ARTS Journal of Arts and Thai Studies
eISSN : 2774-1419

Research Article

Journal of Arts and Thai Studies Vol.46 No.2 https://so08.tci-thaijo.org/index.php/artssu/index

Exploration and Practice of the Collaborative Innovation Model of Chu Culture Lacquerware: Industry-Academia-Research Cooperation
การสำรวจและการปฏิบัติของรูปแบบนวัตกรรมเครื่องเขินวัฒนธรรมฉู่ในการทำงานร่วมกันของการผลิต การศึกษาและการวิจัย

Peipei Mu* **Miyoung Seo** **Kriangsak Khiaomang**
เปเป่ยมู **มิยอง ซอ** **เกรียงศักดิ์ เชียวมั่ง**
Faculty of Fine and Applied Arts, Burapha University, Thailand

Corresponding author*
e-mail: 413139183@qq.com

Received 19-01-2024
Revised 11-03-2024
Accepted 12-03-2024

DOI: 10.69598/artssu.2024.2730.

Keywords: Chu culture lacquerware, lacquerware, collaborative innovation

คำสำคัญ: เครื่องเขินวัฒนธรรมฉู่, เครื่องเขิน, นวัตกรรมร่วมกัน

Abstract

Objectives: This study aims to delve into the current status and challenges of the inheritance of Chu Culture Lacquerware, as well as analyzing the factors influencing the collaborative innovation capability of universities.
Methods: This study utilized a literature review, analyzing academic journals, theses, and local records on Chu Culture Lacquerware and its cultural context. Interviews were conducted with educators, artisans, company representatives, and experts to gather diverse insights. Additionally, a questionnaire survey was implemented, targeting various audiences to assess their awareness and attitudes towards Chu Culture Lacquerware.
Results: The study reveals that the general public has a certain level of understanding and interest in Chu Culture Lacquerware. However, the inheritance of Chu Culture Lacquerware faces multiple challenges such as the transmission of craftsmanship, dissemination of cultural value, market promotion, and industrialization. The research also uncovers the significant influences of internal and external forces, university-industry collaboration, and policy regulation on the collaborative innovation capability of universities.
Application of this study: This study not only offers practical guidance for the inheritance of Chu Culture Lacquerware but also provides theoretical foundations and strategic recommendations for industry-academia-research cooperation in universities.

บทคัดย่อ

วัตถุประสงค์: วัตถุประสงค์ของการศึกษานี้เพื่อสำรวจสถานะการสืบทอดและความท้าทายของเครื่องเขินวัฒนธรรมฉู่ และวิเคราะห์ปัจจัยที่มีอิทธิพลต่อความสามารถในการสร้างนวัตกรรมร่วมกันของมหาวิทยาลัย
วิธีการศึกษา: การศึกษานี้ใช้วิธีการทบทวนวรรณกรรม โดยวิเคราะห์วารสารวิชาการ วิทยานิพนธ์ และบันทึกท้องถิ่นเกี่ยวกับเครื่องเขินวัฒนธรรมฉู่และบริบททางวัฒนธรรม ได้ดำเนินการสัมภาษณ์กับนักวิชาการ ช่างฝีมือ ตัวแทนจากบริษัท และผู้เชี่ยวชาญเพื่อรวบรวมข้อมูลที่หลากหลาย นอกจากนี้ยังได้ดำเนินการสำรวจด้วยแบบสอบถามกับผู้ที่เกี่ยวข้องในหลากหลายกลุ่มเพื่อประเมินความตระหนักรู้และทัศนคติต่อเครื่องเขินวัฒนธรรมฉู่
ผลการศึกษา: ผลการศึกษาพบว่าประชาชนทั่วไปมีความเข้าใจและสนใจในเครื่องเขินวัฒนธรรมฉู่อยู่ในระดับหนึ่ง อย่างไรก็ตาม การสืบทอดเครื่องเขินวัฒนธรรมฉู่ต้องเผชิญกับความท้าทายหลายประการ เช่น การถ่ายทอดฝีมือ การเผยแพร่ค่านิยมทางวัฒนธรรม การส่งเสริมการตลาด และการอุตสาหกรรม นอกจากนี้ การวิจัยยังเผยให้เห็นถึงอิทธิพลที่สำคัญของปัจจัยภายในและภายนอก การร่วมมือระหว่างมหาวิทยาลัยกับอุตสาหกรรม และการกำกับดูแลด้านนโยบายที่มีต่อความสามารถในการสร้างสรรค์นวัตกรรมร่วมกันของมหาวิทยาลัย
การประยุกต์ใช้: การศึกษานี้ไม่เพียงแต่ให้คำแนะนำเชิงปฏิบัติสำหรับการสืบทอดเครื่องเขินวัฒนธรรมฉู่เท่านั้น แต่ยังให้พื้นฐานทางทฤษฎีและข้อเสนอแนะเชิงกลยุทธ์สำหรับความร่วมมือระหว่างอุตสาหกรรม สถาบันการศึกษา และการวิจัยในมหาวิทยาลัย

Introduction

Chu Culture Lacquerware is a treasure among ancient Chinese lacquerware, carrying the unique regional culture and artistic style of the Chu Kingdom. The history of Chu lacquerware dates back to the Warring States period and reached maturity during the Han Dynasty, forming a distinctive lacquerware production technique with strong regional

characteristics of the Chu Kingdom. Chu lacquerware stands out in terms of its form, decorative patterns, and craftsmanship (Figure 1). The Chu lacquerware culture was not only influenced by the technical advancements of the northern regions but also had exchanges and interactions in terms of craftsmanship and technology with various states, such as Zeng and Sui, which were annexed by the Chu Kingdom. It also had extensive contacts with neighboring countries like Ba and Shu (Hu, 2018). This open cultural environment allowed Chu daily-use lacquerware designs to "absorb the essence of multiple countries while eliminating their own deficiencies." It actively absorbed the excellent cultural influences from other nations while maintaining a cultural attitude that promoted the Chu-style aesthetics. Ultimately, this led to the development and elevation of domestic lacquerware design (Chen, 2003).

Figure 1 Tiger-based bird frame drum

(**Source:** Mu et al., 2023)

However, with the passage of time, Chu Culture Lacquerware is facing a crisis of being lost and urgently requires effective measures to protect and inherit this intangible piece of cultural heritage. Higher education institutions bear an important responsibility in protecting Chu lacquer craftsmanship. Some universities have attempted to protect and inherit Chu lacquer craftsmanship through the establishment of industry-academia-research cooperation models. Specifically, research teams have conducted studies on traditional lacquerware materials, developed modern lacquer art designs with cultural significance, explored improvements and advancements in lacquerware production techniques, as well as preservation and restoration of lacquerware. However, existing research shows that there are issues with the management system and collaboration mechanisms in university-industry-research cooperation, which have hindered the effectiveness of protecting these techniques. For example, a study titled "Research on the Collaborative Innovation Mechanism of 'I-U-R' in Local University-Industry-Research Cooperation" primarily explored the collaborative innovation mechanism of local university-industry-research cooperation, in which the industry, university, and research institutions collaborate, and studied its implementation effectiveness and existing problems (Tao, 2019).

The development of industry-academia-research collaboration is an important and highly regarded subject globally. Currently, with the increasing globalization of technology, research on industry-academia-research collaboration is entering a new stage of deeper and multidimensional development. International industry-academia-research collaboration has been rapidly growing, yielding fruitful research outcomes. Particularly, in the early 21st century, it has become an important choice for implementing national innovation-driven strategies (Fan & Tang, 2009). Similarly, in China, a series of policies have been introduced to promote the development of industry-academia-research collaboration. These include programs to enhance the innovation capacity of higher education institutions and the establishment of a technological innovation system that deeply integrates industry, academia, and research.

Despite achieving certain accomplishments, the development of industry-academia-research collaboration still faces numerous challenges. These challenges include inadequate management systems, ineffective collaboration mechanisms, low technology transfer rates, unfair distribution of benefits, and a disconnect between technology supply and demand. Particularly in the context of the inheritance and development of Chu lacquer craftsmanship, industry-academia-research collaboration lacks sufficient motivation and often takes on formal or short-term behavior, resulting in low technology transfer rates. These issues are closely related to the ineffectiveness of the development model and mechanisms of industry-academia-research collaboration, making it difficult to tap into the inherent driving force of collaboration and reducing the overall effectiveness of industry-academia-research development.

The role of universities in the inheritance of Chu Culture Lacquerware through industry-academia-research collaboration is crucial. University teachers, specialized programs, and research facilities provide an important foundation for the inheritance of Chu Culture Lacquerware. Chu Culture Lacquerware enterprises serve as vital carriers of the inheritance. These enterprises ensure the continuous development of Chu Culture Lacquerware by taking on traditional techniques and developing new products. The guidance and knowledge of cultural lacquerware experts are invaluable. Their mastery of traditional craftsmanship and foresight in industrial development are decisive forces in driving the inheritance process. Close collaboration and cooperation between industry, academia, and research play a key role in the inheritance and innovative development of Chu Culture Lacquerware. Moreover, it is necessary to strengthen university-enterprise cooperation and establish a flexible industry-academia-research platform.

In order to effectively protect and inherit Chu Culture Lacquerware, a systematic approach is required, considering and coordinating every aspect, so that various forces can align and collaborate for innovation. This not only involves the preservation of traditional techniques but also concerns how to promote and develop this ancient art form in modern society. The inheritance and innovation of Chu Culture Lacquerware require the collective efforts of multiple stakeholders, including the educational and research capabilities of universities, the production and market operation capabilities of enterprises, the policy support and financial investment from the government, as well as the technical guidance and innovative thinking from cultural lacquerware experts and craftsmen. Exploring and addressing the challenges of industry-academia-research collaboration in the inheritance of Chu lacquer craftsmanship can enrich and deepen the theory of industry-academia-research collaboration and provide valuable experiences and insights for the preservation and inheritance of other traditional crafts. The inheritance and development of Chu Culture Lacquerware also make significant contributions to the protection of Chinese traditional culture, enhancing cultural confidence, promoting cultural diversity, and fostering sustainable cultural development.

Research Objectives

1. To investigate the current status and challenges of the inheritance of Chu Culture Lacquerware and understand the public's perception and attitudes towards it.

2. To analyze the influencing factors of collaborative innovation capacity in universities and explore the impact of factors such as university-industry collaboration, internal and external motivations, research institution capabilities, and policy regulations on the collaborative innovation capacity in universities.

Research Methods

1. Literature Review

The literature review method involves analyzing existing literature to collect information and theoretical support. It involves in-depth reading and analysis of books, academic journal articles, reports, and papers. In this study, we conducted a literature review by consulting literature on the cultural ecology of the Chu region, Chu lacquerware craftsmanship, and other relevant journals, theses, and local records. This helped us understand the historical background, production techniques, and artistic characteristics of Chu culture lacquerware, as well as the historical development, current status, operational mechanisms, and existing issues of the university-industry-research management models in China and abroad.

2. Interviews

The interview method is a research approach that involves obtaining information through direct conversations. Interviews can be structured, semi-structured, or unstructured, depending on the research needs. In this study, we conducted interviews with respondents to gather their perspectives on the current status and challenges of inheriting Chu culture lacquerware, as well as their understanding and suggestions regarding the collaborative innovation capabilities of universities. We interviewed a total of 12 individuals in Hubei Province, including 3 university teachers in relevant disciplines, 3 inheritors of Chu lacquerware craftsmanship, 3 representatives from Chu lacquerware-related companies, and 3 Chu lacquerware experts. Through these interviews, we gathered their viewpoints, recommendations, and experiences, enriching the research content and conclusions on the inheritance, development, and policy support of Chu culture lacquerware and the university-industry-research model.

3. Questionnaire Survey

The questionnaire survey method involves designing and distributing questionnaires to collect data from a specific number of samples. The questionnaire consists of a series of questions aimed at understanding the respondents' perspectives, behaviors, experiences, or knowledge on specific topics. In this study, we designed questionnaires targeted at different audiences to understand their level of awareness, attitudes, and needs regarding Chu culture lacquerware, the university-industry-research collaborative innovation mechanism, and the relationship between the two. In the formal survey, a total of 405 questionnaires were distributed, resulting in 401 valid responses, achieving a response rate of 99.01%. We obtained 400 valid questionnaires, resulting in an effective rate of 99.75%.

4. Data analysis method

The method of data analysis consisted of analyzing, summarizing, and understanding the collected large amounts of data to maximize the exploitation of data's function. In this study, when researching the key factors of university-industry collaboration, methods such as descriptive analysis, correlation analysis, regression analysis, and mediation effect analysis were employed.

Research Scope

This study involves a comprehensive analysis of the current status and challenges of inheriting Chu culture lacquerware, combined with the development of university collaborative innovation capabilities. The research not only delves into the perception and inheritance issues of Chu culture lacquerware in modern society but also focuses on analyzing various factors such as university-industry cooperation, internal and external motivations, research institution levels, and policy regulations that affect the innovation capabilities of higher education institutions. The aim is to provide theoretical support and practical guidance for the effective inheritance and innovative development of Chu culture lacquerware.

Research Results

This study provides insights into the university-industry-research inheritance model of Chu culture lacquerware through questionnaire analysis. It establishes a moderated mediation model (Figure 2) with university-industry cooperation and internal and external motivations as independent variables, research institution level as a mediating variable, policy regulation as a moderating variable, and university collaborative innovation capability as the dependent variable. This research constructs a moderated mediation model to gain a deeper understanding of the inheritance strategies of Chu culture lacquerware.

The researchers will use descriptive statistical analysis to showcase the basic characteristics of the survey data. Descriptive statistical analysis can uncover various statistical features and provide an understanding of the basic distribution of the data. These features include minimum and maximum values, mean, standard deviation, and other data characteristics. Standard deviation is an important indicator that describes the degree of dispersion of the data. Descriptive statistical analysis is the most commonly used process for statistical description of continuous data.

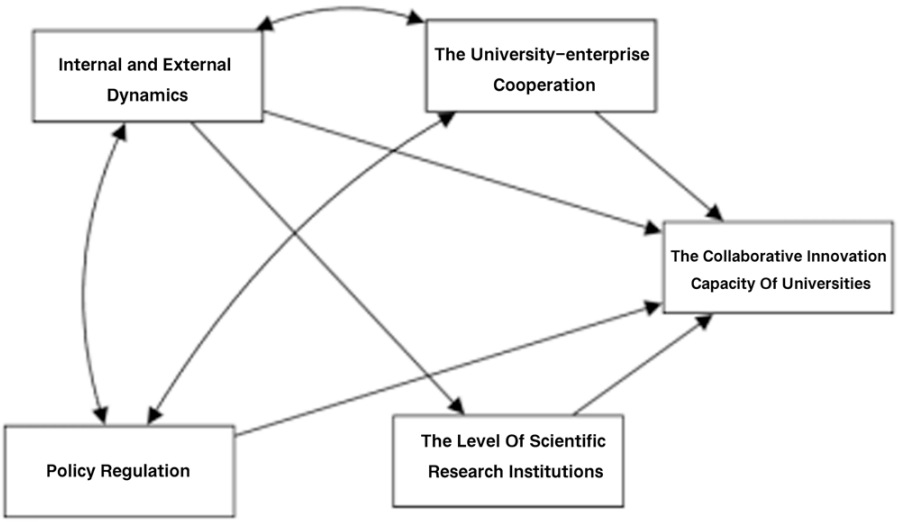

Figure 2 Theoretical Model

(**Source:** Mu et al., 2023)

Current Status and Challenges of Inheriting Chu Culture Lacquerware

The researchers focus on the public's level of awareness and attitudes towards Chu culture lacquerware. Through a detailed questionnaire survey targeting respondents of different age groups, genders, and occupational backgrounds, the study aims to explore the respondents' understanding of this art form, their sources of knowledge, and their perceptions of its cultural value. This in-depth analysis aims to provide a comprehensive and detailed overview of the current status of inheriting Chu culture lacquerware in contemporary society and the primary challenges it faces.

Table 1 Basic Information of Respondents

Category	Option	Frequency	Percentage
Gender	Male	206	51.50
	Female	194	48.50
Age	Below 18 years	67	16.75
	18-25 years	58	14.50
	26-35 years	93	23.25
	36-45 years	180	45.00
	46-55 years	2	0.50
Occupation	High School Student	67	16.75
	College student	100	25.00
	Teacher	233	58.25
Total		400	100

Table 1 displays basic information about the respondents, including age and gender. The surveyed population has a relatively balanced gender distribution, with slightly more male respondents, accounting for 51.50%, compared to female respondents at 48.50%. The age range is broad, with a concentration between 36-45 years and 26-35 years. The surveyed population is predominantly composed of teachers and high school students, with fewer university students participating.

Table 2 Respondents' Understanding of Lacquerware-related Content

Name	Option	Frequency	Percentage
The understanding degree of the lacquerware of the Chu culture	Very unfamiliar	67	16.75
	Not very familiar	58	14.50
	Average	93	23.25
	Quite familiar	180	45.00
	Very familiar	2	0.50
Chu culture lacquer ware understanding channels	Books	68	17.00
	Exhibitions	64	16.00
	Internet	99	24.75
	Folk artists and craftsmen	169	42.25
Production Techniques and Characteristics of Chu Culture Lacquerware	Very unfamiliar	59	14.75
	Not very familiar	63	15.75
	Average	101	25.25
	Quite familiar	177	44.25

Table 2 Respondents' Understanding of Lacquerware-related Content (cont.)

Name	Option	Frequency	Percentage
Possession of Chu Culture Lacquerware Collection	Yes	200	50.00
	No	200	50.00
Awareness of Market Value of Chu Culture Lacquerware	Very unfamiliar	79	19.75
	Not very familiar	40	10.00
	Average	63	15.75
	Quite familiar	154	38.50
	Very familiar	64	16.00
Willingness to Purchase Chu Culture Lacquerware as a Collection or Decoration	Purchase	205	51.25
	Not purchase	195	48.75
Perceived Practical Value of Chu Culture Lacquerware in Today's Society	Has practical value	180	45.00
	Does not have practical value	220	55.00
Willingness to Learn More about Chu Culture Lacquerware Knowledge and Information	Very unwilling	82	20.50
	Not very unwilling	92	23.00
	Average	22	5.50
	Quite willing	162	40.50
	Very willing	42	10.50
How Chu Culture Lacquerware Should be Inherited and Developed	Enhance publicity and promotion	64	16.00
	Cultivate more lacquerware craftsmen	59	14.75
	Innovative design and craftsmanship	97	24.25
	Improve product quality	180	45.00
Issues to be Addressed or Focused on in the Protection and Inheritance of Chu Culture Lacquerware	Issues of inheriting the production techniques of Chu cultural lacquerware	50	12.50
	Issues of inheriting the cultural connotation and historical value of Chu cultural lacquerware	60	15.00
	Issues of marketing and sales of Chu cultural lacquerware	57	14.25
	Issues of cultural industrialization and sustainable development of Chu cultural lacquerware	159	39.75
	Issues of inheritance and innovation of Chu cultural lacquerware in the digital era	74	18.50
Total		400	100

According to the survey results shown in Table 2, the majority of people have a certain level of understanding of Chu culture lacquerware, primarily obtained through folk artists, craftsmen, and the internet. There is relatively more awareness about the production techniques and characteristics of Chu culture lacquerware. Half of the respondents reported owning collections of Chu culture lacquerware and have some knowledge of its market value. Most people

express a willingness to purchase Chu culture lacquerware as collectibles or decorative items, but opinions vary regarding their practical value. Some individuals show interest in further understanding the knowledge and information related to Chu culture lacquerware.

Regarding the inheritance and development of Chu culture lacquerware, people believe that there is a need to improve product quality, strengthen promotional efforts, and encourage innovative designs. Moreover, attention should be given to issues of cultural industrialization, sustainable development, as well as the inheritance of cultural connotations and historical value while protecting and inheriting Chu culture lacquerware.

Table 3 Analysis of Education and Social Participation in the Conservation and Inheritance of Chu Culture Lacquerware

Name	Option	Frequency	Percentage
How should the school improve the management model for the protection and inheritance of Chu culture lacquerware?	Strengthening collaboration and communication with society.	60	15.00
	Establish dedicated conservation institutions and organizations.	256	64.00
	Establish scholarships and sponsorship programs.	84	21.00
How should the school offer courses related to Chu culture lacquerware?	Offer specialized courses.	181	45.25
	Offer elective courses.	61	15.25
	Offer public courses.	158	39.50
What else can the school do in the inheritance and development of Chu culture lacquerware?	Strengthen external communication and publicity.	189	47.25
	Enhance internal education and training.	111	27.75
	Promote the formulation of policies and regulations.	100	25.00
How should schools in Hubei Province participate in the protection and inheritance of Chu culture lacquerware?	Actively carry out teaching and research projects related to Chu culture lacquerware to cultivate more professional talents	72	18.00
	Establish relevant research centers and laboratories to conduct research and practical activities.	61	15.25
	Establish an exhibition and display platform for Chu culture lacquerware to promote its inheritance and development	66	16.50
	Strengthen collaboration with Chu culture lacquerware production enterprises, exploring cooperative mechanisms and models.	143	35.75
	Conduct conservation and restoration work for Chu culture lacquerware, and enhance the cultivation of awareness in cultural heritage protection.	58	14.50
What specific measures do you hope schools in Hubei Province will take in the protection and inheritance of Chu culture lacquerware?	Increase the number of exhibitions and promotional activities related to Chu culture lacquerware	103	25.75
	Establishment of a platform for the industrialization of artwork related to Chu culture lacquerware	76	19.00
	Strengthening the Conservation and Restoration of Chu Culture Lacquerware	87	21.75
	Increasing public awareness of Chu culture lacquerware	134	33.50
For the preservation and inheritance methods of Chu culture lacquerware, which approach do you prefer?	Inheritance through training courses on lacquerware making techniques, etc.	124	31.00
	Passing on through lacquer art exhibitions and cultural lectures	60	15.00
	Passed down through a lacquerware making competition and other means	57	14.25
	Passing on through lacquer art exhibitions and cultural lectures	159	39.75

Table 3 Analysis of Education and Social Participation in the Conservation and Inheritance of Chu Culture Lacquerware (cont.)

Name	Option	Frequency	Percentage
How should schools strengthen the integration of industry, academia, and research in the field of Chu culture lacquerware?	Cooperating with enterprises related to Chu culture lacquerware to develop new products together	189	47.25
	Carrying out research and exploration of Chu culture lacquer ware and promoting technological innovation	57	14.25
	Establishing an industrialization platform for Chu culture lacquerware and promoting industrial development	100	25.00
	Carrying out social practice and internship activities of Chu culture lacquer ware, improving students' practical ability to research and explore the lacquer ware, and promoting technological innovation.	54	13.50
How should schools strengthen the training of talents in the inheritance of Chu culture lacquerware?	Strengthening the teaching and transfer of Chu culture lacquerware production techniques	60	15.00
	Establishing Chu Culture Lacquerware specialization or related majors	170	42.50
	Conducting activities such as the Chu Culture Lacquerware Making Craft Competition to improve the skills of students	84	21.00
	Practical activities in cooperation with enterprises related to Chu culture lacquerware	86	21.50
How should schools promote Chu culture lacquerware to enhance its visibility and influence in society?	Organizing exhibitions and displays of Chu culture lacquerware, so that more people can understand Chu culture lacquerware	150	37.50
	Carrying out publicity and promotional activities for Chu culture lacquerware to increase its visibility and influence	61	15.25
	Establishing a publicity platform for Chu culture lacquerware on the Internet, so that more people can understand Chu culture lacquerware	62	15.50
	Cooperating with cultural and tourism-related departments to promote Chu cultural lacquerware	127	31.75
What role should the government play in the protection and inheritance of lacquerware of Chu culture?	Strengthening the legal protection of Chu culture lacquerware and the protection of cultural relics	62	15.50
	Introducing relevant policies to promote the protection and inheritance of Chu culture lacquerware	184	46.00
	Increasing investment in research and education related to Chu culture lacquerware	100	25.00
	Strengthening the publicity and promotion of Chu culture lacquerware and increasing public awareness of Chu culture lacquerware	54	13.50
What role should enterprises play in the protection and inheritance of Chu culture lacquerware?	Strengthening the production and sale of Chu culture lacquerware and promoting the development of Chu culture lacquerware	72	18.00
	Strengthening the publicity and promotion of Chu culture lacquerware and increasing public awareness of Chu culture lacquerware	119	29.75
	Focusing on the technological development and innovation of Chu culture lacquerware to promote industrial development	66	16.50
	Strengthening the cultivation and support for the inherited talents of Chu culture lacquerware	143	35.75

Table 3 Analysis of Education and Social Participation in the Conservation and Inheritance of Chu Culture Lacquerware (cont.)

Name	Option	Frequency	Percentage
What role should the public play in the protection and inheritance of Chu culture lacquerware?	Emphasizing the protection and inheritance of Chu culture lacquerware and actively participate in related activities	58	14.50
	Enhancing knowledge and understanding of Chu culture lacquerware and improving public cultural literacy	121	30.25
	Supporting the production and sale of Chu culture lacquerware and contributing to the development of Chu culture lacquerware	87	21.75
	Strengthening the publicity and promotion of Chu cultural lacquerware, and increasing the visibility and influence of Chu cultural lacquerware	134	33.50
In the protection and inheritance of Chu culture lacquerware, what other problems need to be solved or need to be paid attention to?	The inheritance of lacquerware production techniques in the Chu culture	50	12.50
	The inheritance of cultural connotations and historical value of lacquerware of Chu culture	60	15.00
	Marketing and sales issues of Chu culture lacquerware	57	14.25
	Cultural industrialization and sustainable development of Chu culture lacquerware	159	39.75
	The inheritance and innovation of Chu culture lacquerware in the age of digitization	74	18.50
Total		400	100

Based on the analysis of the survey results from the sample, Table 3 reveals the following observations and suggestions regarding how schools can improve the management model for the protection and inheritance of Chu culture lacquerware:

In terms of the protection and inheritance of Chu culture lacquerware, it is necessary to strengthen cooperation and communication with society. This can be achieved by establishing specialized protection institutions and organizations. Additionally, efforts should be made to enhance the protection and inheritance of Chu culture lacquerware through the implementation of relevant courses, increased external exchanges and promotion, as well as strengthened internal education and training.

The government, enterprises, and the general public should also bear their respective responsibilities and actively participate in the protection and inheritance of Chu culture lacquerware. By doing so, they can collectively promote the traditional art of Chu culture lacquerware towards broader development.

Furthermore, attention should be given to key issues in the inheritance process of Chu culture lacquerware, including the transmission of craftsmanship, the preservation of cultural connotations, market promotion and industrialization, as well as digital heritage and innovation. Only through the joint efforts of all stakeholders can the protection and inheritance of this important cultural heritage, Chu culture lacquerware, be effectively achieved.

5.2 Analysis of the Collaborative Innovation Model of Production, Education, and Research in Chu Culture Lacquerware

Correlation refers to the uncertain dependency relationship between variables, where one variable cannot uniquely determine the value of another variable when the former takes on a certain value. However, they still exhibit certain patterns of variation within a certain range. The correlation coefficient accurately describes the degree and direction of the linear relationship between variables using numerical values. Correlation analysis does not require distinguishing

between independent and dependent variables. To study the degree of correlation between variables, a correlation coefficient is used. A correlation coefficient smaller than 0 indicates a negative correlation, while a positive correlation is indicated when the coefficient is greater than 0. The closer the correlation coefficient is to 1, the stronger the correlation between the variables.

Table 4 Correlation Analysis of Key Factors in University Collaborative Innovation

	University Collaborative Innovation Capability	Internal and External Forces	Industry-University Collaboration	Policy Regulation	Research Institution Level
University Collaborative Innovation Capability	1				
Internal and External Forces	0.780**	1			
Industry-University Collaboration	0.712**	0.742**	1		
Policy Regulation	0.665**	0.576**	0.598**	1	
Research Institution Level	0.720**	0.755**	0.783**	0.661**	1

From Table 4, it can be observed that the correlation analysis was used to study the relationships between four factors: collaborative innovation capability of universities, internal and external driving forces, university-industry cooperation, policy regulation, and research institution level. The Pearson correlation coefficient was used to measure the strength of these relationships. The analysis reveals the following:

The collaborative innovation capability of universities shows significant positive correlations with internal and external driving forces (correlation coefficient = 0.780), university-industry cooperation (correlation coefficient = 0.712), policy regulation (correlation coefficient = 0.665), and research institution level (correlation coefficient = 0.720). All correlation coefficients are greater than 0, indicating positive correlations between the collaborative innovation capability of universities and the other four factors. There is a close relationship and interaction among these factors.

Based on the purpose of this research, with internal and external driving forces and university-industry cooperation as independent variables, the collaborative innovation capability of universities as the dependent variable, research institution level as the mediating variable, and policy regulation as the moderating variable, the study employed Process Model 5 to investigate these relationships.

Table 5 Regression Analysis Results of Factors Influencing University Collaborative Innovation Capability

	Regression Coefficients	95% CI	Collinearity Diagnosis	
			VIF	Tolerance
Constant	0.146 (1.135)	-0.106 ~ 0.397	-	-
Internal and External Forces	0.492** (10.698) T statistic	0.402 ~ 0.582	2.222	0.450
Industry-University Collaboration	0.263** (5.714)	0.173 ~ 0.353	2.222	0.450

Table 5 Regression Analysis Results of Factors Influencing University Collaborative Innovation Capability (cont.)

	Regression Coefficients	95% CI	Collinearity Diagnosis	
			VIF	Tolerance
Sample Size		290		
R^2		0.648		
AdjustedR^2		0.646		
***F*-Value**		264.137***		
Dependent Variable: University Collaborative Innovation Capability				
***p<0.05 **p<0.01, values in parentheses are t-values**				

From Table 5, it can be observed that a linear regression analysis was conducted with internal and external driving forces, and university-industry cooperation as independent variables, and the collaborative innovation capability of universities as the dependent variable. The model equation derived from the analysis is as follows: Collaborative innovation capability = 0.146 + 0.492 * internal and external driving forces + 0.263 * university-industry cooperation (Figure 3).

According to the regression results, the coefficient of determination (R-squared) is relatively high at 0.648, and the adjusted R-squared is 0.646. This indicates that the regression equation provides a relatively good fit to the data and explains a substantial portion of the overall variance in the dependent variable. The analysis suggests that the independent variables explain a significant portion of the variation in the dependent variable.

The analysis of variance (ANOVA) results show an F-value of 264.137. By consulting the F-distribution table, it is determined that the F-value exceeds the critical value, indicating that the overall equation is significant. The significance level for the F-test is 0.000, which is less than the significance level of 0.05, confirming the overall significance of the model.

The regression coefficient for internal and external driving forces is 0.492 (t = 10.698, p = 0.000 < 0.01), indicating a significant positive relationship between internal and external driving forces and the collaborative innovation capability of universities. Similarly, the regression coefficient for university-industry cooperation is 0.263 (t = 5.714, p = 0.000 < 0.01), indicating a significant positive relationship between university-industry cooperation and the collaborative innovation capability of universities.

In conclusion, the analysis demonstrates that both internal and external driving forces and university-industry cooperation have a significant positive impact on the collaborative innovation capability of universities.

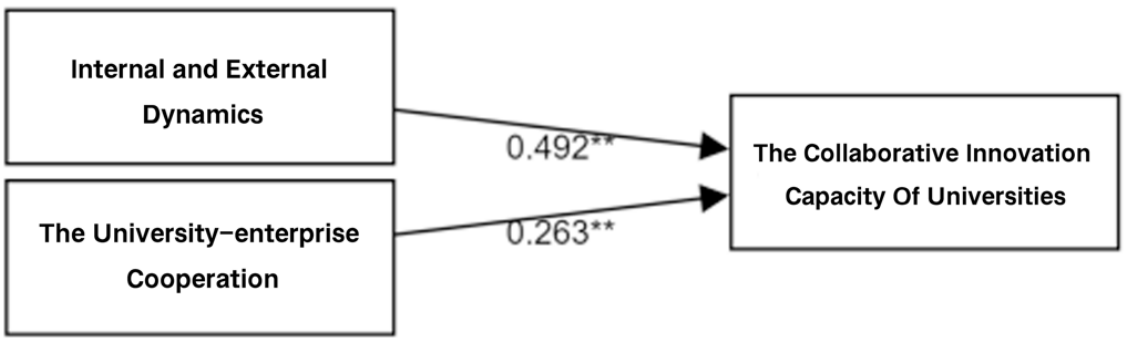

Figure 3 Regression Coefficient Diagram

(**Source:** Mu et al., 2023)

Table 6 Multivariate Regression Analysis Results of University Collaborative Innovation Capability

	University Collaborative Innovation Capability	Research Institution Level	University Collaborative Innovation Capability
Constant	0.146	0.397**	0.076
	(1.135)	(2.820)	(0.593)
Internal and External Forces	0.492**	0.393**	0.422**
	(10.698)	(7.802)	(8.495)
Industry-University Collaboration	0.263**	0.504**	0.174**
	(5.714)	(9.987)	(3.319)
Research Institution Level			0.176**
			(3.326)
Sample Size	290	290	290
R^2	0.648	0.681	0.661
Adjusted R^2	0.646	0.679	0.658
***F*-Value**	264.137***	306.828***	185.952***
***p<0.05 **p<0.01, values in parentheses are t-values**			

From Table 6, it can be observed that the independent variables, internal and external driving forces, and university-industry cooperation have a significant correlation with the collaborative innovation capability of universities. Based on the theory of mediation, we found that the significance of the independent variables in the second model is 0.000, rejecting the null hypothesis and indicating that the coefficient (c) in the equation Y=cX+e1 is significant. This implies that the independent variables, internal and external driving forces, and university-industry cooperation have a significant direct effect on the dependent variable, the collaborative innovation capability of universities. In other words, internal and external driving forces and university-industry cooperation can directly predict the collaborative innovation capability of universities.

In the second step, we conducted a test on the regression equation of the independent variables on the mediating variable, research institution level. Referring to the coefficient table above, we found that the significance of the independent variables on the research institution level is less than the significance level of 0.05. Therefore, we reject the null hypothesis and conclude that the independent variables can predict the research institution level. This indicates that internal and external driving forces and university-industry cooperation can influence the research institution level.

Furthermore, we examined the relationship between the mediating variable, research institution level, and the dependent variable. It was found that the significance of the research institution level on the dependent variable, the collaborative innovation capability of universities, is less than the significance level of 0.05. This suggests that the research institution level has a significant impact on the collaborative innovation capability of universities.

In conclusion, our findings indicate the presence of a mediating effect in the model. When the independent variables, internal and external driving forces, have a significant impact on the collaborative innovation capability of universities, the research institution level acts as a mediator.

Table 7 Statistical Analysis Results of University Collaborative Innovation Capability and Its Influencing Factors

	University Collaborative Innovation Capability	Research Institution Level
Constant	-0.270 (-1.150)	0.885** (5.790)
Internal and External Forces	0.563** (7.703)	0.767** (19.563)
Policy Regulation	0.337** (3.882)	
Interaction Effect of Internal and External Forces with Policy Regulation	The coefficient is 0.041* with a p-value less than the significance level of 0.05 (2.102).	
Research Institution Level	0.126** (2.598)	
Sample Size	290	290
R^2	0.692	0.571
Adjusted R^2	0.687	0.568
***F*-Value**	160.358***	382.708***
***p<0.05 **p<0.01, values in parentheses are t-values**		

According to Table 7, both internal and external driving forces and policy regulation have a significant impact on the collaborative innovation capability of universities. The correlation coefficients for internal and external driving forces and policy regulation are 0.563 and 0.337, respectively. This indicates that increasing internal and external driving forces and policy regulation can enhance the collaborative innovation capability of universities.

R2 and adjusted R2 are indicators used to assess the goodness of fit of the model. The results show that the R2 is 0.571 and the adjusted R2 is 0.568, suggesting that the model can explain 57.1% and 56.8% of the variation in collaborative innovation capability between universities and research institution level, respectively.

The F-value is an indicator used to test the overall significance of the model. The results show an F-value of 382.708***, indicating that the model is highly significant statistically. This suggests that the impact of collaborative innovation capability, internal and external driving forces, and policy regulation on the research institution level is significant.

The regression coefficient for the interaction term of internal and external driving forces and policy regulation is 0.041, and the p-value is less than the significance level. Therefore, we reject the null hypothesis and conclude that the interaction between internal and external driving forces and policy regulation plays a facilitating role in the collaborative innovation capability of universities.

In summary, the collaborative innovation capability of universities has a significant impact on the research institution level and is influenced by internal and external driving forces and policy regulation. Additionally, the interaction between internal and external driving forces and policy regulation may also have an effect on the collaborative innovation capability of universities.

Table 8 Regression Analysis Results of the Impact of Industry-University Collaboration and Policy Regulation on Research Institution Level

	University Collaborative Innovation Capability	Research Institution Level
Constant	-0.645*	0.778**
	(-2.015)	(5.365)
Industry-University Collaboration	0.547**	0.795**
	(5.815)	(21.392)
Policy Regulation	0.609**	
	(4.570)	
Interaction Effect of Industry-University	0.094**	
Collaboration and Policy Regulation	(3.325)	
Research Institution Level	0.179**	
	(3.149)	
Sample Size	290	290
R^2	0.636	0.614
Adjusted R^2	0.629	0.611
***F*-Value**	124.347***	457.636***

*** *p*<0.05 ** *p*<0.01, values in parentheses are t-values.**

From the table above, it can be seen that the linear regression analysis is conducted with school-enterprise cooperation as the independent variable and the level of scientific research institutions as the dependent variable. The model equation is: Level of scientific research institutions = 0.778 + 0.795 * school-enterprise cooperation. The model's R-square value is 0.614, which means that school-enterprise cooperation can explain 61.4% of the variation in the level of scientific research institutions.

The F-test conducted on the model shows that the model passes the F-test (F=457.636, p=0.000<0.05), which means that school-enterprise cooperation definitely has an impact on the level of scientific research institutions. Further analysis reveals that the regression coefficient for school-enterprise cooperation is 0.795 (t=21.392, p=0.000<0.01), indicating a significant positive relationship between school-enterprise cooperation and the level of scientific research institutions. Additionally, the regression coefficient for the interaction between school-enterprise cooperation and policy regulation is 0.094, with a T-value of 3.325 and a p-value smaller than the significance level of 0.05. This leads to the rejection of the null hypothesis and suggests that school-enterprise cooperation has a significant impact on the collaborative innovation capability of universities, and policy regulation plays a moderating role.

The results of the descriptive statistical analysis show that the surveyed samples cover different genders, age groups, and identities, and overall have a certain level of understanding and attention to Chu cultural lacquerware. The results of the regression analysis indicate that both internal and external motivations and school-enterprise cooperation have a significant positive impact on the collaborative innovation capability of universities. This implies that cultivating internal motivation, providing external incentives, and strengthening school-enterprise cooperation are key factors for enhancing the collaborative innovation capability of universities. The verification analysis also reveals that the level of scientific research institutions partially mediates the relationship between internal and external motivations and collaborative innovation in universities. This suggests that improving the level of scientific research institutions will help transform internal and external motivations into collaborative innovation outputs in universities.

It can be seen that school-enterprise cooperation significantly influences the level of scientific research institutions, and the level of scientific research institutions also positively affects the collaborative innovation capability of universities. This indicates that school-enterprise cooperation can enhance the capacity of scientific research institutions and thus have a positive impact on university innovation.

Overall, internal and external motivations, school-enterprise cooperation, and policy support are key factors affecting and promoting the cooperation between universities, industry, and research institutions. Internal and external motivations influence the innovation awareness of universities, while school-enterprise cooperation provides channels for university innovation, and policy support creates an environment supportive of innovation. In addition, the improvement of the level of scientific research institutions plays a crucial role in this process. Therefore, cultivating innovation awareness, providing policy support, establishing industry-university-research platforms, and continuously enhancing research capabilities are key measures to promote and achieve deep cooperation between universities, industry, and research institutions (Li, 2021).

Conclusion and Discussion

Based on an in-depth analysis of the inheritance of Chu cultural lacquerware and the collaborative innovation capabilities of universities, this study draws the following conclusions:

1. This study provides a comprehensive analysis of the current status and challenges faced by Chu cultural lacquerware. The research findings indicate that the public has some understanding and interest in Chu cultural lacquerware, primarily obtaining information through channels such as folk artists, craftsmen, and the internet. However, their understanding of the deep cultural value and practicality of Chu cultural lacquerware is still limited, and there are differences in the perception of its market and practical value. The inheritance and development of Chu cultural lacquerware face various issues, including the transmission of craftsmanship, the protection of cultural connotations and historical value, market promotion, industrialization, and sustainable development.

2. Through correlation and regression analysis, this study explores the relationship between university collaborative innovation capabilities and internal and external driving forces, university-industry cooperation, policy regulation, and the level of research institutions. The results show a significant positive correlation between these factors. Internal and external driving forces and university-industry cooperation have a direct positive impact on university collaborative innovation capabilities. The level of research institutions plays a partial mediating role between the internal and external driving forces and collaborative innovation capabilities. Policy regulation not only directly affects university collaborative innovation capabilities but also plays a moderating role in the relationship between university-industry cooperation and collaborative innovation capabilities. These findings provide theoretical and practical foundations for formulating industry-academia-research strategies, promoting university-industry cooperation, and developing relevant government policies.

The study demonstrates the recognition and inheritance status of Chu cultural lacquerware in contemporary society. Compared to most studies that emphasize the craftsmanship of lacquerware, this study focuses more on the diversity and complexity of lacquerware culture cognition. It analyzes the public's understanding of the basic knowledge and cultural value of Chu cultural lacquerware, as well as the main challenges in its inheritance and development. These challenges include the preservation of craftsmanship, market promotion, the exploration of cultural connotations, and adaptation to the digital age. It is necessary to enhance the public's understanding of the deep cultural and practical value, which poses new requirements for the long-term inheritance of lacquerware culture.

Furthermore, through the exploration of university collaborative innovation capabilities, this study confirms the significant impact of internal and external driving forces, university-industry cooperation, and policy regulation on university collaborative innovation capabilities. In particular, university-industry cooperation plays a key role in promoting university innovation, and the level of research institutions serves as a mediating variable that further strengthens this impact. Policy regulation not only directly promotes university innovation but also plays an important moderating role in the relationship between university-industry cooperation and collaborative innovation. These findings are of great significance for understanding and promoting deep cooperation between universities and enterprises. Compared to existing literature, this research offers a new perspective on the analysis of university collaborative innovation capabilities, further verifying through empirical data the role of the research institution level as a mediating variable.

Research Recommendations

1. General Recommendations

Policy and Regulatory Framework: The government should strengthen the policy design for industry-academia-research cooperation, establish preferential policies to incentivize collaboration between enterprises and universities, and clarify the rights and obligations of all parties involved. For instance, by providing tax incentives, research and development subsidies, and preferential policies, the threshold and cost of cooperation can be reduced, enhancing its attractiveness. Additionally, attention should be given to intellectual property protection to ensure the interests of both collaborating parties.

Construction of Collaboration Platforms: Universities should establish collaboration platforms closely aligned with the government and enterprises, focusing on market demand, optimizing program offerings, and establishing long-term strategic relationships with enterprises. Efforts should be made to promote the development of industry-academia-research parks and technology incubators, exploring diverse collaboration models. Through these platforms, diverse cooperation models such as resource sharing, collaborative research, technology exchange, and talent exchange can be realized.

Talent Development and Faculty Incentives: Universities should deepen talent development mechanisms by designing courses that align with industry development needs and enhance students' practical abilities. Simultaneously, universities should foster a positive industry-academia-research culture to stimulate a faculty's intrinsic motivation to participate in collaboration and enhance the attractiveness of research activities. In addition, universities should increase internship and practical training opportunities, and promote student participation in industry-academic-research projects.

2. Further Research Recommendations

In-depth Field Research: Future research can delve into specific fields of industry-academia-research collaboration, such as collaborative innovation models in specific technological areas or industries. This includes analyzing the dynamics, challenges, and impacts of industry-academia-research collaboration in specific sectors on innovation and development. Moreover, the adaptability of specific industry cooperation models can be researched, as well as how to apply successful models to other industries or fields.

Interdisciplinary Methodology: It is recommended to adopt interdisciplinary research methods to explore the social, economic, and cultural factors within industry-academia-research collaboration, such as organizational behavior and market dynamics. This approach will facilitate a comprehensive understanding of the complexity and multidimensional impact of collaboration. This includes building effective communication and coordination mechanisms to foster understanding and cooperation among participants from different backgrounds and professional fields.

Long-term Impact Assessment: Future research can focus on the long-term effects of industry-academia-research collaboration, including its influence on research output, technological innovation, talent development, and economic growth. Long-term tracking studies can provide deeper insights for policy-making and practice optimization. Moreover, future research can analyze the changes in benefits at different stages of industry-academic-research cooperation, identify new issues, needs, and adjustment strategies that arise during the continuous cooperation process.

International Collaboration Models: Future research can explore the models of industry-academic-research cooperation in different countries and cultural backgrounds, compare the strategies, structures, and cultural differences of industry-academic-research cooperation in different countries and regions, especially in international cooperation projects under globalization. Moreover, future research can analyze successful cases and failure experiences of industry-academic-research cooperation from a global perspective, exploring cooperation models that adapt to different cultural and market environments.

Acknowledgements

I am deeply grateful for the help and support I have received from many individuals throughout the completion of this research. First and foremost, I would like to express our special thanks to my doctoral supervisor.

I would also like to express my gratitude to all the participants who took part in the survey. Their sincere feedback and valuable opinions have been the cornerstone of this research, providing me with abundant first-hand data. Their willingness to contribute has been invaluable to the success of this study.

Lastly, I want to extend my gratitude to all those who have directly or indirectly provided assistance and support throughout this research process. This research represents an important achievement during my doctoral studies, and I am thankful to all those who have helped and supported me along the way.

References

Chen, Z. (2003). Research on Chu Lacquerware Group in the Warring States Period. *Archaeological Research*, (00), 701-719.

Fan, D. & Tang, X. (2009). Performance Evaluation of Industry-University-Research Collaboration Technology Innovation in Various Provinces and Cities in China. *Studies in Science of Science*, (01), 66-70.

Hu, Y. (2018). The Concept of Creation in Chu Lacquerware. *Journal of Hubei Vocational and Technical College*, (04), 70-74. doi:10.16347/j.cnki.cn42-1742/z.2018.04.015.

Li, X. (2021). *Research on the Dynamic Mechanism and Model of Industry-University-Research Collaborative Innovation*. Doctoral Dissertation, Ph.D. in Mechanics, Dalian University of Technology, China. (In Chinese)

Mu, P. & Others. (2023). Figure 1 *Tiger-based bird frame drum*.

Mu, P. & Others. (2023). Figure 2 *Theoretical Model*.

Mu, P. & Others. (2023). Figure 3 *Regression Coefficient Diagram*.

Tao, D. (2019). *Research on Mechanism of "I-U-R" Collaborative Innovation of Local Universities*. Doctoral Dissertation, Southwest University, China. (In Chinese)