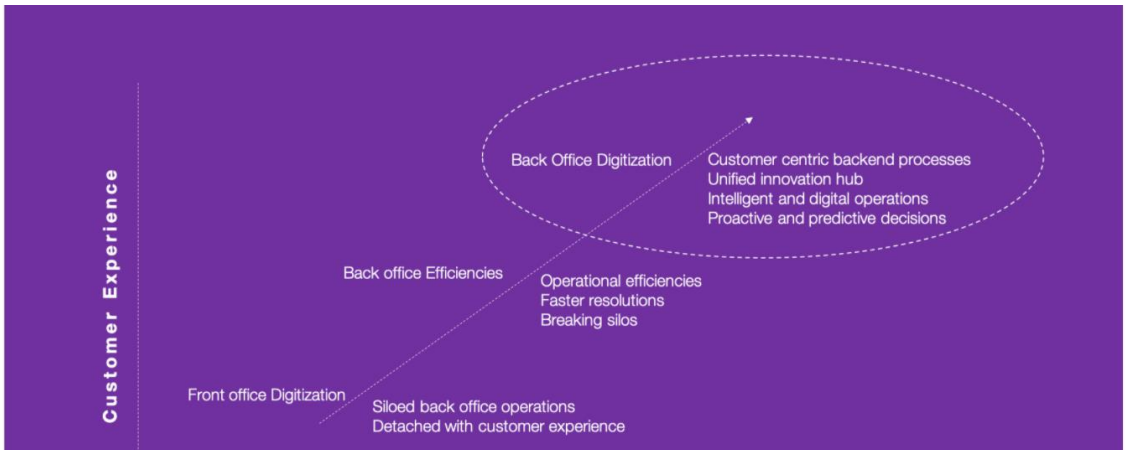


Figure 10 : Digital transformation development line.

means that the company can provide customers with more efficient and high-quality interior design works, as well as consulting, budgeting and after-sales services, and provide data support for the front-office system. Within the enterprise, it means that employees can complete the projects they are responsible for in an organized and hierarchical way with the highest efficiency. Therefore, an excellent and complete back-office digital operating system is the basic element for interior design enterprises to complete digital transformation.

For enterprises, with the help of cloud technology and RPA to establish digital internal channels and establish internal databases, each department enjoys a professional data storage platform and process automation design model. For example, when the sales department needs more product data, they can ask the business department Implementation of obtaining information in internal databases. The system will send notifications to designers in the design department, and assign one or more employees to provide technical support for the sales project. At the user level, there are dedicated databases and RPA models for all user information and design product information. You can access the front-end system to complete the understanding of the company's design product information. For example, when a user visits the design company's portal website, the system will analyze the user's personal information about login and purchase intentions, and provide corresponding AI robot assistance, according to user needs (Such as design style, budget and other factors) assign the corresponding sales staff. This series of system operation modes, front-end operations, designer classification and a series of user-centric behaviors are all due to the powerful digital back-end system.

2.3.2 The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise.

"The enterprise system is a complex computing system that accurately coordinates the internal resources of the enterprise through the processing of large-scale data (Xu & Vrieze, 2016)."

"The enterprise system (ES) combined with the digital platform can produce a disruptive improvement in fundamental efficiency and output (Sedera, Lokuge,

Grover, Sarker, Sarker S, 2016).” Through RPA (Robot Process Automation), big data Analysis, cloud storage and other technologies applied to enterprise operating procedures can strengthen the information storage capacity and operating efficiency of the system, and provide more powerful computing capabilities for complex tasks. At the same time, it can enhance the interaction between companies and customers, provide customers with better corporate services, and increase customer loyalty.

2.3.3 The application of the digital maturity model helps enterprises measure digital transformation.

“Through the analysis of the company's own situation, starting from the two main levels of "leadership and strategy" and "digital realization and adoption" (Armstrong, 2019).” Starting from the internal environment of the enterprise and the application degree of enterprise digital technology, comprehensively analyze the current status of enterprise development, formulate digital strategic solutions, establish enterprise digital awareness, and promote enterprise digital transformation.

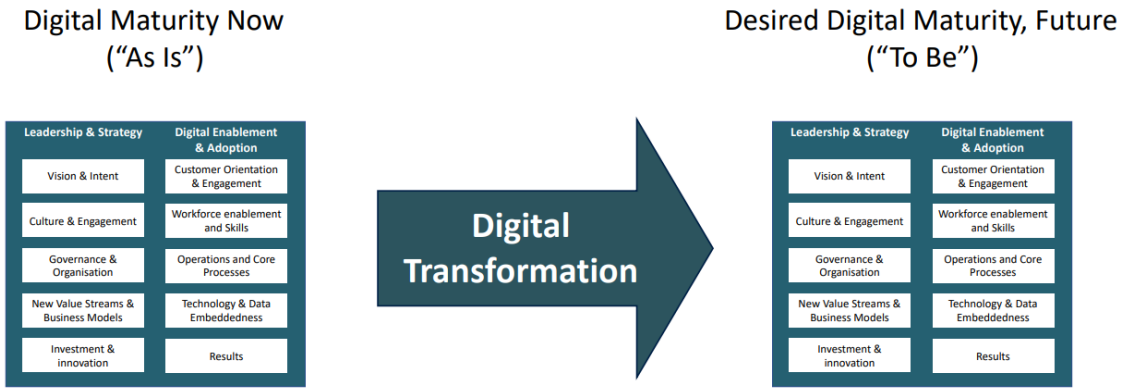


Figure 11 : Digital Maturity and Digital transformation(Sourse from Brain Armstrong 2019).

“Combined with the digital transformation model, the results are based on the analysis of digital maturity. According to the company's own status quo, and for its future development direction, construct a digital goal. With the steps of Framing the digital challenge-Foucusing investment-Mobilizing the organization-Sustaining the digital transition (McAfee, Bonnet & Westerman, 2014),”

gradually complete the digital transformation of the enterprise and enhance the digital maturity of the enterprise.

2.3.4 Hypothesis 1

The application of digital technology can promote the digital transformation of enterprises, improve the internal management model of enterprises, and enhance the development of enterprise core business processes.

2.4 To research how digital technologies have transformed core processes of the interior design Industry .

The application of digital technology improves the efficiency of the design process and reduces design costs. “For example, the popularization of design software such as 3DS MAX and Raino can display graphic design drafts in three-dimensional form in front of designers, eliminating the time for manual model building and possible errors during manual operation (Mortezapour,2014).” On the other hand, it also provides more solutions to the design barriers faced by the interior design industry.

2.4.1 The application of digital technology improves the efficiency of the design process and reduces design costs.

The interior design process is mainly divided into measurement, drawing (Figure 12) and construction steps. In terms of measurement, interior design in the traditional sense requires professionals to go inside the building to measure the dimensions and spatial data. In this process, there are usually centimeter-level errors. “The impact of such errors on the final design is devastating.By using a 3D scanner, indoor data errors are reduced to within microns and measurements are transmitted seamlessly to a computer (Schwab, 2016).” Modeling software (3DS MAX, RAINO, etc), then stretches and models the precise data drawing.On the one hand, this method can greatly reduce the probability of error of

measurement data and reduce the cost of measurement.Secondly, due to the accuracy of the data, in the later construction design scheme, it can also avoid the construction problems caused by inaccurate data and avoid rework.

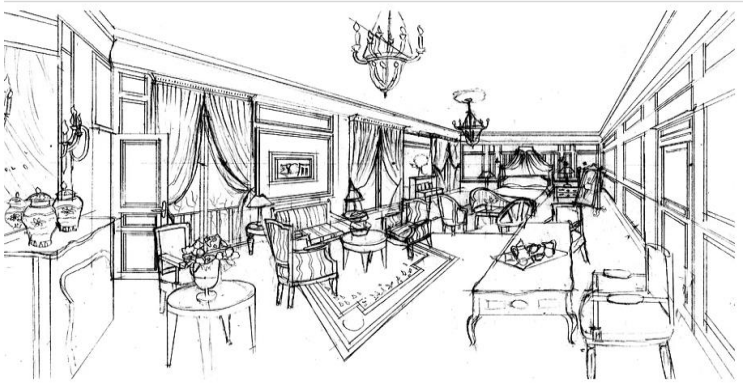


Figure 12 : Traditional interior design hand drawing (Source from Lucina Ortiz, Hotel Le Meurice France Practice Drawing).

Secondly, the cycle of hand drawing and data measurement far exceeds the cycle of 3D modeling. The application of digital technology can accelerate the design process to a large extent, leaving time for construction and final product delivery, greatly improving the efficiency of the entire design process and saving design costs.

2.4.2 The application of digital technology can break through design barriers and expand solutions.

In the initial planning drawing stage, traditional interior design needs to summarize the data measured by professionals, listen to the opinions of customers, and hand draw the design scheme. In this process, the designer needs a lot of time to modify the design drawings repeatedly according to customers' opinions. The main reason is that the hand-drawn renderings cannot fully meet some specific scenes or some special customer needs.However, the application of corresponding digital technology can completely solve this problem. “For example, the application of 3D software mentioned above, as well as CAD and Rhino, can overcome the limitation of hand-drawing and complete the design scheme according to the indoor environment characteristics and customer requirements (Mortezapour, 2014).”



Figure 13 : 3D-Printed shaped chairs(Source 3D printing designer Beatrice Müller).

In the process of scheme design, due to the special or special customization requirements of interior structure, the design drawings often cannot fully meet the special requirements of the scheme. But the advent of 3D printing completely solves this problem. Through three-dimensional modeling of the objects to be printed (special-shaped furniture, special indoor structure, etc), appropriate 3D printing materials are selected, and the printing data is checked before printing (Saad, 2016). The application of this technology extends the formulation of design solutions and construction solutions, and opens up a broader vision for the interior design industry.

2.4.3 The integrated digital platform allows designers to obtain better design resources.

In the design process, designers will face many challenges such as customer needs, technical constraints and insufficient design resources. At this level, it is particularly important to establish a digital platform to integrate the resources of various departments in the enterprise. Designers can adapt to different design requirements, Mobilize limited resources within the enterprise, such as completing difficult modeling with the support of the design technology department. With the support of design resources from other design departments, we can obtain more comprehensive design materials. The sales department and background information support to meet the user's design needs and budget requirements from a deeper perspective. Use multi-departmental resource

integration to improve the efficiency of the design process and the quality of design products.

2.4.4 Hypothesis 2

The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.

2.5 To study the transformation of digital technology into user experience and users' expectations of products and services.

2.5.1 The application of digital technologies provides better performance for interior design products.

Through the use of AR, VR, smart home embedding and other technical methods, we can strengthen users' participation in the design process and final design products from multiple perspectives, and realize the interaction between users and virtual design works through digital technology, so as to achieve higher Service standards.

In the design process, the designer needs to design the indoor environment according to customer needs. However, due to the difference between the design concept and the design concept, in the initial stage of the design plan, whether the designer can fully meet the special needs of the customer, while ensuring the rationality and feasibility of the design. Is the biggest problem. “However, the application of AR (augmented reality) and VR (virtual reality) technologies can present design works to customers in a more vivid and three-dimensional form (Chang, Hu, Chiang and Lugmayr, 2019).” By transferring the virtual models to mobile devices, customers can observe the design work in 360 degrees and adjust the furniture and layout at will. In addition to involving customers in design work, this is also a real-time direct interaction between customers and design work (Mortezapour, 2014).



Figure 14 : Application of AR and VR technology in interior design.

“From the perspective of satisfying customer participation, customers can design works according to their own wishes on the online platform, and use the design works to explain their needs to the designer from a relatively professional perspective (Mortezapour, 2014),” so that the design plan can be expanded effectiveness. Kujiale is an open design platform. On the platform, customers can enter their own house data, and the system will automatically generate the required house layout. After that, customers can control the style of interior decoration, decoration materials, furniture, etc. The high degree of freedom of the operating environment allows customers to express their design intent and requirements more specifically. However, due to the limitation of rationality and enforceability, the client still needs to negotiate with the designer to ensure the rationality of the final design plan and construction. But this greatly improves the user experience, and improves the efficiency of product design, and improves the user experience through digital tools.



Figure 15: Open smart interior design platform (from Kujile design platform).

2.5.2 The embedding of digital platform can better meet customers' expectations and satisfaction of products.

After logging in to the portal of the interior design company, the platform will record the user’s basic information and push a series of interior design styles to the user for selection. At this time, the salesperson will detect the user’s login information and platform data through the background and assign it Online sales staff provide customers with a series of auxiliary services. For example, product features, budgets and designer recommendations to help customers understand their needs, expectations and corresponding budgets more deeply. After completing the sales introduction and recommendation, the system will assign or select the corresponding designer team to discuss the customer's design style, concept and other requirements. In order to meet their needs and expectations for design works from a more professional perspective.

After users and designers complete the interior design plan, they will enter the construction phase. The entire design team and construction team will regularly provide feedback to customers, and timely supplement and modify the design plan and construction plan according to customer requirements. At the end of the construction process, there will be a one-year after-sales feedback, during which the follow-up situation of the construction will be reviewed Carry out continuous monitoring and investigation to ensure the reliability of the design plan and construction plan. At the same time, customers can also feedback the construction effect through online platforms or offline channels, and the system will also assign corresponding logistics personnel to provide timely assistance.

2.5.3 Hypothesis 3

Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services.

2.6 Conclusion of Literature Review

Introduce the concept of digital technology and digital management into the business operation process, start with the internal management model and digital construction of the enterprise, and promote the digital transformation of the enterprise. Through the application of digital technology and the embedding of digital concepts, the comprehensive strength of the enterprise is continuously improved. In addition, in the digitization of the core design process, digital technology should be used to improve the efficiency of different design stages. Provide customers with design products and services in digital form, focusing on the construction of user experience and the development of digital products.

2.6.1 Hypothesis 1

Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design enterprises' core business processes.

2.6.2 Hypothesis 2

The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.

2.6.3 Hypothesis 3

Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services .

Table 3. Consistency table

RQ #	State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis
1	To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?	1	Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design enterprises' core business processes.
1.1	How does the back-office and front-office system maintain the development of the enterprise and the operation of core business processes?	1.1	A stable and efficient digital back-office and front-office system are the foundation of a company's digital transformation
1.2	What role does the application of enterprise system and digital platform play in enterprise development ?	1.2	The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise .
1.3	What is the impact of digital maturity in the enterprise digitization process ?	1.3	The application of the digital maturity model helps enterprises complete digital transformation.
2	In what aspects has digital technology changed the core service offering of the interior design industry?	2	The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.
2.1	In what way has the application of digital technology changed the core design process ?	2.1	The application of digital technology increases the efficiency of the design process and reduces the cost.

RQ #	State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis
2.2	What problems does the application of digital technology solve for the design process?	2.2	The application of digital technology can break through design barriers and expand solutions.
2.3	What advantages does the application of digital platform bring to the design process?	2.3	The integrated digital platform allows designers to obtain better design resources.
3	How does digital technology, as applied with regard to (1) and (2) above, improve user experience ?	3	Digital technology enhances and improves the performance and quality of interior design products.Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services .
3.1	How does digital technology affect product performance?	3.1	The apply of digital technologies provides better performance for interior design products.
3.2	What is the impact of digital technologies used in interior design products and processes on users?	3.2	The embedding of digital platform can better meet customers' expectations and satisfaction of products.

Table 3 : Consistency table.

2.7 ANALYTICAL FRAMEWORK

2.7.1 *Theoretical Framework*

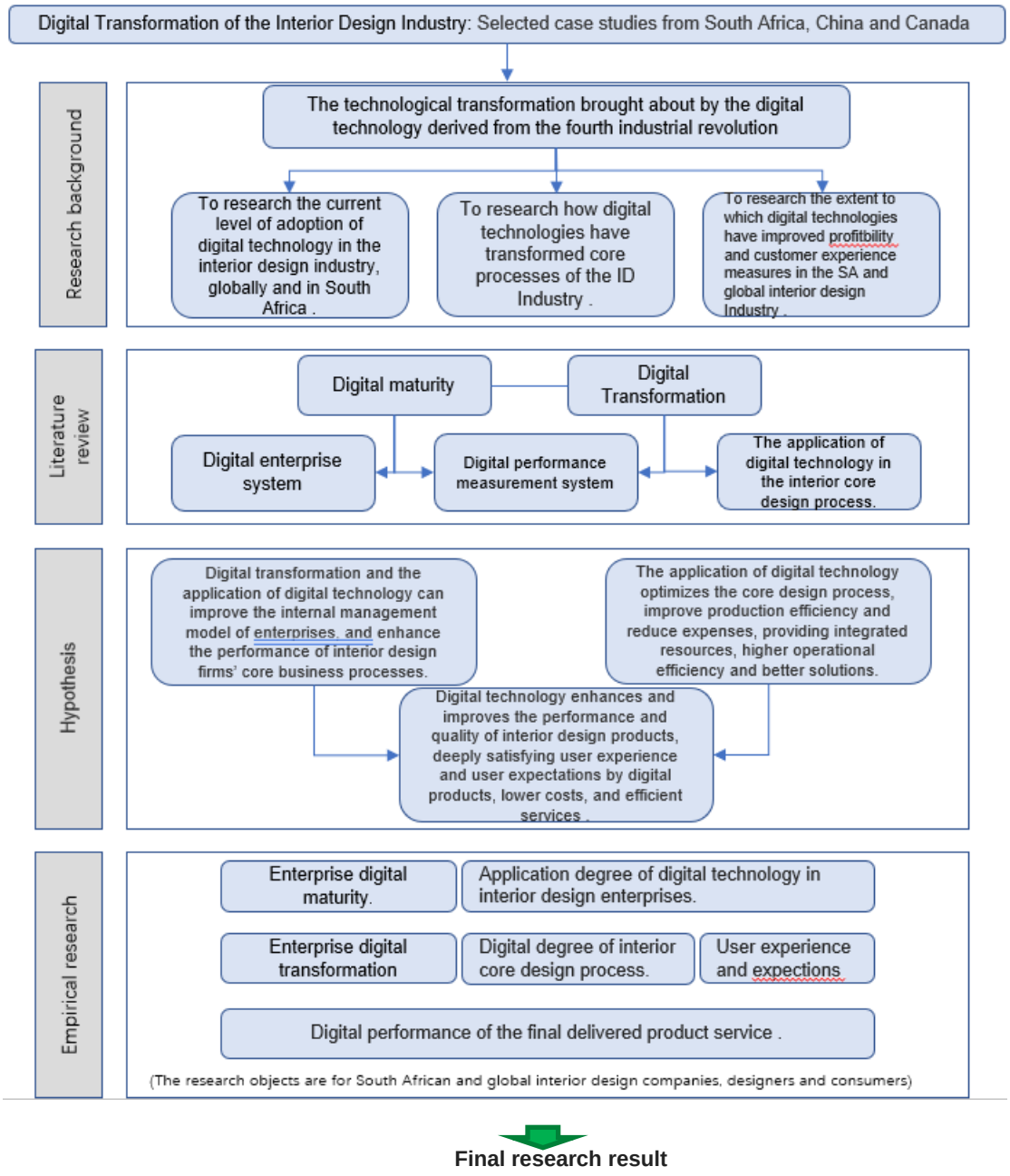


Table 4: Theoretical Framework

The core direction of this research is "digital transformation of the interior design industry". The research background is derived from the development of digital technology in the industry brought about by the fourth industrial revolution. In terms of research background, the company's digital maturity and the company's

digital system development have brought innovative development models to the interior design industry. In the process of digital technology application, study the impact on the design process, user experience and final product delivery (Table 5). In the literature review stage, the digital maturity theory and the digital level of enterprise systems are used to study the digital maturity of interior design companies and the application level of digital technology. The research focuses on the South African interior design industry as well as the digital maturity and digital transformation models on a global scale. The research objects are based on South African and global interior design companies, professional designers, and consumer groups who have consumed or experienced interior design products and services. Finally, through the feedback they brought, the final research conclusion was put forward.

2.7.2 Conceptual Framework

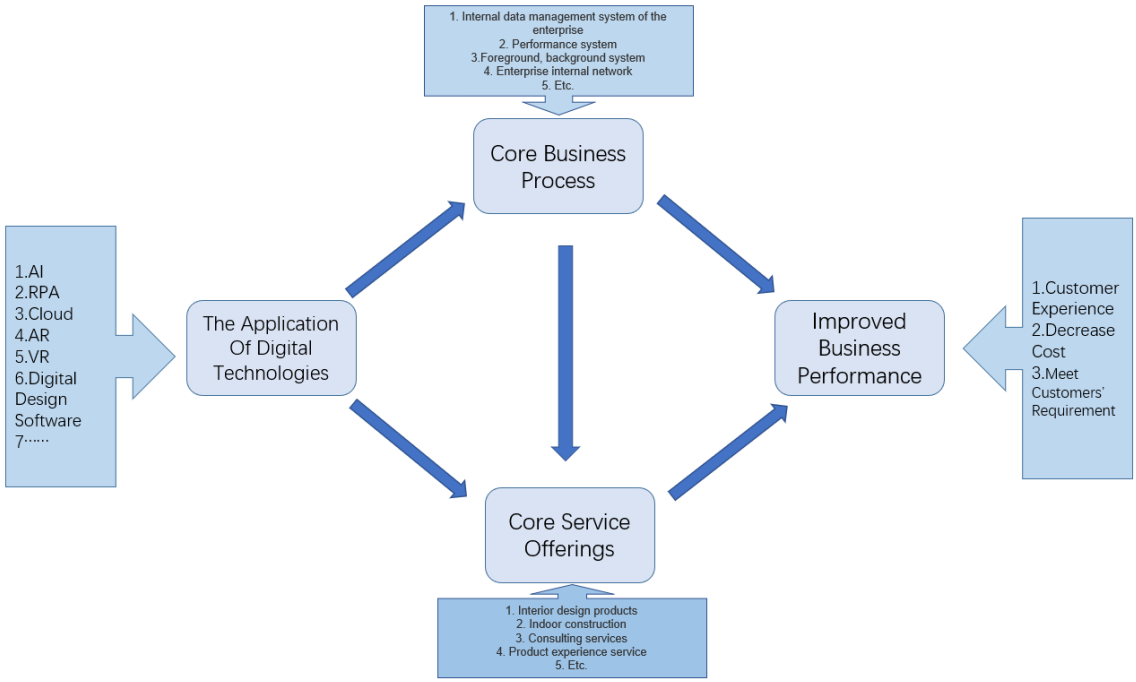


Table 5: Conceptual Framework.

To research the application and influence of digital technology in the operation process of interior design companies, in the core business process and core Service Offerings of the company. Through the digital transformation of core

business processes and core Service Offerings, it promotes business performance .

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research approach

“According to this report's topic and background, qualitative research methods are used in research and analysis. The primary purpose of qualitative research is to describe and explain the things, events, and phenomena to be remembered and better understand the researched issues' research methods through these research objects (Silverman, 2016).” The research direction is mainly aimed at interior design companies, interior designers, consumer groups of interior design products, and the scope and influence of digital technology. “According to the particularity of the research goal, the primary analysis method used is an induction to understand the first-hand data of the research goal, analyze the meaning and behavior of the feedback from the research sample's feedback, and establish a hypothesis—this foundation and theory (Chen, 1996).” By understanding the sample data of interior designers in SA and other countries and regions, we can use the data generated from interviews and surveys with interior designers in the company, interviews and questionnaires with interior designers in South Africa and other countries and regions the audience of users and the data provided by authoritative literature are summarized and summarized, and finally the research conclusions are drawn.

3.2 Research design

According to the research topics, starting with "digital transformation", and taking the application of digital technology and the maturity of enterprise digitalization as the main observation points for research and design, many survey projects will become reality during the design process. “At the same time, each process will affect the operation of other processes (Maxwell, 2012).” Therefore, the research direction has expanded from digital transformation to digital maturity. Organizational research starts from the designer, goes to the design process, then to the company’s employees (designers), and finally reaches the product, and finally reaches the audience for consumer research. The entire research

process is gradually carried out in layers, so that the research results are more persuasive.

The first part is feedback and document support from designers from different countries, showing the development of various interior design industries in different countries, analyzing the digital differences in interior design between South Africa, China, and Canada, and the digital technology application scale. The application level of digital technology, the degree of enterprise digitalization, the core design process, and other factors analyze the future development direction of the three countries' interior design industry. The second part uses a questionnaire survey to sample consumer groups of interior design products and services in three different countries to exploring consumer groups' intuitive feelings, opinions and suggestions on the application of digital technology, from the perspective of consumers, analyze the changes brought by the application of digital technology to the entire industry. Determine what positive or negative effects the emergence and application of digital technologies have brought to consumers. There's 30 questionnatires in each country. To analyze how to improve product performance and service quality, and meet customer requirements, sort out and analyze based on feedback, and propose corresponding analysis reports and solutions.

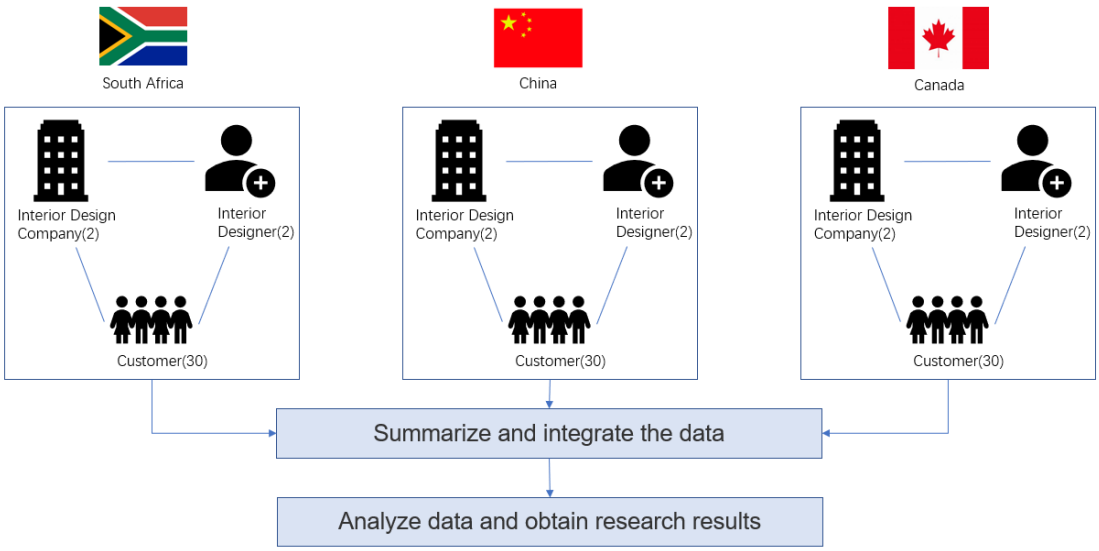


Table 6: Research Design Framework.

3.3 Data collection methods

This research mainly consists of three research objectives. These three research goals point to three different directions of research topics.

1. To research the current level of adoption of digital technology in the interior design industry, globally and in South Africa .

To research the application scope and application mode of digital technology in the internal operation management of selected interior design companies in South Africa and around the world. And how digital technology drives the core business processes of the company.

2. To research how digital technologies have transformed core processes of the Interior Design Industry .

The application and application mode of digital technology in interior design process are understood through face-to-face interview of designers in selected interior design companies. And compared with the traditional interior design mode, digital technology for the design process of the impact.

3.To research the extent to which digital technologies have improved profitbility and customer experience measures in the SA and goobal interior design Industry.

The research object of this target is mainly aimed at the users of interior design, that is, consumers in South Africa and other countries. The main way is to analysis the impact of the apply of digital technologies in interior design on consumers and the later experience through interviews and questionnaires. To analysis the impacts on digital technology on delivered product performance and user experience.

3.4 Population and sample

3.4.1 Population

The research population for Objective 1-2 is interior designers from South Africa, China, and Canada. From a professional perspective, this paper makes professional comments and discussions on interior design enterprises, internal environment of enterprises, design process, application of digital technology and other aspects. The population selected in objective 3 is the target audience of interior design products in South Africa, China and Canada. And conduct comprehensive feedback for the different experiences generated by themselves.

3.4.2 Sample and sampling method

In this project, the form of interview will be adopted for Objective 1-2, and targeted designers working in South Africa, China and Canada interior design companies will be selected.From a more professional and authoritative perspective, they can provide professional answers to the questions in the professional field involved in this subject.In order to ensure the authoritativeness of this academic topic, detailed discussions and feedbacks are generated from the internal issues of the enterprise, design process, application of digital technology and other aspects.For target 3, research was conducted on the audience of interior design products in South Africa, China and Canada. First of all, through the form of interview, interview sampling survey of the selected population as a sample.Secondly, through questionnaire survey, a batch questionnaire survey was conducted on the target population and the survey feedback was collated to form professional data to support the theory proposed in this paper. The investigation focuses on the influence of digital technology in interior design product delivery and on product itself from the perspective of user experience.

3.5 The research instrument

This research mainly adopts qualitative research methods to illustrate the innovation and challenges that digital technology brings to the application

process of the interior design industry, as well as the impact on the development of interior design enterprises, interior design process, user experience and other products. The first part addresses question 1, "To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?" Use face-to-face interviews or telephone interviews to investigate designers of interior design companies. For the first question, the questions designed in the interview include:

-What digital technologies are used in the process of digital transformation and in the construction of back-office and front-office system?

-And how does it affect the performance of the back-office and front-office system?

-What digital technologies have been applied to the core business processes of the enterprise?

-And what changes have been made to the core business processes of the enterprise?

During the operation of the enterprise, the application and development of digital technology play a vital role in the digital transformation of the enterprise. In which fields are digital technology applied, the advantages and disadvantages of digital technology application, etc. Finally, from the interview Classify and summarize the information obtained, learn and discuss the impact of integrated digital technology on the enterprise.

For question 2, the factors involved in "In what aspects has digital technology changed the core service offering of the interior design industry?" are:

-What digital technologies are used in the interior design core process?

-How do these digital technologies affect the core design process?

The core goal of this part of the survey is to study the impact of digital technology on the design process from the designer's professional perspective. The survey is mainly conducted through interviews and telephone interviews, focusing on the

application, impact, efficiency and cost of digital technology in the interior design process.

Regarding question 3 "How does digital technology, as applied with regard to (1) and (2) above, improve user experience?", the elements involved are

-How has the application of digital technology changed the design of products and services?

-How dose the application of digital technology on design product and service improve the business profitability?

-Do digital interior design products satisfy users' demands for products and services from a deeper level?

From the perspective of consumer experience, this article studies and explores how the application of digital technology in interior design and production can bring about changes in consumer experience. Through interviews, telephone interviews and questionnaire surveys, to understand the use of interior design users on product design and work experience, the application of digital technology to their families, why choose a design company to complete the interior design, instead of choosing your own design, the application of digital technology Compared with traditional interior design, what are the advantages and disadvantages.

3.6 Procedure for data collection

In the first part of the survey, it will be conducted in the design department of the selected interior design company and collect data on designers in the design department in the form of interviews or videophone interviews. During the thesis design stage, we had effective discussions with several representative and authoritative interior designers from South Africa, China and Canada. Discussed research methods and methods with the designer, and repeatedly confirmed the theories, hypotheses and research goals involved in the research and design to ensure that in the second part, the group involved in this part is mainly the users of interior design. Through the interviewed designer’s customer network and the

designer’s ongoing projects, select customers for personal visits, email visits, online visits and other methods to obtain user feedback. On the other hand, a corresponding number of questionnaires will be prepared and distributed to users. Users who have passed interior design related services, and then extract feedback information from them for classification and comprehensive comparison.

3.7 Data analysis and interpretation

Two methods were mainly used in this study:

1. Taking the degree of digital transformation, the application of digital technology, and digital strategy implementation as independent variables. The future development status and direction of enterprises and industries and the impact on consumer groups are used as dependent variables to judge the necessity of digital transformation of the interior design industry.

2.Construct validity: Through the establishment of a data analysis framework for the collected data, the data can be standardized and standardized analysis.The data indicators to be evaluated in this paper are as follows.

1. The influence of the apply of digital technologies on operation and development of interior design enterprises (cost, efficiency, risk, etc).

2. The impacts on the application of digital technology on interior design enterprises (efficiency, quality, etc).

3. The impacts on digital technologies on design process (efficiency, quality, cost, etc).

4. The impacts on digital technologies on interior design process (efficiency, quality, cost, etc).

5. Changes in interior design products caused by the application of digital technology (quality, cost, efficiency, etc).

6. Impact of digital interior design products on consumers (user experience, cost, etc).

In the research process, the questions raised in the questionnaire survey for the consumer group are measured according to the following standards.

- Users' trust and support for digital interior design products.

- Users' feelings on the performance of the designed products in the digital community.

- The impact of digital interior design products and services on user needs.

- Whether the digital community design products have economic advantages over the traditional design model.

- Whether users have long-term demand for interior design products.

3.8 Limitations of the study

In this report , the core target of the selected case is the interior design industry, and the main application of digital technologies in the interior design industry, its limitation is that the research results discussed can represent the interior design industry. In addition , due to different degree of digital infrastructure construction of different countries, or different interior design enterprises will apply different digital technologies, the comprehensive comparison of research results will show certain differences. And the interior design industry will also be affected by cultural, geographical and other factors, there is no guarantee that the feedback data from different countries will be highly matched.

3.9 Transferability and dependability

3.9.1 Transferability

The subject of this paper is "Digital Transformation of the Interior Design Industry: A comparison of South African and Global Case Studies", and three representative countries, South Africa, China and Jin Ah Da University, are selected in this study. The three countries have different geographical environment, different culture, different degree of digital infrastructure and so on factors, so when the results of the study in the process of adoption, adopters can according to the status quo and characteristics of their own country, and in the results of different samples, in order to obtain and research the most relevant data.

3.9.2 Credibility

In this study, the samples selected during the interview are the core part of the interior design industry, designers.As a service industry, the quality of the design work provided and the relevant user experience are the core elements for the development of the industry. However, designers officially guarantee the development of these core elements.The designers selected in the interview all work in representative interior design companies in different countries and have more than four years of working experience.Because of the different countries and background elements, the feedback provided is diversified, representative and professional. In the questionnaire survey, the main people who fill in the questionnaire are those who have purchased interior design services and are capable of providing relevant service experience, product use feedback and other data, which are targeted and representative.

3.9.3 Dependability

All interviewees are designers with many years of professional experience. They have absolute experience in the process of design and corporate effectiveness. Can skillfully use and operate the internal digital system and digital tools in the

design process. The samples are all engaged in professional work in professional fields, and the research results are representative and reliable. On the other hand, in the questionnaire survey, the respondents have purchased or experienced consumer groups of interior design products and services. In this case, the sample itself has experienced interior design services and products of different companies, and the feedback provided is based on interior design in the context of products and services, and the purpose and direction of the research are pertinent.

3.10 Demographic profile of respondents

There are two ways to obtain special data: interview method and questionnaire survey method. In the interview, an interior designer with many years of work experience in South Africa, Canada and China was selected. Through the interview, the designer is in different countries and to different degrees. Analyze the background of the digital infrastructure, different environmental backgrounds and other factors, and conduct professional exchanges and discussions based on your own work status and the actual indoor industrial environment. Since the scope of this article is global, the three countries selected in this article all represent three different levels of digital infrastructure. The advantages and disadvantages of the South African interior design industry compared with the international environment can be clearly compared. Finally, the data is summarized, sorted and comprehensively analyzed to prove its status and function. The impact of digital technology on the interior design industry. Comprehensive discussion, the working mode and role of digital technology in the interior design industry.

In the questionnaire survey, the selected respondents were also distributed in South Africa, Canada and the United States. By comparing differentiated data, it analyzes the feedback factors of different countries, environments, digital infrastructure and consumers on interior design products and services, and how digital technology drives the effectiveness of interior design products and user experience analysis and integration data according to the situation. Draw conclusions and analyze the advantages and disadvantages.

3.11 Ethical considerations

This research requires information about the degree of digitalization of interior design companies, as well as interior designers' work experience, personal opinions and professional information. It does not involve the company's core confidential data. The company data used is taken from the company's official website or published company reports. The data risk index generated in the research is low-risk. During the interview and questionnaire survey phase, respondents can voluntarily participate and can withdraw from the research project at any time. In addition, the respondent has the right to check the progress of the research process and data adoption process. When the research is released, the personal information of the respondents and questionnaire participants will be protected. Without the permission of the respondents, no background and work information about the respondents will be published. All respondents and participants in the questionnaire have the right to understand the entire search process and participate voluntarily, and have the right to withdraw from the survey at any time. Throughout the research process and analysis process, the data used will maintain the highest authenticity.

Chapter 4 . PRESENTATION OF FINDINGS

4.1 Introduction

The research content of this paper is to study the digital transformation in the interior design industry. The countries covered in the study are South Africa, China and Canada. This study used interviews and questionnaires to collect data. Two interior designers with more than three years of work experience were selected for interviews in each country. Secondly, 30 questionnaire surveys were put into each country, combined with the theoretical support provided in the literature review, to discuss and answer the following three research hypotheses:

1.Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.

2.The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency, and better solutions.

3.Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services.

The questionnaire survey covers a total of fourteen core questions. During the interview, many related questions were discussed on the core questions to discover and verify the degree of match between the actual situation and the hypothesis. In addition, ten core questions were set up in the questionnaire to discover and verify the hypotheses involved. This chapter mainly explains how interview and questionnaire questions verify the hypotheses put forward, as well as the reasons and methods for verifying the hypotheses put forward by each core question.

4.2. Finding pertaining Hypothesis 1

Hypothesis 1 - Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.

RQ #	State Research Question	Hyp #	Hypothesis	Data collection detail
1	To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?	1	Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.	Interview questions 1 to 8 .
1.1	How does the back-end system maintain the development of the enterprise and the operation of core business processes?	1.1	A stable and efficient digital back-end system is the foundation of a company's digital transformation .	Interview questions 1 to 4 .
1.2	What role does the application of enterprise system and digital platform play in enterprise development ?	1.2	The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise .	Interview questions 5 to 6
1.3	What is the impact of digital maturity in the enterprise digitization process ?	1.3	The application of the digital maturity model helps enterprises	Interview questions 7 to 8

			complete digital transformation.	

Table 7: Interview schedule for hypothesis 1.

During the interview, a total of fourteen core questions and derivative questions generated from the core questions were set up. Interview questions 1-9 are used to discover and verify hypothesis 1. According to hypothesis 1, three subsets are set up, and the conclusions are discovered and proved through different interview feedback.

4.2.1 Hypothesis 1 part one

A stable and efficient digital back-end system is the foundation of a company's digital transformation .

Interview questions

1. Do you think that the interior design industry you work in is a highly digital industry?
- Summarize the status of the background system and the foreground operating system.
-The impact on the company's digitalization.

2. What digital changes do you think have taken place in this industry since you first entered it? And in your firm?

- Regarding the upgrade of the back-end system, front-end system and related digital technology.

-The impact of technological changes on the company and industry

3. Can you talk about the advantages and disadvantages of the management mode of digital platform in your industry? And in your firm?
-Changes brought about by company development and digital transformation (positive/negative aspects)

-How has the company's operating model and core business processes changed?

4. Has your company gone through a digital transformation? If not, has your company made any digital upgrades?

-Digital transformation brings about changes in the company's development direction.

-Is the transformation necessary?

The questions raised in the interview are based on digital transformation and the application of digital technology. The feedback data obtained from the interview can reflect the impact of digital transformation and digital technology application on the interior design industry, company, design process, etc. influences. In order to judge whether the feedback obtained can prove the hypothesis proposed. Three color modules will be used to represent the extent to which the feedback obtained from the interview question can support the corresponding hypothesis.



Country	Interior Designer #	Answer(recapitulative)	The degree to which hypotheses are validated
South Africa	1	Q1:Yes, Highly digitalized office processes and product forms. Q2: Listed multiple digital changes. Q3: Digital tools are needed to improve product performance, but at the same time, the ability to draw is also indispensable. Q4:Yes, digital transformation.	
South Africa	2	Q1: The design process is completely digital. Q2: Listed multiple digital changes.	

		Q3: Digital technology has a greater performance improvement than hand-painting. Q4:Yes(Since 2010) , digital transformation.	
China	1	Q1:Yes Q2: Performance improvement of design tools. Q3: Digital technology has a greater performance improvement than hand-painting. Q4:Yes ,digital transformation.	
China	2	Q1: Yes Q2: Budget system and internal system improvement. Q3: Digital technology has a greater performance improvement than hand-painting. Q4: Yes, digital transformation.	
Canada	1	Q1: Yes Q2: Listed multiple digital changes. Q3: The two have different applications in different design scenarios. Q4: Yes, digital transformation.	
Canada	2	Q1:Yes Q2: Listed multiple digital changes. Q3: Digital technology has a greater performance improvement than hand-painting. Q4:Yes, digital transformation.	

Table 8: Interview feedback of hypothesis 1 part one.

4.2.2 Hypothesis 1 part two

The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise .

Interview Questions

5. During the company's application of digital technology, which business processes have changed? How did they change?

-Technology upgrade.

-Integration of digital platforms.

6. Does your company regularly check the digital status of its operations? (or digital level)?

-Ensure the stability of the platform and the internal environment.

-Evaluate and upgrade the performance of digital technology.

Country	Interior Designer #	Answer(recapitulative)	The degree to which hypotheses are validated
South Africa	1	Q5: Lists the business process and the way of transformation Q6: yes	

South Africa	2	Q5: Lists the business process and the way of transformation Q6: Once a year.	
China	1	Q5: Lists the business process and the way of transformation Q6: There is no clear timeline, but it will be upgraded.	
China	2	Q5: Lists the business process and the way of transformation Q6: Once a year.	
Canada	1	Q5: Lists the business process and the way of transformation Q6: Every three months.	
Canada	2	Q5: Lists the business process and the way of transformation Q6: There is no clear timeline, but it will be upgraded.	

Table 9: Interview feedback of hypothesis 1 part two.

4.2.3 Hypothesis 1 part three

The application of the digital maturity model helps enterprises complete digital transformation.

Interview Questions

7. If yes, please describe at what level the enterprise has gone digital/if not, do you think it is necessary for the enterprise to go digital transformation? And Why?

8. What do you think needs to be transformed digitally in your organization?

Country	Interior Designer #	Answer(recapitulative)	The degree to which hypotheses are validated
South Africa	1	Q7: Yes and necessary. Q8: Listed several projects that require digital transformation.	
South Africa	2	Q7: Yes and necessary. Q8: Listed several projects that require digital transformation.	
China	1	Q7: Yes and necessary. Q8: Listed several projects that require digital transformation.	
China	2	Q7: Yes and necessary. Q8: Listed several projects that require digital transformation.	
Canada	1	Q7: Yes and necessary. Q8:Communication method with clients.	
Canada	2	Q7: Yes and necessary. Q8: Material allocating system.	

Table 10:Interview feedback of hypothesis 1 part three.

4.3. Finding pertaining to Hypothesis 2

Hypothesis 2 - The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.

RQ #	State Research Question	Hyp #	Hypothesis	Data collection detail
2	In what aspects has digital technology changed the core service offering of the interior design industry?	2	The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.	Interview questions 9 to 14 .
2.1	How has digital technology changed the performance core service offering in the interior design industry?	2.1	The application of digital technology increases the efficiency of the design process and reduces the cost.	Interview questions 9 to 12 .
2.2	What problems does the application of digital technology solve for the design process?	2.2	The application of digital technology can break through design barriers and expand solutions.	Interview questions 13 to 14 .

2.3	What advantages does the application of digital platform bring to the design process?	2.3	The integrated digital platform allows designers to obtain better design resources.	Interview questions 13 to 14 .

Table 11: Interview schedule for hypothesis 2.

Questions 10-14 set in the questionnaire survey are used to discover and prove hypothesis 2. According to hypothesis 2, three subsets are set up, and the conclusions are discovered and proved through different interview feedback.

4.3.1 Hypothesis 2 part one

The application of digital technology increases the efficiency of the design process and reduces the cost.

Interview Questions

9. How do you think the application of digital technology change the core service offering?

-Changes in interior design products.

-Impact on users.

10. What digital technologies (software, hardware) do you use in your interior design process?

-List and describe its general functions.

11. During the design process, do you prefer to use traditional design method or digital design method?

-Why is that?

12. Do you think the application of digital technology has improved the design process?

-In what ways?

Country	Interior Designer #	Answer(recapitulative)	The degree to which hypotheses are validated
South Africa	1	Q9: Enrich product functions and enhance user experience. Q10: Giving examples of several digital software and hardware currently in using. Q11: Both,depends on different projects. Q12: More efficient, but interior design is a combination of science and art, and designers need to have the ability to hand-paint.	
South Africa	2	Q9: Improve the accuracy of the program, and make it easier for users to understand the program(VR,AR). Q10: Giving examples of several digital software and hardware currently in using. Q11: Both,depends on different projects. Q12: Yes.More accurate and easier to adjust.	
China	1	Q9:Better performance and more realistic user experience(VR). Q10: Giving examples of several digital software and hardware currently in using. Q11: More often on digital methods. Because of its more complete functions and better performance. Q12: Yes. Improve the efficiency of the design process and save expenses.	
China	2	Q9: Product Features. Q10: Giving examples of several digital software and hardware currently in using.	

		Q11: More often on digital methods. More functions can also provide users with more choices. Q12: Yes.Injects more possibilities into the design.	
Canada	1	Q9: Digital technology helps our insdusty to provide drawings in a highly-efficient way, getting rid of the handdrawings which is less accurate and time-consuming. Q10: Giving examples of several digital software and hardware currently in using. Q11: More often on digital methods. Designers could finish their work without many limitations. Q12: Yes. It imporved the process of providing a drawing,	
Canada	2	Q9: it can improve efficiency, manage different businesses and projects easily, and then improve the core competitiveness of the enterprise. Q10: Giving examples of several digital software and hardware currently in using. Q11: More often on digital methods. it is easier, faster and more accurate than traditional methods. Q2:Yes, the design process that has greatly reduced the time to revise the drawings and the time of coordination with clients, trades and construction.	

Table 12:Interview feedback of hypothesis 2 part one.

4.3.2 Hypothesis 2 part two & three

The application of digital technology can break through design barriers and expand solutions.

The integrated digital platform allows designers to obtain better design resources.

Interview Questions

13. Do you think digital technology can break through current design barriers and expand solutions?

-Performance improvement examples.

14. Can you talk about the advantages and disadvantages of digital technology compared with traditional interior design?

Country	Interior Designer #	Answer(recapitulative)	The degree to which hypotheses are validated
South Africa	1	Q13: The application of new technology can provide more functions for the program, but still needs the blessing of hand-painted technology, because the program is artistic. Q14: Digital technology can provide better product performance, but hand-painting is still an indispensable technology.	
South Africa	2	Q13: Digital means has its advantages (efficiency, function). But hand-painting is convenient for us to record ideas anytime and anywhere. Q14: Digital technology is more time-sensitive, and users need to see more modern products.	
China	1	Q13: Digital technology has more advanced functions, such as a more complete design system and more user-friendly functions. Q14: More complete functions and richer user experience plan.	
China	2	Q13: The existence of digital design mode is based on the traditional hand-drawn mode of resumes. Even if digital technology provides more design features, hand-drawn cannot be completely abandoned. Q14: Digital technology can greatly shorten the design cycle and make it easier.	

Canada	1	Q13: Digital technology does provide more solutions for design schemes, but only with hand-painted technology and perfect design concepts can we better use the convenience brought by technology. Q14: Digital technology is more convenient, but it also relies on hardware. Some special occasions need to be hand-drawn to record the plan in time (meeting with customers, etc.).	
Canada	2	Q13: Yes, Compared with traditional hand-painting, digital technology breaks the limitations of the original technology and completes the product presentation methods (AR, VR) that hand-painted cannot do. Q14: Its higher efficiency, higher product quality, and richer user experience cannot be achieved by traditional hand-painting.	

Table 13: Interview feedback of hypothesis 2 part two & three.

4.4. Finding pertaining to Hypothesis 3

Hypothesis 3 - Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services of interior design firms' core business processes.

RQ #	State Research Question	Hyp #	Hypothesis	Data collection detail
3	How does digital technology, as applied with regard to (1) and (2) above, improve user experience ?	3	Digital technology enhances and improves the performance and quality of interior design products. Deeply	Questionnaire questions 1 to 10.

			satisfying user experience and user expectations by digital products, lower costs, and efficient services .of interior design firms' core business processes.	
3.1	How does digital technology affect product performance?	3.1	The application of digital technologies provides better performance for interior design products.	Questionnaire questions 1 to 5.
3.2	What is the impact of digital technologies used in interior design products and processes on users?	3.2	The embedding of digital platform can better meet customers' expectations and satisfaction of products.	Questionnaire questions 6 to 10

Table 141:Questionnaire schedule for hypothesis 3.

For Hypothesis 3, a total of ten questionnaire questions were set up to discover and prove the hypothesis. Hypothesis 3 is proposed and requires data support from consumer groups. By obtaining consumers' intuitive experience of digital interior design services and products, we can analyze the impact of digital technology application and digital transformation in the industry on consumer experience. In South Africa, China and Canada, 30 questionnaire surveys were launched in each country. Hypothesis 3 also has two sub-hypotheses. Questionnaire survey questions 1-5 are derived from sub-hypotheses 1. Questionnaire survey questions 6-10 are derived from sub-hypotheses 2. General findings and survey results will be presented in sections 4.4.1 and 4.4.2, and specific conclusions will be in the fifth Chapter for detailed discussion.

In the following table, question sections 1-5 are the five options of question 1-5 of each questionnaire, and the options 1-5 of all questions are the same

option,except question 7 has three specific options. The percentage data that follows is the total number of survey users who choose this option.

In addition, in the "The degree to which hypotheses are validated" section, if the sum of the average values of 1-2 feedback from the question is the highest, it is determined that the question can prove the hypothesis. If the average value of question feedback 3 is the highest, it is judged that the question cannot fully prove the hypothesis, and there are certain differences. If the sum of the average values of 3-4 feedback from the question is the highest, it is judged that the question cannot prove the hypothesis. Finally, according to the question whether the hypothesis can be determined, the results are comprehensively analyzed and the average value is taken to find and judge whether the hypothesis is true.

The hypothesis can be fully proved.

The hypothesis cannot be fully proved.

The hypothesis cannot be proved at all.

4.4.1 Hypothesis 3 part one

The application of digital technologies provides better performance for interior design products.

Questionnaire Questions

1. You prefer design firms to use digital technology to design the interiors of your house/apartment rather than traditional interior design models.

2. You think the interior design company's design plan is better than your own idea

3. The application of digital technology brings better performance to interior design products

4. The application of digital technology in interior design has brought more advantages than disadvantages

5. Digital interior design products and services can better meet your needs and expectations.

Questionnaire options

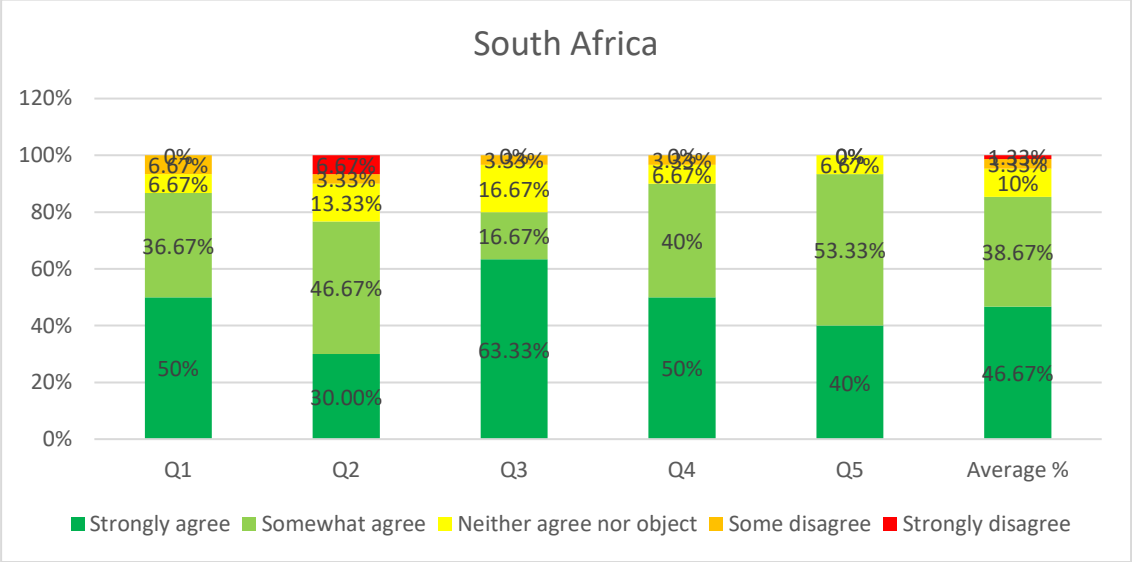
1. Strongly agree

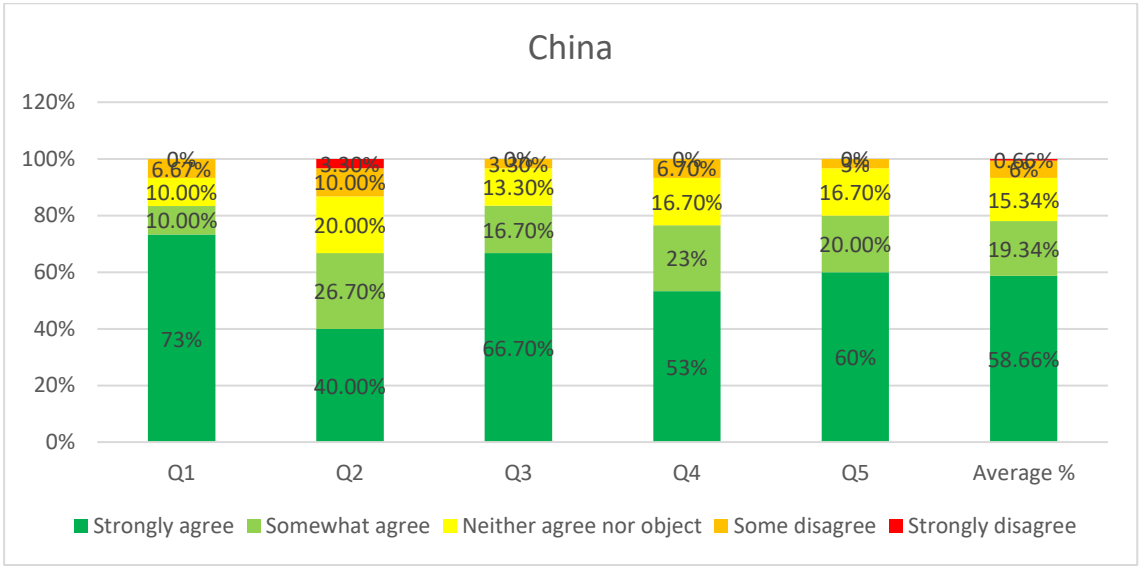
2. Somewhat agree

3. Neither agree nor object

4. Some disagree

5. Strongly disagree





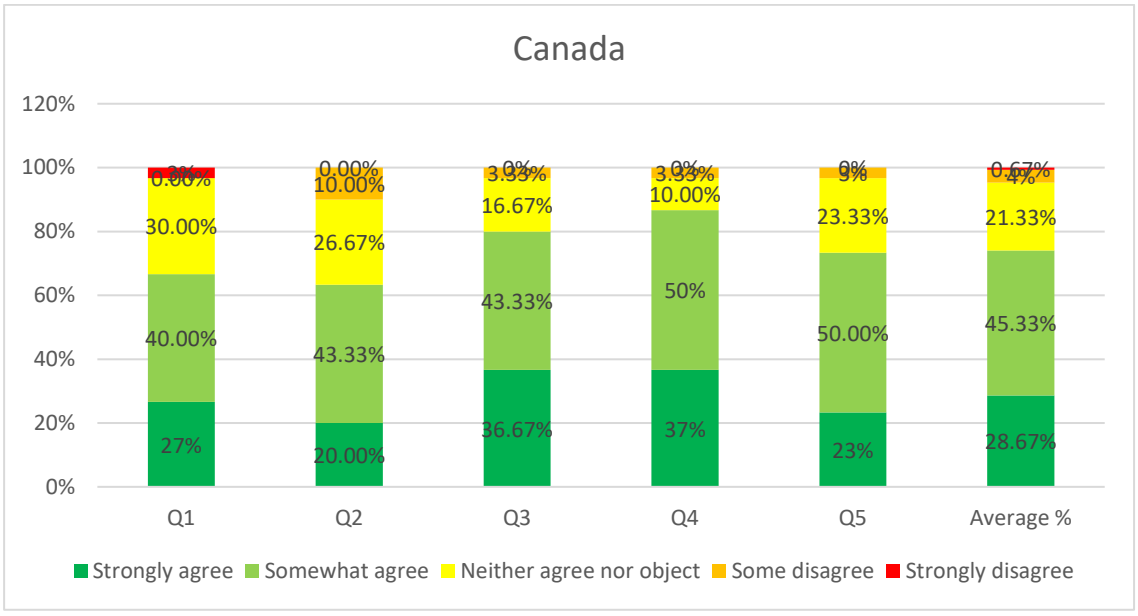


Table 15: Questionnaire feedback of hypothesis 3 part one.

4.4.2 Hypothesis 3 part two

The embedding of digital platform can better meet customers' expectations and satisfaction of products.

Questionnaire Questions

6. The application of digital technology to interior design products will reduce the cost of interior design products (renderings, construction).

7. If you have the same budget and cost, will you choose traditional interior design or digital interior design products.

8. You will install digital devices into the indoor environment (smart home, etc.) during the decoration process.

9. When you have a new home, you may also choose an interior design company to provide you with design solutions.

10. When you move to a new home , you will also choose digital interior design products.

Questionnaire options

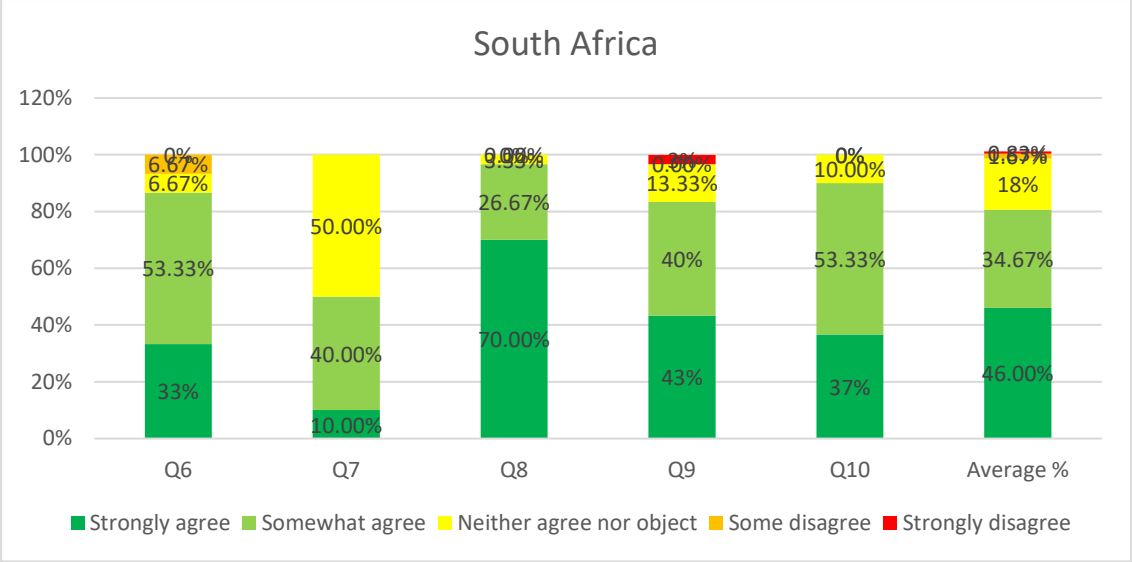
1. Strongly agree

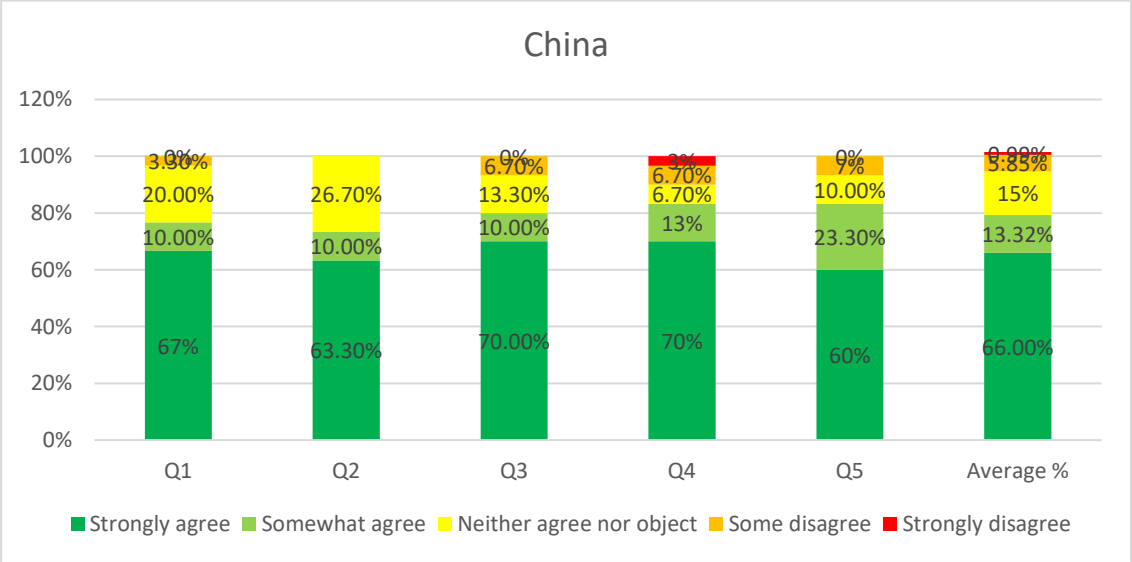
2. Somewhat agree

3. Neither agree nor object

4. Some disagree

5. Strongly disagree





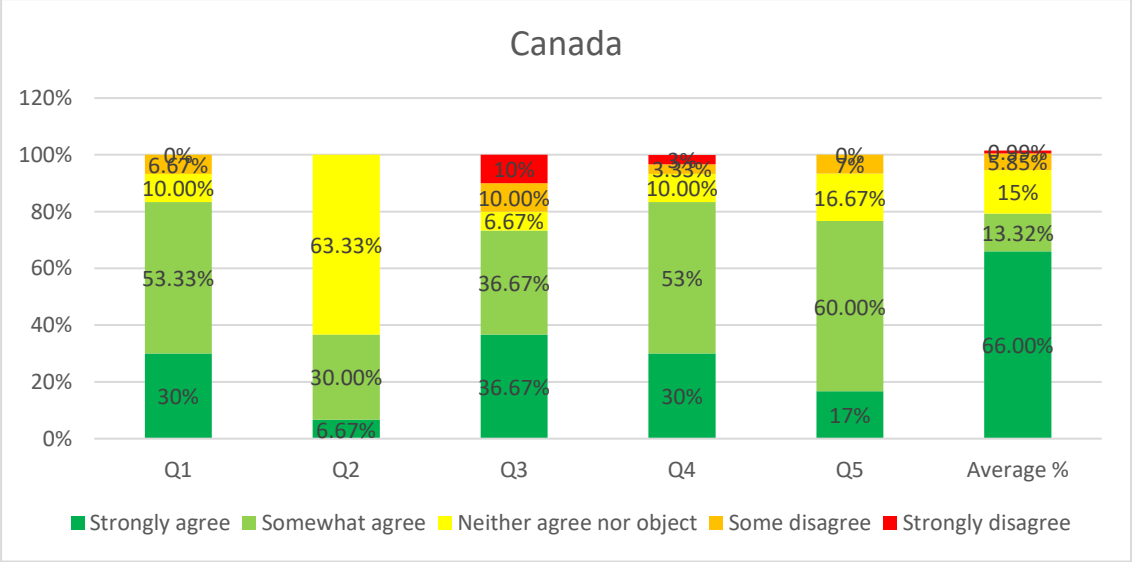


Table 16: Questionnaire feedback of hypothesis 3 part two.

4.5.Summary of the findings

After data collection on interview questions and questionnaire survey questions, questions were set up for exploration and research in accordance with the research direction of each hypothesis. After preliminary analysis, the results obtained are positive. The data feedback to be obtained can support the proposed hypothesis to a large extent. However, there are still differences in the feedback received in different countries for some individual questions. But this difference will not affect the overall trend of the research report. The reason for the differences is due to the different digital infrastructure construction conditions in different countries, the personal digital awareness of citizens of different levels, and a little cultural difference.

All factors that can affect the establishment of the hypothesis will be explained in detail in Chapter 5, and the proposed hypothesis and corresponding sub-hypotheses will be analyzed and proved one by one.

Chapter 5. DISCUSSION OF THE RESULTS OR FINDINGS

5.1 Introduction

The main content of this chapter is to further explore and study the feedback data from interviews and questionnaires. Explore the data obtained in which way to support the hypothesis proposed in the article. And, in the data obtained, there are conflicting assumptions in the data, research the reasons for such data, and future solutions. A small part of the collected feedback data, the investigations found did not fully prove the hypothesis, and this phenomenon only exists in a single sub-hypothesis of individual countries. In the process of analyzing the data, different opinions and ideas from designers from different countries during the

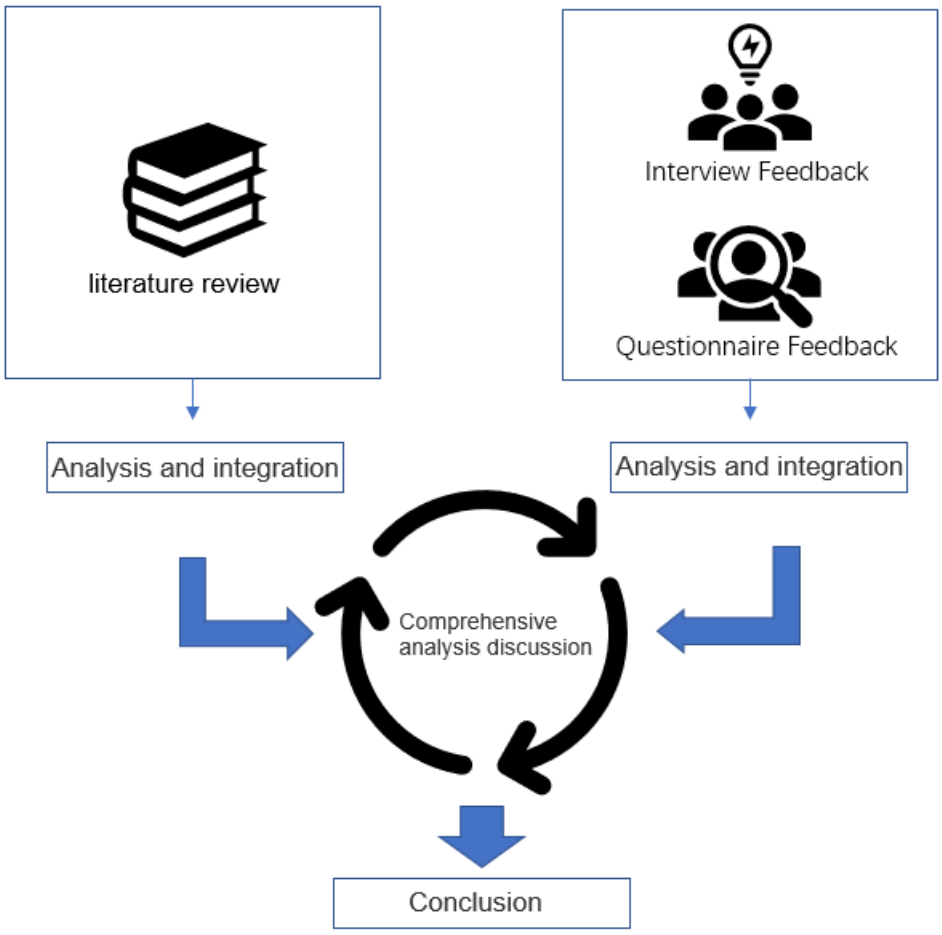


Figure 16： Chapter 5 data analysis framework.

interview process will be used to conduct professional in-depth analysis of the

questions and hypotheses raised, and to explain and prove the hypotheses raised.

Secondly, according to the guidelines of the cited literature review, combined with the data obtained from interviews and questionnaire surveys, a comprehensive comparison was made to further explore and study the disruptive impact of digital transformation in the interior design industry. Based on the concepts proposed in the literature review, combined with the actual survey results, the proposed hypotheses are analyzed and proved one by one.

5.2 Discussion pertaining to Hypothesis 1

Hypothesis 1 - Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.

The focus of development and operation of enterprises is gradually shifting from enterprise systems to the field of digital technology, and digital technology strength is gradually becoming the core competitiveness of enterprises (Sedera, Lokuge, Grover, Sarker, Sarker S, 2016). In the process of collecting interview data, We also discussed this series of issues with designers from various countries. The core business process of the enterprise is constantly moving closer to digitalization. The powerful internal management platform provides leaders with a more transparent and efficient management model. Provide employees with a powerful resource integration office platform. This is reflected in every country studied. Especially in China, interviewed designers from China mentioned that "in the past five years, our office model and management model have undergone drastic changes. I believe that China's interior design industry has transformed into a highly digital industry." Interviewed designers from Canada and South Africa also strongly affirmed this hypothesis, respectively

enumerating the digital upgrade of the company's internal management system, core business process system and design process during the development of the company.

Of course, some steps and processes cannot be fully digitalized. During the interview, the designer enumerated the following processes, such as face-to-face communication with users, transmission of corporate culture, and design patterns for some special cases. This series of processes cannot be replaced by digital technology. However, digital technology has to a large extent promoted the development of internal management models and core business processes of enterprises. The hypothesis will be divided into several parts below for explanation and discussion one by one.

5.2.1 Hypothesis 1 part one

A stable and efficient digital back-end system is the foundation of a company's digital transformation .

Compared with the traditional business process of enterprise systems, the introduction of digital technology has undoubtedly solved the obstacles and difficulties faced by enterprises in the development process to a great extent (Sedera, Lokuge, Governor, Sarker, Sarker S, 2016).During the interview, the designers interviewed from various countries listed the internal system upgrades that occurred within their own companies. The Chinese designers interviewed mentioned that companies regularly check the operation of the back-end system to ensure the stable operation of the company's website, performance appraisal system, and front-end customer interaction platform. Two South African designers interviewed mentioned the BIM system module in this module. BIM (Building Information Modeling) system is a professional system used in architecture and interior design. It can help realize the integration of building information. From the design, construction, and operation of the building to the end of the building's life cycle, all kinds of information are always integrated in a

three-dimensional model information database, design team, construction unit, facility operation department and owner All parties can work collaboratively based on BIM to effectively improve work efficiency, save resources, reduce costs, and achieve sustainable development (Dong, 2017). In the process of use, you can use and retrieve past data from the background system at any time data. On the one hand, it ensures the security of the internal data of the enterprise and also improves the operational efficiency of the business. And according to different operators, different operation interfaces are provided. For example, managers can observe business processes and personnel status. Users can observe the construction situation and so on. The designer interviewed in Canada mentioned that the company's internal management system has been completely digital. From the background data storage and core operating modules, to the front-end customer interaction, it has been completely digitalized. And the AI module in the background system connects the front end to the internal management system. For example, a fully intelligent employee time scheduling system, a holiday reserve system, and automatic timing of meetings.

It can be seen that an efficient and stable digital back-end system is the core of an enterprise's internal management system. She connects these various departments, leaders, employees and customers. Provide a foundation for the digital transformation of enterprises.

5.2.2 Hypothesis 1 part two

The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise .

“The enterprise system (ES) combined with the digital platform can produce a disruptive improvement in fundamental efficiency and output (Sedera, Lokuge, Grover, Sarker, Sarker S, 2016).” In the process of enterprise development, it will face many challenges, such as operating speed, operating program design, or as the enterprise continues to grow, the original system can no longer meet the

current development strategy of the enterprise. The emergence of digital technology and digital platforms can break the barriers for traditional enterprises to move towards digital enterprises and keep up with the development trend of the times.

The raging coronavirus in 2020 has made the interior design industry aware of the importance of digital technology and digital platforms. All interior designers interviewed have experience in applying remote conferencing technologies, such as ZOOM, TEAMS and WeChat. The South African designers interviewed especially mentioned that these remote communication software have undoubtedly saved many companies under the epidemic. Through this type of platform, leaders can timely communicate with employees remotely and issue work tasks. On the other hand, it also strengthened the communication between designers and clients. It ensures the stable operation and continuous output of the enterprise under the special background.

During the interview, each designer interviewed said that the company would regularly check its own digital level, or regularly upgrade its internal systems and digital tools. One of the Canadian designers interviewed said that the company will check and upgrade its internal systems and digital platforms every three months to ensure an efficient operating environment within the company. And, regularly upgrade the digital technology used by employees to continuously improve work efficiency and quality.

The company's core system cannot be replaced frequently due to factors such as huge data and high replacement costs. Therefore, tools such as digital technology and digital platforms need to be used to improve the quality of business operations. An interviewed South African designer mentioned “When I first joined the company, there was no such formal system to record the estimated and actual completion time of each project. We started using Buildertrend, which is a project management The software integrates project scheduling, project management, customer management and service management in our design, construction and materials departments. Compared with the previous system, it provides a better and more systematic method to manage all projects of any construction work , Contracts and tasks.” This phenomenon has become more

affirmed. The combination of enterprise systems and digital technology can provide enterprises with higher quality and efficient output. The process that cannot be achieved by the enterprise system can be completed by the external digital platform. On the one hand, the enterprise system provides stable data and management mode support for the digital platform. The digital platform uses digital technology to re-integrate and calculate data and processes, thereby enhancing the overall strength of the enterprise.

5.2.3 Hypothesis 1 part three

The application of the digital maturity model helps enterprises complete digital transformation.

Digital maturity is a prerequisite for enterprises to complete digital transformation. According to its own development status, the enterprise digitally upgrades the organization's development strategy, internal structure, and digital technology application. Every company that has completed digital transformation has demonstrated its application in digital maturity. Because the development conditions and development needs of enterprises are different. Therefore, enterprises of any level can find the transformation conditions they need in the digital maturity model.

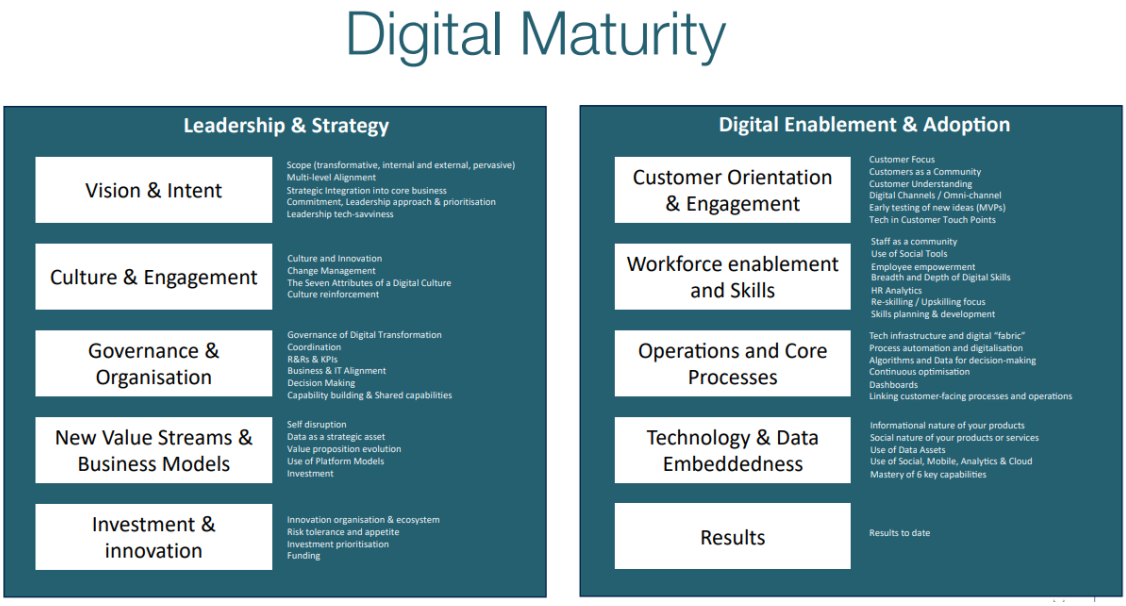


Figure 17 : Digital Maturity Model(Armstrong, 2019)(For Chapter 5).

The emergence of digital technologies, such as social networking, cloud technology and mobile Internet, are all driving forces that affect business growth in the current environment. “The digital transformation model can let us know how it works and how to use these digital technologies to create maximum efficiency for business operations (McAfee, Bonnet, and Westerman, 2014).” Digital transformation modules can help companies identify how different digital technologies can improve different parts of the company. Companies can better judge their own development status based on digital maturity and digital transformation modules, and provide a high-quality theoretical basis for their digital transformation.



Figure 18 : Digital Transformation Model (McAfee, Bonnet & Westerman, 2014)(For Chapter 5).

In the interview process, the interviewed designers from various countries made it clear that since entering the company, they have carried out different degrees of digital transformation. First, they all explained the digital technology upgrade within the company. The six designers all expressed digital technology upgrades in the company's internal systems and design software systems.

As mentioned in the previous question, the 2020 coronavirus has had a huge impact on the physical industry. But this is also a test of the company's digital capabilities. The feedback from the Canadian designer mentioned: "I would suggest that the way of communicationg through clients and designers needs to be transformed digitally with a better application. Due to the covid-19, we could not meet with the clients physically and the only App we use is Zoom, we might find a more efficient way. "During the epidemic, communication with customers has become a challenge for design companies. On the other hand, feedback from Chinese designers, through the application of the KUJIALE platform (online free interior design solution platform), customers use the platform to draft their own design ideas, design intent, design requirements, etc. Sending the designed file to the designer can enable the designer to better understand the design needs and shorten the distance between the design plan and the psychological expectations of the user.

In the interviewed designers, they all explained that whenever the company is doing software or hardware internally, employees will be digitally trained and guided. It shows that the interior design industry is a highly digital industry, and companies also pay attention to the formulation of digital development strategies and the cultivation of employees' digital capabilities. Moreover, a designer in South Africa said that the company's digital development strategy and the level of digitalization are at the international leading level. Another designer from South Africa also said that maintaining technology and concept leadership is an important ability to maintain the company's competitiveness in the industry.

Without exception, the development of every digital strategy and the upgrading of digital technology are inseparable from digital mature analysis. Understand the company's own development needs, and accurately promote the company's digital transformation on the company's internal management model, strategy formulation, and technology upgrade.

5.3 Discussion pertaining to Hypothesis 2

Hypothesis 2 - The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.

During the interview, the most important part of the discussion was the changes brought about by the application of digital technology for enterprises, core business processes, costs, and product performance. Designers interviewed from various countries cited a large number of cases to participate in this discussion. Due to the different levels of digital infrastructure in various countries, there are differences in the digital software and hardware selected. Moreover, in China, due to the rapid development of digital software and hardware, there are also a series of negative effects on the industry. It will be discussed in the following sub-hypothetical chapters.

In general, digital technology still has more advantages than disadvantages in core service offering, and it has made a huge contribution to business management, core design process and the process of communicating with customers.

5.3.1 Hypothesis 2 part one

The application of digital technology increases the efficiency of the design process and reduces the cost.

The technologies discussed in the previous literature review, the emergence of CAD, 3ds max and other technologies provide technical support for indoor drawing. Scan the indoor structure through a 3D scanner, then import the scan results into the corresponding software, and then the designer completes the modeling. This has to be said that on the basis of saving time, it also saves a lot of cost and fault tolerance.

During the interview, interviewed designers from various countries cited a series of digital technologies. Both software and hardware have greatly improved the performance of interior design works, design cycle, design budget, fault tolerance and other factors. The survey results show that two Chinese designers are more inclined to use digital technology software and hardware to design. They believe that in the drawing of large-scale projects, or in the case of a large number of orders, digital software and should be able to maximize work efficiency. The design pattern of the traditional pattern. Need to draw multiple renderings in one space. And through digital technology, to establish a 3D space, only need to control the rendering angle and parameters of the software, can produce multiple renderings at the same time in a short time. Interviewed designers from Canada also had the same feedback, “I do prefer digital design method as it brings efficiency.drawings could be finished at office or home, multi designer could work on the same projects. ”Because the data shown in electronic drawings is identical. There are no differences in traditional hand-painting techniques. However, the answer given by two designers interviewed in South Africa is that although they prefer to use digital tools for design, it depends on the requirements of the project and the personal needs of the client. Some users may ask for hand-drawn renderings, so the designer believes that even if we rely on the convenience of digital technology most of the time, mastering traditional hand-drawn memories is also a quality that an interior designer should possess.

A negative point of view also emerged during the interview. Judging from the feedback from the interview and questionnaire survey, this situation only exists in China, so we will discuss it separately. Due to the continuous upgrading and evolution of digital interior design software and platforms, a series of simple tools have emerged. With 3D MAX, Raino, Cad and other tools, users need to receive professional training to master the operation and parameter ratio of related software. But the emergence of some simple tools broke this balance. The software and the built-in materials in the platform enable users to complete the rendering of the renderings without complicated operations. Size problems will occur in the process, and non-professional users will have a lot of design concept errors. This has greatly reduced the threshold for the industry, and some untrained personnel start companies and solicit interior design projects. Because

no complicated design process is required, the cost is much lower than that of a professional design company. This is a vicious circle in the design industry. Some customers with insufficient budgets choose this kind of non-professional company. After the construction, the indoor environment cannot be reasonably guaranteed. This phenomenon is very serious in China. Suggestions and solutions to this phenomenon will be discussed in the conclusion section.

5.3.2 Hypothesis 2 part two

The application of digital technology can break through design barriers and expand solutions.
The integrated digital platform allows designers to obtain better design resources.

The application of digital technology can effectively solve a large number of barriers that appear at this stage. The AR, VR, and 3D scanning technologies mentioned in the previous literature review provide more adequate solutions for the presentation of interior design solutions and product performance. In the same way, the digital processing of software and hardware can provide designers with more sufficient design resources and the injection of design ideas.

Interviewed designers from various countries listed the corresponding digital technologies and discussed their advantages and disadvantages. Designers from China use VR equipment to show their design works to customers, allowing customers to experience immersively. Customer feedback on this technology is also very positive. And the use of 3D printing technology to overcome the difficulties of alien homes. In the interview feedback, designers interviewed in China and Canada believe that the application of digital technology has more advantages than disadvantages compared to traditional hand-painted models. Higher efficiency, lower cost, better product performance, and some digital display format designers cannot achieve traditional hand-painting methods.

In the interview, a question was set up: "Will digital interior design technology replace traditional hand-painting methods?" On this question, the interviewed

designer from China believes that in the current situation, whether it is the workflow or the core design process There is no need for products in the form of hand-painted products at all, and Chinese consumers are looking forward to seeing high-tech interior design works. Two designers from Canada gave a relatively prudent answer. One of the designers believes that this is a manifestation of design ability. Even if a large number of digital technologies are applied in the design process, the hand-painting ability should be the ability that a qualified interior designer should possess. One of the interviewed designers from South Africa said, "I don't think digital interior design can replace the traditional process, again, interior design is Art, Art from human senses which it is nonreplaceable. The design process is always the same, even if we use the BIM Revit software. Interior design integrated with Art and Science. Technology can't replace Art." And another South African interior designer is also cautious about this issue, even if digital technology is booming Today, traditional hand-painted techniques should not be replaced.

5.4 Discussion pertaining to Hypothesis 3

Hypothesis 3 - Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services .

In the feedback mentioned above, the application of digital technology not only plays a positive role in the core design process, enterprise management system, etc. It can make a huge contribution to product performance and user experience. For Hypothesis 3, a total of ten questions were set up, and they were put in three countries: South Africa, China and Canada. Each country set up thirty questionnaires to study the hypothesis. Come to a comprehensive study, how does the consumer group think about the application of digital technology in interior design products. And, in contrast to traditional interior design methods,

consumer groups' views on the two, collecting data, and discussing the proposed hypotheses.

In Chapter 4, all the results of the questionnaire survey data have been displayed, so in the discussion process of this chapter, we will conduct a general discussion and analyze the differences between the assumptions and actual survey results.

5.4.1 Hypothesis 3 part one

The application of digital technologies provides better performance for interior design products.

Digital technology has indeed brought huge changes to the interior design industry, both from the perspective of software and hardware, bringing a brand new experience to consumer groups. According to the results of the questionnaire survey, more consumers are more inclined to let interior designer to use digital design tools to design and plan their interior spaces. In the second part of the questionnaire survey, it can be determined that even if more people are willing to choose digital interior design products, consumers do not all think that the design solutions proposed by interior design companies are better. The reason is that the consumer group is buying a service from an interior design company, and the beneficiaries are the consumers themselves. Professional interior design companies can provide consumers with better design solutions, but the implementation of the solutions also needs to integrate the actual needs of consumers and the ideal design concepts in the hearts of consumers.

More than half of consumers believe that digital technology has brought better performance to interior design products. But there are still very few consumers who oppose this proposal. This aspect also echoes the issues involved in Hypothesis 2. There are still a small number of consumers who accept traditional hand-painted interior design works. It also further echoes a theme. Even if digital technology can bring higher data and better performance to interior design

products and processes, the traditional hand-painted design method cannot be completely replaced.

In the feedback from the questionnaire survey, far more than half of consumers in the three countries believe that the advantages of digital technology in the interior design industry far outweigh the disadvantages. Moreover, because digital technology can provide more solutions for design solutions, consumers believe that the application of digital technology can meet their needs for personal design solutions to a greater extent.

5.4.2 Hypothesis 3 part two

The embedding of digital platform can better meet customers' expectations and satisfaction of products.

The survey results show that the vast majority of consumers believe that the application of digital technology can reduce the purchase and implementation costs of interior design solutions. Compared with the traditional hand-painted mode, digital technology can indeed shorten the design cycle and budget. And hand-painting style is an uncontrollable factor. Hand-painting cannot accurately display the actual spatial data of the interior design space, and it is easy to bring a visual error to consumers.

In response to interview question 7, "If you have the same budget and cost, will you choose traditional interior design or digital interior design products." The feedback shown has the following results.

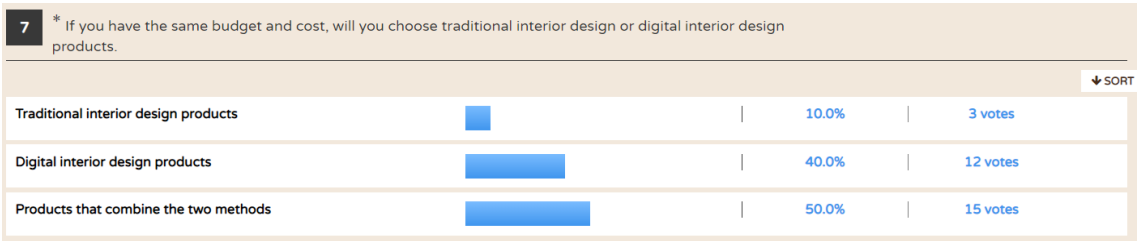


Figure 19: Feedback of questionnaire question 7(South Africa).

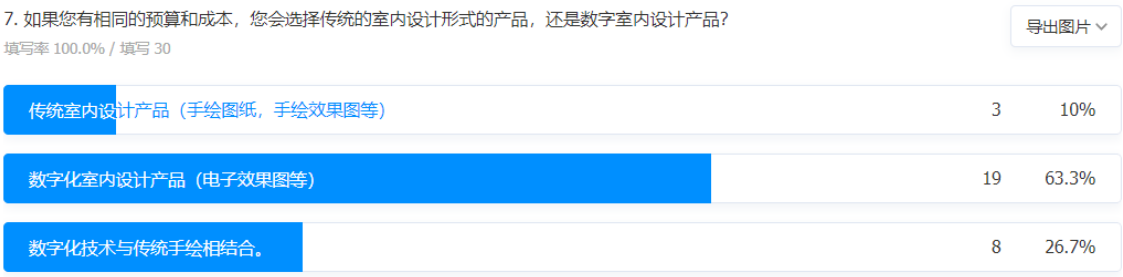


Figure 20： Feedback of questionnaire question 7(China)(Same order of questions and answers as the other two countries).

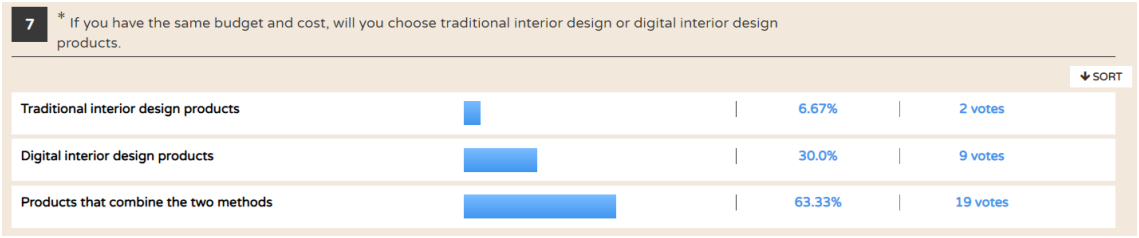


Figure 21： Feedback of questionnaire question 7(Canada).

The survey results show that compared to traditional hand-painted models, consumer groups from China are more inclined to use digital interior design methods. Data from South Africa and Canada shows that consumers are more inclined to use digital methods that combine traditional hand-painting and digital technology. It can be seen that consumers in South Africa and Canada, while enjoying the improvement in the performance of interior design products brought about by digital technology, also agree with the traditional hand-painted design method. The combination of the two can be more effective Improve user experience.

In the next survey, a large number of consumer groups from three countries hope to bring digital technology into the indoor environment to enhance consumers' digital product service experience. Moreover, in the case of changing residences in the future, consumers are more inclined to find professional interior design companies to provide design solutions. Moreover, the digital interior design method will be chosen to complete the design plan. This feedback reflects the trust and attention of consumers to interior design companies. On the other hand, it can also reflect that the digital technology applied to interior design can

effectively meet consumers' expectations and needs for design solutions. Compared with traditional hand-painted design models, the user experience has been greatly enhanced.

5.5 Conclusion

By analyzing and sorting out the feedback data from interviews and questionnaire surveys, it can be seen that digital transformation has an overall driving effect on the development of the interior design industry. The hypothesis was proved through literature review and factual basis. However, in the process of discovering facts and proving hypotheses, we also found that different countries have different levels of digital infrastructure construction, cultural background, and interior design industry development status. The feedback data collected is different. The difference is within an acceptable range.

The hypotheses discussed and proved are:

H1-Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.

H2-The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher operational efficiency and better solutions.

H3-Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services.

The differences found in the survey are

1. Although the application of digital technology in the interior design industry, both the interior design company, the design process, and the later user experience have an overall improvement. But in China, some simplified digital design tools and platforms have brought users without professional backgrounds into the industry. Malicious competition has occurred.

2. Even if the application of digital tools can improve the efficiency of the design process, shorten the design cycle, save costs, etc. Traditional hand-painted design patterns are still irreplaceable design methods. First, it exists as a form of designer's artistic accomplishment. In addition, it can also reflect the designer's

design level and professionalism. Moreover, some consumer groups still have special needs for this type of design.

3. Due to the different development directions of digital technology, the directions of professional software used in interior design in various countries are different.

4. Consumer groups from China are more inclined to use digital interior design tools and products, compared to Canada and South Africa.

Chapter 6 . CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This chapter is the summary link of the whole research. By combining the theoretical basis and research evidence designed in the literature review, and the feedback data collected from interviews and questionnaires, the research questions are answered one by one. Compare each question and the degree of matching of the proposed hypothesis, and discuss the data that differs from the hypothesis during the research process, and make a prudent summary for the entire study.

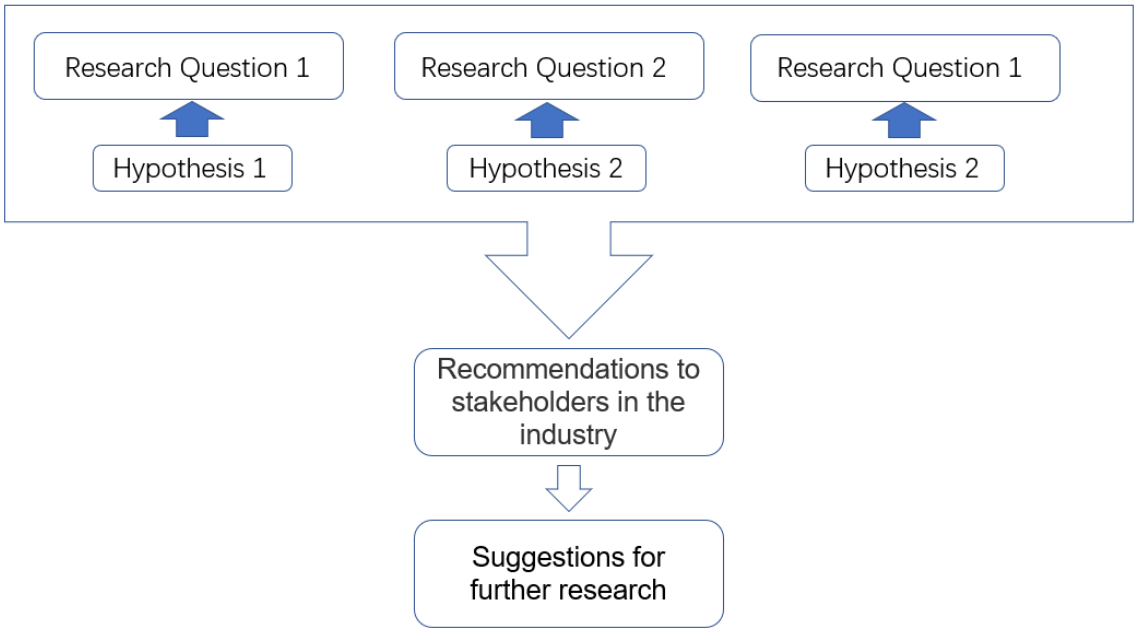


Figure 22: Framework of Chapter 6

In addition, in the research process, based on different types of data collected in different countries surveyed, a series of research results and data, as well as existing problems, were discovered to provide stakeholders in the interior design industry with suggestions for future development and current development. Based on the problems and research methods discovered in the research process, suggestions are made on the future direction of this type of research to ensure that the research on digital transformation can continue.

6.2 Conclusions regarding research question 1

Research Question 1 - To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?

-How does the back-end system maintain the development of the enterprise and the operation of core business processes?

In the literature review, it is mentioned that in the process of enterprise digital transformation, technologies such as AI, RPA, and cloud storage are applied to enterprise systems. Interior design companies can also apply AI systems to their front-end service systems to connect customers and establish connections with customers. RPA reasonably allocates internal data and user data. And upload the interior design resource data to the enterprise cloud storage platform for designers and customers to share.

The feedback data in interviews and questionnaire surveys found that the interviewed designers all expressed their opinions on the digital transformation of their interior design companies. AI and cloud storage technologies are widely used in various interior design companies. And individual companies use AI to measure the KPIs of various departments.

-What role does the application of enterprise system and digital platform play in enterprise development

A powerful digital platform and reasonable application of digital technology can improve the efficiency of the entire enterprise. The improvement of efficiency is reflected in various aspects such as internal management, and core processes. In terms of core business processes, through the combined use of internal systems and digital platforms, a more efficient and stable communication environment has been established for managers. Provides more powerful technical indications (AI, RPA) for the design process. It provides a smarter and faster communication channel for establishing contact with customers.

In the feedback data of interviews and questionnaire surveys, it is found that companies in which designers work in various countries have internal data information storage systems to provide stable data support for the joint office of various departments. During the coronavirus period, it is also possible to maintain communication with enterprises and customers through digital conference software. The blessing of cloud storage and AI technology provides intelligent technical support for the company's front-end response system (company portal, automatic distribution client system, etc).

- What is the impact of digital maturity in the enterprise digitization process ?

The digital maturity model is used for companies to analyze their own digital level, find their own positioning in the model, and thus promote the company's digital transformation in stages and levels.

From the data feedback of interviews and questionnaire surveys, it is found that the companies of the interviewed designers have different degrees of digital transformation. Its transformation methods are reflected in the digital maturity model. For example, the company's digital equipment upgrade, the formulation of the company's digital development plan, and regular company employees' digital skills training.

6.3 Conclusions regarding research question 2

Research Question 2 - In what aspects has digital technology changed the core service offering of the interior design industry?

-How has digital technology changed the performance of core service offering in the interior design industry?

In the process of digital transformation and upgrading of the interior design process, some digital software and hardware are continuously applied to the design and process. For example, the emergence of digital technologies such as 3DS MAX, CAD, AR, and VR has completely changed the presentation mode of interior design solutions. From traditional manual painting to digital renderings, virtual reality space, etc. According to the information provided in the literature review, the application of these technologies has not only shortened the design cycle and improved work efficiency, but has not provided designers with more accurate data sources. On the one hand, it can improve the accuracy of the plan in the later construction process, and it can also save costs to a large extent.

The feedback data in interviews and questionnaire surveys found that the application of digital tools can indeed improve office efficiency and save costs. But the traditional hand-drawn mode cannot be completely replaced. There are still some individual design cases or customer needs that need to be completed with hand-drawn design drawings.

-What problems does the application of digital technology solve for the design process?

In the process of digital transformation in the interior design industry, the advantage of digital technology lies in continuously solving the barriers that appear in the industry. The 3D scanner provides a more accurate guarantee for the indoor structure data. The continuous upgrading of rendering technology has greatly shortened the design cycle. AR, VR can be more in-depth and realistic to show customers design solutions.

From the feedback data in interviews and questionnaire surveys, it can be found that the injection of some digital platforms has provided designers with richer design resources and solutions. Some design platforms are transferred to mobile devices, allowing designers to record their design ideas and ideas anytime, anywhere. In addition, some simplified digital interior design platforms can allow customers to participate in the production of the entire design plan, allowing designers to have a deeper understanding of users' design needs. However, it

was also found in the investigation that due to the emergence of these simplified design platforms, it has also brought corresponding malicious competition to the Chinese interior design industry.

-What advantages does the application of digital platform bring to the design process?

According to the information mentioned in the literature review, the application of digital technology in the interior design process can effectively improve the overall design efficiency, save design costs, and improve the performance of designed products. However, the feedback obtained during the interview shows that, compared with the traditional hand-painted design mode, digital notation can indeed bring more innovation and advantages to the design process, but it still cannot be replaced. On the one hand, its existence is an art form. In addition, it is also a reflection of the design level of a qualified designer. There is still a small group of customers who still prefer the traditional hand-painted renderings.

6.4 Conclusions regarding research question 3

Research Question 3 - How does digital technology, as applied with regard to (1) and (2) above, improve user experience ?

-How does digital technology affect product performance?

The application of digital technology in interior design products can bring better performance and add richer functions and experiences to design products and services. Digital rendering tools (3DS MAX, Raino, etc.) improve the quality and performance of digital design drawings. AR, VR deliver design drawings to customers with a more three-dimensional and realistic experience, thereby enhancing customer experience.

In addition, in the feedback data of the questionnaire survey, it is found that consumer groups have a positive attitude towards the use of digital technology in interior design products and services. At the same time, a large number of customer groups also hope that interior design products are presented to customers in a combination of digital technology and traditional hand-painting. It

is also a challenge for designers, with exquisite hand-drawing ability is long-term learning and exercise.

-What is the impact of digital technologies used in interior design products and processes on users?

The application of digital technology in interior design products can meet user needs and expectations of products and services in a deeper level. Due to the access of digital technology, some previously difficult and complicated design ideas have been realized. To a large extent, it also expands the capabilities of designers, and adds richer features to interior design exhibits and services.

From the feedback of the questionnaire survey, it is found that the user group has a positive attitude towards interior design products and services. Moreover, a large part of customers believe that the design proposal proposed by digital interior design companies can be recognized by them, and in the future they are more inclined to let digital interior design companies complete their design proposals. Because digital tools should be able to enhance their perception of design solutions visually and sensory, and they are more reasonable, thereby enhancing the user experience. But traditional hand-painting still has its significance in this industry, and there is still a small part of consumer groups that recognize traditional hand-painted design methods.

6.5 Recommendations

For the interior design industry

Improve the level of the entire industry by setting higher access standards for the industry, such as corporate qualifications and designer qualifications. Avoid some non-professional practitioners using simple techniques to set foot in the interior design industry. To control the malicious competition in China's interior design industry, and create a more professional and fair industry environment for China's interior design industry. The industry imposes severe penalties on unscrupulous practitioners, and joint law enforcement agencies to supervise and record their

actions can also effectively prevent unscrupulous practitioners from setting foot in related industries again with despicable means.

For interior design companies

Interior design companies should clearly and rationally formulate their digital development strategies. Regularly assess the digital maturity of the enterprise, check the operating status of each part, find the deficiencies in the system in time, and correct them in time to promote the digital transformation process of the enterprise. In addition, the company establishes its own digital strategy culture, and regularly conducts digital training for employees in stages according to their work characteristics to improve their digital technology operations and understanding capabilities. Regularly check the status of digital facilities and digital platforms in the enterprise, and carry out regular upgrades to follow up the process of digital transformation.

For interior designers

Deepen interior designers' understanding of emerging systems, digital technologies and digital devices in the industry. When a company introduces digital technology or equipment, it must actively learn and improve its ability to operate related equipment and technology. In addition, interior designers should also improve their hand-painting ability accordingly to respond to the different needs of different user groups, and gradually improve their own interior design ability and level.

6.6 Suggestions for further research

This research mainly discusses the digital transformation in the interior design industry. In the process of exploration, the cited literature, as well as the interviews conducted with in-service designers in South Africa, China and Canada, and the questionnaire survey of consumer groups were completed in the later period. In general, the application of digital technology and the implementation of digital strategic theories have greatly promoted the entire industry. The adoption of new digital concepts and strategies improves the

operational efficiency and management level of the enterprise, optimizes the design process, and provides more possibilities for interior design products and services. In addition, it also meets users' expectations for products and services, and enhances the user experience from a deeper level.

In the process of research, we also found that different countries have different interior industrial development status. The reasons for this phenomenon are many, such as regional factors, cultural factors, and the degree of digital infrastructure construction in the country. In addition, through comprehensive data comparison, there is also a gap in the degree of application of digital infrastructure construction in different countries in the interior design industry. From the above perspective, the following suggestions are put forward for the future research trend.

1. In the future research process, we must continue to explore the application scope of emerging digital technologies in the interior design industry. The definition of this study is limited, and it does not enumerate all the digital technologies applied in the operation of interior design enterprises and the design process, which has certain limitations. But digital transformation will never stop, and there will be a steady stream of technology pouring into the industry.

2. During the research process, malicious competition emerged in China's interior design industry. In the same level of the industry, only China has such a situation, and it has not been found in other interviewed countries. There are many reasons for this, and the results need to be explored.

3. According to the feedback data, it is found that the traditional hand-painted mode is irreplaceable, but is there any technology that can perfectly solve this problem? First of all, hand-painting skills are a test for designers, whether they can convert data through digital technology to achieve the same hand-painted effect to solve this problem.

4. In future research, we must continue to explore the degree of digital transformation in the field of interior design. What are the main areas of its transformation process? Or, how far should the transformation be to judge that the industry is a highly digital industry.

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APPENDIX A

Participant Information Sheet

WBS letterhead

Dear Sir / Madam,

My name is Jun Zhou Xiao and I am a Masters student in Digital Business at the University of the Witwatersrand, Johannesburg. As part of my studies, I have to undertake a research project, and I am investigating "Digital Transformation of the Interior Design Industry: A comparison of South African and Global case studies" under the supervision of Professor Brain Armstrong. The aim of this research project is to find out the influence of digital technology on interior design industry .As part of this project, I would like to invite you taking part in a interview. This activity will involve several questions about the application of digital technology in interior design and will take you a few minutes. With your permission, I would also like to record the interview using a digital device There will be no personal costs to you if you participate in this project, You will not receive any direct benefits from participation but there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. You may withdraw at any time or not answer any question if you do not want to. The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report. If you experience any distress or discomfort at any point in this process, we will stop the interview or resume another time.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report which will

be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you .If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrec-medical.researchoffice@wits.ac.za

Yours sincerely,

Jun Zhou Xiao

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Supervisor: Brain Armstrong

Email: brian.armstrong@wits.ac.za

Phone Number : +27 11 717 3951

APPENDIX B

Consent Form

Title of project : Digital Transformation of the Interior Design Industry: A comparison of South African and Global case studies

Name of researcher : Jun Zhou Xiao

I, ……., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in his / her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO

…..

…… (signature)
…… (name of participant)
…… (date)



…… (signature)
Jun Zhou Xiao …… (name of person seeking consent)
…… (date)

APPENDIX C Ethics approval notification

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE **PROTOCOL NUMBER: WBS/BA2162059/98**

PROJECT TITLE Digital transformation of the interior design industry: selected case studies from South Africa, China and Canada

INVESTIGATOR	Mr Jun Zhou Xiao
SCHOOL/DEPARTMENT OF INVESTIGATOR	MM (Digital Business)
DATE CONSIDERED	16 November 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	MINIMAL RISK
EXPIRY DATE	30 JUNE 2021

MMatshabaphala

ISSUE DATE OF CERTIFICATE 25 November 2020 **CHAIRPERSON** _____
(Dr MDJ Matshabaphala)

cc: Supervisor: Prof Brian Armstrong

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

_____ 26 / 11 / 2020
Signature **Date**

APPENDIX D Research Structure

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
1		To what extent has digital technology changed the internal operational platforms and core business processes of the interior design enterprise?	1	Digital transformation and the application of digital technology can improve the internal management model of enterprises, and enhance the performance of interior design firms' core business processes.	Comprehensive data report issued by enterprises and Interview questions 1 to 8 .	Construct validity
1.1		How does the back-end system maintain the development of the enterprise and the operation of core business processes?	1.1	A stable and efficient digital back-end system is the foundation of a company's digital transformation .	Comprehensive data report issued by enterprises and Interview questions 1 to 4 .	Construct validity

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
1.2		What role does the application of enterprise system and digital platform play in enterprise development ?	1.2	The combination of enterprise systems and digital platforms can enhance the overall strength of the enterprise .	Interview questions 5 to 6	Construct validity
1.3		What is the impact of digital maturity in the enterprise digitization process ?	1.3	The application of the digital maturity model helps enterprises complete digital transformation.	Interview questions 7 to 8	Construct validity
2		In what aspects has digital technology changed the core service offering of the interior design industry?	2	The application of digital technology optimizes the core design process, improve production efficiency and reduce expenses, providing integrated resources, higher	Interview questions 9 to 14 .	Construct validity

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
				operational efficiency and better solutions.		
2.1		How has digital technology changed the performance core of service offering in the interior design industry?	2.1	The application of digital technology increases the efficiency of the design process and reduces the cost.	Interview questions 9 to 12 .	Construct validity
2.2		What problems does the application of digital technology solve for the design process?	2.2	The application of digital technology can break through design barriers and expand solutions.	Interview questions 12 to 14 .	Construct validity
2.3		What advantages does the application of digital platform bring to the design process?	2.3	The integrated digital platform allows designers to obtain better design resources.	Interview questions 12 to 14 .	Construct validity

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
3		How does digital technology, as applied with regard to (1) and (2) above, improve user experience ?	3	Digital technology enhances and improves the performance and quality of interior design products. Deeply satisfying user experience and user expectations by digital products, lower costs, and efficient services .	Questionnaire questions 1 to 10	Correlation analysis
3.1		How does digital technology affect product performance?	3.1	The apply of digital technologies provides better performance for interior design products.	Questionnaire questions 1 to 5	Correlation analysis

RQ #		State Research Question or Objective	Prop/hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
3.2		What is the impact of digital technologies used in interior design products and processes on users?	3.2	The embedding of digital platform can better meet customers' expectations and satisfaction of products.	Questionnaire questions 6 to 10	Correlation analysis

Table 17: Consistency table.

APPENDIX E

Interview and questionnaire instrument

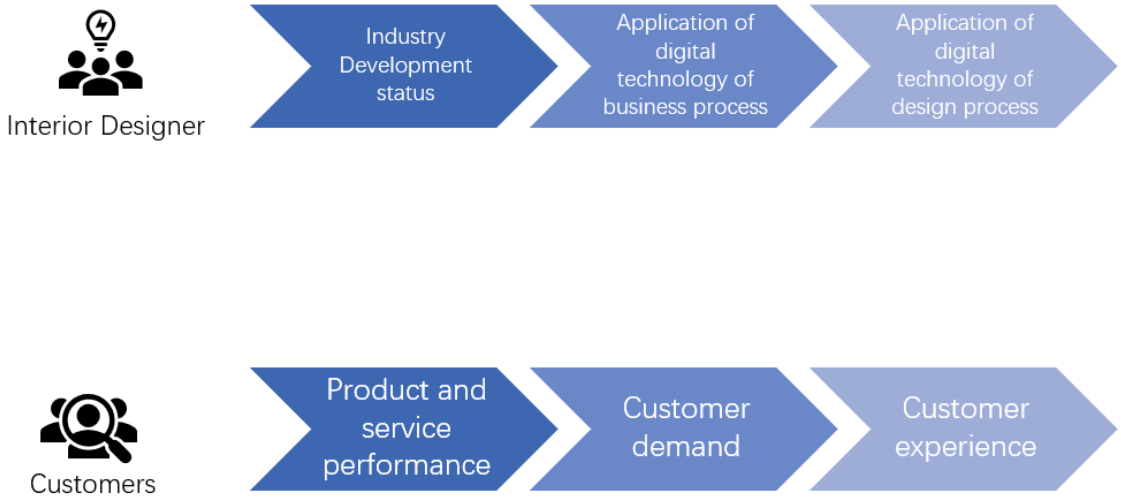


Figure 23: Interview and questionnaire framework.

Interview Questions

1. Do you think that the interior design industry you work in is a highly digital industry?

2. What digital changes do you think have taken place in this industry since you first entered it?And in your firm ?

3. Can you talk about the advantages and disadvantages of the management mode of digital platform in your industry?And in your firm ?

4. Has your company gone through a digital transformation?If not , has your company made any digital upgrades?

5. During the company's application of digital technology, which business processes have changed? How did they change?

6. Does your company regularly check the digital status of its operations? (or digital level)?

7. If yes, please describe at what level the enterprise has gone digital/if not, do you think it is necessary for the enterprise to go digital transformation?And Why ?

8. What do you think needs to be transformed digitally in your organization?

9. How do you think the application of digital technology change the core service offering?

10. What digital technologies (software, hardware) do you use in your interior design process?

11. During the design process, do you prefer to use traditional design method or digital design method?Why is that?

12. Do you think the application of digital technology has improved the design process development?In what ways?

13. Do you think digital technology can break through current design barriers and expand solutions?

14. Can you talk about the advantages and disadvantages of digital technology compared with traditional interior design method?

Questionnaire questions

1. Strongly agree 2. Somewhat agree 3. Neither agree nor object

4. Some disagree 5. Strongly disagree

Questions	Feedback
1. You prefer design firms to use digital technology to design the interiors of your house/apartment rather than traditional interior design models	1/2/3/4/5
2. You think the interior design company's design plan is better than your own idea	1/2/3/4/5
3.The application of digital technology brings better performance to interior design products	1/2/3/4/5
4.The application of digital technology in interior design has brought more advantages than disadvantages	1/2/3/4/5
5. Digital interior design products and services can better meet your needs and expectations.	1/2/3/4/5
6. The application of digital technology to interior design products will reduce the cost of interior design products (renderings, construction)	1/2/3/4/5

7. If you have the same budget and cost, will you choose traditional interior design or digital interior design products.	1/2/3/4/5 
8.You will install digital devices into the indoor environment (smart home, etc.) during the decoration process.	1/2/3/4/5 
9. When you have a new accommodation , you may also choose an interior design company to provide you with design solutions	1/2/3/4/5 
10. When you own a new accommodation , you will also choose digital interior design products	1/2/3/4/5 