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The 6th International Conference

Vol.4

Management, Business Administration,
Social Sciences & Humanities

May 1 – 2, 2025

Grand Pacific Sovereign Resort & Spa, Cha-am, Phetchaburi Province, Thailand

Organized by King Mongkut's Institute of Technology Ladkrabang,
Prince of Chumphon Campus, Chumphon Province, Thailand

65 KMITL Prince of Chumphon
Happy Learning Campus

The 10th National Conference and The 6th International Conference on Informatics, Agriculture, Management, Business Administration, Engineering, Sciences and Technology (IAMBEST 2025)

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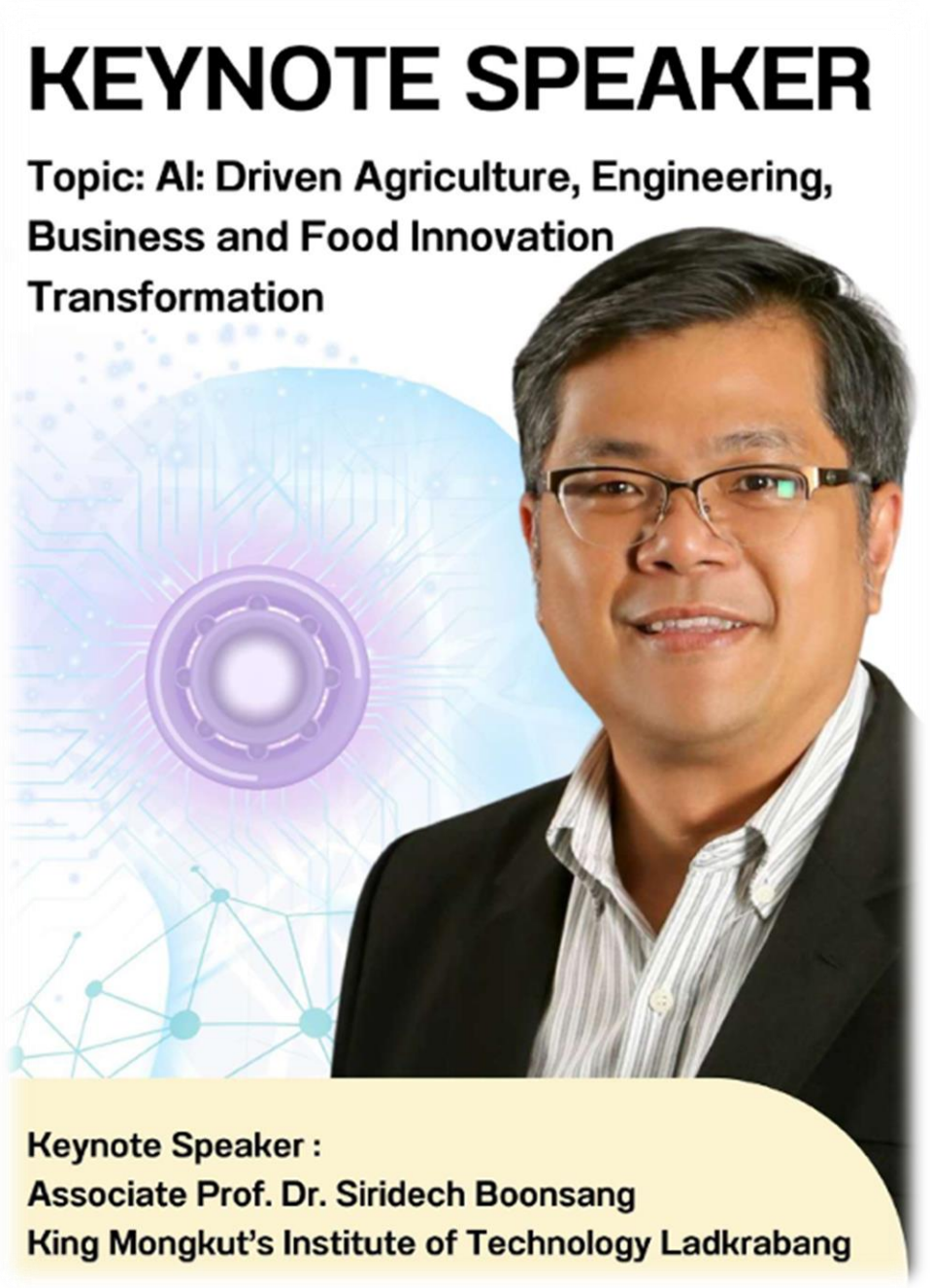
MESSAGE FROM THE EXECUTIVE VICE PRESIDENT KMITL, PRINCE OF CHUMPHON CAMPUS

The 6th International Conference on Informatics, Agriculture, Management, Business Administration, Engineering, Science, and Technology (IAMBEST 2025), along with the 10th National Conference on Informatics, Agriculture, Management, Business Administration, Engineering, Science, Technology, Social Sciences, and Humanities, are conferences for academics, experts, and researchers in the eight fields. The conferences are hosted by the King Mongkut's Institute of Technology Ladkrabang (KMITL), Prince of Chumphon Campus, during 1-2 May 2025. The aim of these conferences is to provide an exchange stage for ideas, knowledge, and research among researchers from various fields. The continued development of research fosters the exchange of knowledge, connections, collaboration, and integration among one another. All of the above contributes to the development of the community, society, and country.

As the chairman of IAMBEST 2025, I sincerely thank all committee members for your time and determination in organizing this wonderful conference. I thank all attendees and guests for sharing your research and innovation. The success of this conference is due to all of you. I wish that the exchange of ideas and sharing of knowledge from this conference will provide you with another step to advance your knowledge and technology and to benefit your communities and countries.

Best wishes to all of you.

(Assoc. Prof. Dr. Kamronwit Thipmanee)
Executive Vice President,
KMTIL, Prince of Chumphon Campus
Chairman of the Organizing Committee


KEYNOTE SPEAKER
Topic: AI: Driven Agriculture, Engineering, Business and Food Innovation Transformation
Keynote Speaker :
Associate Prof. Dr. Siridech Boonsang
King Mongkut's Institute of Technology Ladkrabang

Contents

Contents International Conference

Oral Presentation

Group M : Management

Group SS : Social Sciences & Humanities (ด้านสังคมศาสตร์และมนุษยศาสตร์)

Program

The 10th National Conference and The 6th International Conference 2025
on Informatics, Agriculture, Management, Business Administration,
Engineering, Sciences and Technology (IAMBEST 2025)
May 1-2, 2025
Grand Pacific Sovereign Resort & Spa Hotel, Cha-am, Phetchaburi, Thailand

April 30, 2025

16.00 – 18.30	The meeting of distinguished experts and the judging committee, speakers, and networks for the national and international academic conference IAMBEST 2025	
17.00 – 18.30	Installation of poster	Foyer 2

May 1, 2025

08.00 – 08.30	Registration and Installation of poster and soft file presentation	Foyer 1
08.30 – 09.00	Open Ceremony The 10th National Conference and The 6th International Conference 2025	
09.00 – 10.00	Keynote Speaker	Petch
	Topic AI: Driven Agriculture, Engineering, Business and Food Innovation Transformation	Siam Ballroom
	By Associate Prof. Dr. Siridech Boonsang	
10.00 – 10.15	Coffee break	
10.15 – 12.00	Speaker Topic AI: Driven Agriculture, Engineering, Business and Food Innovation Transformation	Business Center
	By Associate Prof. Dr. Siridech Boonsang	
10.30 – 12.00	International Conference (Oral Presentation)	
	Session I: Informatics and Engineering	Petch Chompoo
	International Conference (Poster Presentation)	Foyer 2
	National Conference (Oral Presentation)	
	Session 1 : Informatics and Technology	Petch Amphan
	Session 4 : Business administration and Social Science & Humanities	Petch Phailin
	National Conference (Poster Presentation)	
	Session 1 Agriculture	Foyer 2
	Session 3 Management and Business administration	Foyer 2
12.00 - 13.00	Lunch break	

Program

The 10th National Conference and The 6th International Conference 2025
on Informatics, Agriculture, Management, Business Administration,
Engineering, Sciences and Technology (IAMBEST 2025)
May 1-2, 2025
Grand Pacific Sovereign Resort & Spa Hotel, Cha-am, Phetchaburi, Thailand

May 1, 2025

13.00 – 14.30	International Conference (Oral Presentation)	
	Session II : Engineering	Petch Chompoo
	Session IV : Agriculture and Sciences	Petch Siam Ballroom
	National Conference (Oral Presentation)	
	Session 2 Management	Petch Amphan
	Session 5 Agriculture and Sciences	Petch Phailin
	National Conference (Poster Presentation)	
	Session 2 : Technology and Engineering	Foyer 2
	Session 4 : Sciences	Foyer 2
14.30 - 14.45	Coffee break	
	International Conference (Oral Presentation)	
14.15 – 15.30	Session V: Management and Social Science & Humanities	Petch Siam Ballroom
14.45 – 17.30	Session III : Engineering	Petch Chompoo
14.15 – 17.30	National Conference (Oral Presentation)	
	Session 3: Engineering	Petch Amphan
	Session 6: Business administration	Petch Phailin
18.30 – 21.00	*Dinner*	Petch Siam Ballroom

May 2, 2025

10.00 – 11.30	The Network Meeting for the National and International Academic Conference IAMBEST 2025.	

Remarks: The program can be adjusted.

Program International Conference (Oral Presentation)

Session V: Management and Social Science & Humanities — Petch Siam Ballroom

Chairperson	Asst. Prof. Dr.Ousanee Sawagvudcharee — KMITL Prince of Chumphon Ms. Yenying Chongchit — KMITL Prince of Chumphon	
Time	Code	Topic
14.30 – 14.45	OM-63	Knowledge Interaction Capability and Enterprise Innovation Performance in Open Innovation Ecosystems: Quantitative Analysis and Validity Study of Questionnaire Design *Dan Zhang Noppadol Amdee Adisak Sangsongfa and Choat Inthawongse*
14.45 – 15.00	OSS-86	Enhancing Adolescent Oral Health Education Through Gamification *Wachirawat Angkatavanich and Pratchayapong Yasri*
15.00 - 15.15	OSS-108	Masculinity representation in TV series: a CDA analysis of “Cherry Magic Japan” and “Cherry Magic Thailand” *Nicolas Barcikowsky*

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Oral Presentation

Knowledge Interaction Capability and Enterprise Innovation Performance in Open Innovation Ecosystems: Quantitative Analysis and Validity Study of Questionnaire Design

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Abstract. This study aims to investigate the measurement and reliability analysis of knowledge interaction capabilities in open innovation ecosystems, focusing on the context of enterprise in Zhejiang Province, China. As technological innovation becomes a driving force for economic growth, developing a valid instrument for assessing knowledge interaction capabilities is particularly important. In this study, a structured questionnaire was developed covering multiple dimensions of knowledge interaction capability, open innovation ecological networks, and firm innovation performance. We analyzed the importance of knowledge interaction capability in corporate innovation by assessing specific aspects of knowledge acquisition, assimilation, integration, application, and sharing. Meanwhile, the reliability and validity of the questionnaire were analyzed using the Cronbach alpha coefficient and KMO test to ensure the reliability of the measurement tool. The study focuses on the validity and applicability of the scale to provide a solid foundation for future empirical research.The results demonstrated strong reliability and validity of the questionnaire, providing a solid foundation for future research.

***Index Terms*—Open Innovation Ecosystems, Knowledge Interaction Capabilities, Enterprise Innovation Performance, Questionnaire Design, Reliability Analysis.**

I. INTRODUCTION

Technological innovation has become a key factor in driving economic growth and enterprise competitiveness in today's fast-changing business environment. With globalization and the rapid development of information technology, enterprises face an increasingly complex external environment, and relying solely on internal resources for innovation is no longer sufficient to respond to the market's changing needs. The rise of open innovation theory provides a new perspective for enterprises, emphasizing the use of external knowledge and resources to accelerate the innovation process through collaboration with external partners [1] . In this context, knowledge interaction capability has received increasing attention as a core capability for firms to engage in open innovation.

Knowledge interaction capabilities, which include a firm's ability to acquire, assimilate, integrate, apply, and share knowledge, not only affect a firm's innovation activities but also directly affect the effectiveness and efficiency of innovation [2] . However, even though studies have explored the relationship between knowledge interaction capabilities and firms' innovation performance, there is still a dearth of scales for measuring and assessing knowledge interaction capabilities effectively [3] . Therefore, establishing a set of scientific and practical assessment tools for knowledge interaction capability has essential theoretical and practical significance.

This study aims to develop a scale for knowledge interaction capability and analyze its reliability and validity to ensure its validity and applicability in an open innovation ecosystem. Focusing on the corporate environment in Zhejiang Province, China, the study will collect data through quantitative questionnaires to systematically assess multiple dimensions of knowledge interaction capabilities. In addition, we will explore how these dimensions affect enterprises innovation performance and their relationship with the open innovation ecosystem network. This study contributes by developing and validating a reliable instrument for measuring knowledge interaction capability within open innovation ecosystems.By conducting this study, we expect to provide a solid foundation for future empirical research and practical guidance for firms to optimize their knowledge management and interaction strategies.

II. OBJECTIVE(S)

The main objective of this study is to explore the measurement and reliability analysis of knowledge interaction capability in open innovation ecosystems, which includes the following aspects:

(1) To design a structured questionnaire containing multiple dimensions of knowledge interaction capability,

open innovation ecosystem network, and corporate innovation performance to assess the relationship between related variables comprehensively.

(2) Define the measurement indexes of each dimension in the questionnaire, paying special attention to knowledge acquisition, absorption, integration, application, and sharing content to ensure a comprehensive assessment of knowledge interaction capability.

(3) Using statistical methods such as the Cronbach α coefficient and KMO test, the developed questionnaire's reliability and validity are thoroughly analyzed to ensure its reliability and validity in theory and practice.

III. METHODOLOGY

This study adopts a quantitative research methodology to design a questionnaire for the knowledge interaction capability of enterprises in Zhejiang Province, combined with structural equation modeling (SEM) to analyze the relationship between knowledge interaction capability and enterprise innovation performance. The specific design of the methodology is as follows:

3.1 Analysis of variables

This study identifies three main latent variables: enterprise innovation performance (EIP), knowledge interaction capability (KIC), and open innovation ecological network (OIE). Enterprise Innovation Performance (EIP) serves as the dependent variable to assess the performance of firms in terms of knowledge and technological innovation. Knowledge Interaction Capability (KIC) is the independent variable used to assess a firm's ability to acquire, assimilate, integrate, apply, and share knowledge [4] . Open Innovation Ecological Network (OIE) is a mediator variable used to assess the relationship characteristics between an enterprise and its external partners, which includes the dimensions of relationship duality, relationship quality, network centrality, and network openness, respectively, and deconstructs the operation mechanism of the innovation network from the four dimensions of interaction logic, linkage strength, structural characteristics, and system boundaries [5] .

Among them, relationship duality reflects the dynamic balance of "competition-cooperation" between enterprises and external partners and ensures the efficiency of knowledge flow; relationship quality reduces the barriers to knowledge sharing through the mechanism of trust and commitment; network centrality reflects the hub position of enterprises in the ecosystem and determines the ability of resource integration; and network openness drives the breadth of cross-organizational collaboration and the integration of knowledge heterogeneity. Network openness drives the breadth of cross-organizational collaboration and the integration of knowledge heterogeneity. Together, they constitute the core framework of collaborative innovation within and outside the enterprise and provide a multidimensional analysis perspective to reveal the operation logic of the open innovation ecological network [6] . Table 1 lists the variables used in this study.

TABLE 1 VARIABLES OF SEM

Variable type	Latent Variable	Identifiers
Dependent Variable	Enterprise Innovation Performance (EIP)	Knowledge Innovation Performance
		Technical Innovation Performance
Independent Variable	Knowledge Interaction Capability (KIC)	Knowledge Acquisition Capability
		Knowledge Absorptive Capability
		Knowledge Integration Capability
		Knowledge Exploitation Capability
		Knowledge Sharing Capability
Intermediate Variable	Open Innovation Eco-network (OIE)	Duel Degree of Relationship
		Relationship Quality
		Network Centeredness
		Network Openness

3.2 Scale design

In this study, scale design is a key step to ensure the reliability and validity of data collection. First, based on existing theoretical and empirical studies, research variables and concepts were identified to form the first draft of the questionnaire. In the questionnaire revision stage, a total of six experts in related fields were invited to participate, and the clarity of the presentation of individual items was optimized based on the feedback from the experts, focusing on solving key problems such as insufficient supplementation of the practical indicators of the knowledge interaction ability dimension, ambiguity in the presentation of the concept of network centrality, and semantic ambiguity in the items of the scale. The revised questionnaire's overall CVI (Content Validity Index) is 0.95. Subsequently, a small-scale pre-test was conducted with 15 companies to collect feedback, and based on the feedback, some of the questions were modified to form the final questionnaire to ensure that the collected data accurately reflected the relationship between knowledge interaction capability, open innovation ecological network, and enterprise innovation performance.Table 2 below is an overview table of the scale design in this study.

3.3 Indicators of content validity (IOC)

In the scale design stage, the IOC method was used to assess the content validity of each measurement item in the questionnaire. Experts in related fields are invited to score the relevance and applicability of each topic, and the IOC value of each topic is calculated based on the expert scores to ensure the consistency of each measurement item with the research objectives. The IOC value should be greater than 0.5, and the content validity of the overall scale will be analyzed [7] .

In this study, we used Item Objective Congruence (IOC) to assess the questionnaire's content validity, and six experts were engaged to assess the questionnaire's content. The results showed that most of the items received an IOC of 1, indicating a high degree of agreement among the experts on the relevance of the items to the measurement concept. Individual items received slightly lower IOC values, such as 'Discovering industry information relevant to the company's core business is a daily task' (item 7) and 'We only communicate with some of our partners once a week' (item

28), which received an IOC value of 0.83. Overall, most items received an IOC value of 1, indicating a high degree of agreement on their relevance to the measurement concept. Overall, the high IOC values indicate that the questionnaire items align highly with the intended measurement objectives and have good content validity.

3.4 Sample Selection

This study chooses knowledge- and technology-intensive high-tech industries as the research object. The study area is mainly in Zhejiang Province, which has a better innovation environment in China. High-tech enterprises with over 100 employees, a record of R&D investment in the past five years, or at least five invention patents are selected as research subjects. The study period is from 2014 to 2024.

3.5 Data collection

The data collection of this study was mainly carried out through questionnaires, with 200 questionnaires distributed and 172 valid questionnaires recovered. There are two main ways to distribute questionnaires: first, questionnaires are sent through Questionnaire Star's paid sample service, which specifies industries and positions. Secondly, the questionnaire is placed to the target enterprises through acquaintances. All were conducted by distributing questionnaire links online.It covered enterprises in several high-tech industries in Zhejiang Province, including the advanced equipment manufacturing industry, energy-saving and environmental protection industry, new energy industry, etc., which ensured the diversity and representativeness of the sample. The questionnaire is divided into four parts: basic information about enterprises, knowledge interaction questions, open innovation ecological network-related questions, and enterprise innovation, aiming to comprehensively understand the knowledge interaction capability and network management status of enterprises in the open innovation ecosystem. Among them, the basic information section involves key indicators such as the industry to which the enterprise belongs, the number of employees, and the proportion of R&D personnel, which provides essential data support for the subsequent analysis; the knowledge interaction questions section evaluates the enterprise's ability to acquire, assimilate, integrate, apply, and share knowledge through a series of declarative statements; and the section of questions related to open innovation ecosystem network focuses on the frequency of exchanges and the depth of cooperation between the enterprise and external organisations, which reveal the the firm's position and role in the innovation network; and the section on firm innovation assesses the firm's performance in terms of innovative product launches, application of new technologies, market response and success rate of new product development by comparing with peers.The questionnaire survey involves the industries to which the enterprises belong, as shown in Table 3.

TABLE2 SCALE DESIGN

Scale Name	Measurement Dimensions	Number of Items
Knowledge Acquisition Capability	The ability of enterprises to acquire new knowledge through formal and informal channels	5
Knowledge Absorptive Capability	The ability of enterprises to integrate and absorb external knowledge	4
Knowledge Integration Capability	The ability of enterprises to integrate knowledge from different sources	4
Knowledge Application Capability	The ability of enterprises to apply knowledge for improvement or innovation	3
Knowledge Sharing Capability	The ability of enterprises to share knowledge with partners	4
Dual Degree of Relationship Scale	The presence of multiple interaction relationships between enterprises and partners	3
Relationship Quality	The trust and quality of collaboration between enterprises and partners	5
Network Centrality	The importance of enterprises in the network, controlling knowledge resources	5
Network Openness	The cross-regional connectivity attributes of the network	3
Enterprise Innovation Performance	The performance of enterprise innovation, including new product/service launch and success rates	5

Among the participants in the survey, technical research and development personnel accounted for the highest proportion of 63.95 percent (110), followed by department or project managers at 19.19 percent (33), senior management at 10.47 percent (18), and other positions at 6.4 percent (11).

3.6 Data analysis

SPSS26 was used in this study for data analysis. The main focus was to analyze the reliability and content validity of the scales in order to ensure that the designed measurement instrument reliably reflects the dimensions of knowledge interaction competence.

(1) Reliability Test

To ensure the reliability of the questionnaire, this study assessed the internal consistency of the scales by calculating the Cronbach's alpha value for each scale. Cronbach's alpha is a statistical method used to assess the internal consistency of a scale. Cronbach's alpha is a statistical method used to assess the internal consistency of a scale by calculating the correlation between the items to measure whether the items in the scale measure the same underlying variable. Cronbach's alpha ranges from 0 to 1, with higher values generally indicating better scale internal consistency [8] . The Cronbach's alpha coefficients are shown in Table 4.

TABLE3 DISTRIBUTION OF INDUSTRIES INVOLVED IN THE SURVEY

Industry	Total	Percentage
Advanced Equipment Manufacturing	14	8.14%
Energy-saving and Environmental Protection Industry	5	2.91%
New Energy Industry	21	12.21%
Automotive Industry	21	12.21%
Aerospace Industry	16	9.3%
Electronic Information Industry	12	6.98%
Modern Agriculture	21	12.21%
Pharmaceutical Manufacturing	20	11.63%
New Materials Industry	17	9.88%
High-tech Service Industry	18	10.47%
Others	7	4.07%
Total Valid Responses	172	

TABLE4 CRONBACH'S ALPHA COEFFICIENT RUBRICS

Parameter	Value	Result
Cronbach's alpha	$\alpha>0.9$	Great
	$0.8<\alpha\leq0.9$	Good
	$0.7<\alpha\leq0.8$	Acceptable
	$0.6<\alpha\leq0.7$	Lower
	$\alpha\leq0.6$	Undesirable

(2) Validity Tests

In the validity analysis of this study, the KMO (Kaiser-Meyerollum) measure and Bartlett's Sphericity test were used for construct validity. The KMO test assesses the partial correlation between the variables and measures the degree of commonality between the variables to determine the suitability of the data for factor analyses. The value of the KMO is between 0 and 1. The value of KMO is between 0 and 1 [9] . Bartlett's sphericity test checks whether the correlation matrix between the variables is a unit matrix. This test checks whether there is sufficient correlation between the variables to perform factor analysis.

IV. RESULT

4.1 Reliability analysis

As can be seen from Table 5, the Cronbach's alpha coefficients for each variable are above the acceptable threshold of 0.7[10], with the dimensions of Knowledge Acquisition Ability (0.867) and Knowledge Integration Ability (0.850) reaching a good reliability level of 0.8 or above, and Network Openness (0.774), although slightly lower than 0.8, still meets the basic reliability requirements. The alpha coefficient of the overall questionnaire was 0.935 (CITC value > 0.4 for each question item), which far exceeded the high-reliability benchmark of 0.9 suggested by Tavakol and Dennick (2011), indicating that the scale has excellent internal consistency [11]. This result validates the stability of the measurement instrument in capturing the theoretical constructs of knowledge interaction capabilities, open innovation ecological networks, and firm innovation performance, and it can support subsequent structural equation modeling analysis.

4.2 Validity analysis

As can be seen in Table 6, the KMO test coefficient of 0.868 (above the recommended threshold of 0.8) indicates that the bias correlation between the variables is strong and suitable for factor analysis. The chi-square value of Bartlett's test of sphericity is 3774.801, which is significant at the 0.001 level ($p<0.001$), and the significance result of this test ($p<0.05$) indicates that the observed data rejects the "no systematic correlation between variables "the original hypothesis [12], further validating the applicability of factor analysis.

As shown in Table 7, the factor analysis extracted the male factors using the Kaiser criterion (eigenvalues >1) [13], which retains potential factors that explain more than the variance of a single original variable. A total of 10 male factors were extracted with a cumulative variance of

69.605%, which meets the minimum standard of >60% for social science research for exploratory factor analysis [14]. After Varimax orthogonal rotation, the distribution of explained variance across factors was balanced (8.654% to 5.178%), and no single factor explained more than 30% (Podsakoff et al., 2003), indicating that the data were not affected by significant standard method bias.

Table 8 shows the rotated component matrix and factor loadings. All the question item factor loadings are >0.5 (range 0.512-0.893). No cross-factor loading >0.4 indicates the scale has good discriminant validity [15]. The factor structure matches perfectly with the theoretical presuppositions, confirming the empirical rationality of the dimensional division of knowledge interaction capability, open innovation ecological network, and enterprise innovation performance.

TABLE5 RELIABILITY TEST (N=172)

Variable	Dimension Name	Item	Corrected Item Total Correlation (CITC)	Alpha If Item Deleted	Cronbach's Alpha Value	Overall Cronbach's Alpha Value
Knowledge Interaction Capability	Knowledge Acquisition Capability	Q1	0.737	0.827	0.867	0.935
		Q2	0.705	0.836		
		Q3	0.668	0.845		
		Q4	0.715	0.833		
		Q5	0.625	0.855		
	Knowledge Absorptive Capability	Q6	0.652	0.783	0.828	
		Q7	0.640	0.789		
		Q8	0.645	0.787		
		Q9	0.682	0.772		
	Knowledge Integration Capability	Q10	0.695	0.807	0.850	
		Q11	0.670	0.818		
		Q12	0.674	0.816		
		Q13	0.722	0.797		
	Knowledge Exploitation Capability	Q14	0.708	0.719	0.821	
		Q15	0.662	0.769		
		Q16	0.662	0.767		
	Knowledge Sharing Capability	Q17	0.712	0.798	0.849	
		Q18	0.673	0.814		
		Q19	0.653	0.824		
		Q20	0.714	0.798		
Open Innovation Eco-network (OIE)	Duel Degree of Relationship)	Q21	0.746	0.796	0.861	
		Q22	0.748	0.794		
		Q23	0.715	0.824		
	Relationship Quality	Q24	0.676	0.796	0.838	
		Q25	0.664	0.799		
		Q26	0.637	0.807		
		Q27	0.590	0.819		
		Q28	0.639	0.806		
	Network Centeredness	Q29	0.696	0.806	0.848	
		Q30	0.628	0.824		
		Q31	0.678	0.811		
		Q32	0.636	0.822		
		Q33	0.644	0.820		
	Network Openness)	Q34	0.600	0.705	0.774	
		Q35	0.641	0.659		
		Q36	0.588	0.721		
Enterprise Innovation Performance (EIP)		Q37	0.747	0.844	0.879	
		Q38	0.728	0.849		
		Q39	0.663	0.864		
		Q40	0.746	0.844		

		Q41	0.669	0.862		

TABLE 6 KMO AND BARTETT'S TEST

KMO Sampling Adequacy Measure |		0.868
Bartlett's Test of Sphericity	Approx. Chi-Square	3774.801
	df	820.000
	Significance	0.000

TABLE7 TOTAL VARIANCE EXPLAINED

Component	Eigenvalue			Rotated Before Variance Explained Rate			Rotated After Variance Explained Rate		
	Total	Variance Explained %	Cumulative %	Total	Variance Explained %	Cumulative%	Total	Variance Explained %	Cumulative%
1	11.597	28.285	28.285	11.597	28.285	28.285	3.548	8.654	8.654
2	3.252	7.932	36.216	3.252	7.932	36.216	3.348	8.165	16.819
3	2.321	5.660	41.876	2.321	5.660	41.876	3.223	7.862	24.681
4	2.184	5.326	47.202	2.184	5.326	47.202	3.200	7.804	32.485
5	1.952	4.760	51.962	1.952	4.760	51.962	2.853	6.959	39.443
6	1.747	4.261	56.223	1.747	4.261	56.223	2.852	6.956	46.400
7	1.608	3.923	60.146	1.608	3.923	60.146	2.687	6.554	52.953
8	1.375	3.353	63.499	1.375	3.353	63.499	2.423	5.910	58.863
9	1.313	3.202	66.701	1.313	3.202	66.701	2.281	5.564	64.427
10	1.191	2.904	69.605	1.191	2.904	69.605	2.123	5.178	69.605
11	0.808	1.970	71.576						
12	0.690	1.682	73.258						
13	0.683	1.666	74.924						
14	0.674	1.644	76.568						
15	0.638	1.556	78.124						
16	0.616	1.502	79.626						
17	0.607	1.481	81.107						
18	0.563	1.373	82.480						
19	0.520	1.269	83.749						
20	0.507	1.236	84.985						
21	0.494	1.204	86.189						
22	0.462	1.128	87.317						
23	0.443	1.081	88.397						
24	0.421	1.027	89.424						
25	0.370	0.904	90.327						
26	0.370	0.903	91.230						
27	0.351	0.856	92.086						
28	0.335	0.818	92.904						
29	0.304	0.741	93.645						
30	0.299	0.730	94.375						
31	0.281	0.684	95.059						
32	0.263	0.641	95.700						
33	0.257	0.627	96.327						
34	0.240	0.584	96.911						
35	0.222	0.541	97.453						
36	0.207	0.504	97.957						
37	0.193	0.470	98.426						
38	0.187	0.457	98.883						
39	0.175	0.428	99.311						

40	0.149	0.363	99.673
41	0.134	0.327	100.000

TABLE 8 ROTATED COMPONENT MATRIX AND COMMON FACTOR VARIANCE WITH FACTOR LOADINGS

Item	Factor Loading Coefficient										Common Factor Variance
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	
Q1			0.747								0.716
Q2			0.705								0.689
Q3			0.690								0.648
Q4			0.667								0.711
Q5			0.672								0.599
Q6							0.740				0.665
Q7							0.762				0.697
Q8							0.714				0.669
Q9							0.697				0.695
Q10						0.750					0.723
Q11						0.746					0.693
Q12						0.751					0.701
Q13						0.801					0.746
Q14									0.797		0.772
Q15									0.756		0.732
Q16									0.795		0.740
Q17					0.788						0.744
Q18					0.755						0.690
Q19					0.706						0.654
Q20					0.790						0.775
Q21								0.837			0.789
Q22								0.793			0.773
Q23								0.825			0.782
Q24				0.757							0.656
Q25				0.714							0.645
Q26				0.741							0.662
Q27				0.684							0.604
Q28				0.693						0.004	0.646
Q29		0.773									0.673
Q30		0.684									0.634
Q31		0.747									0.690
Q32		0.756									0.636
Q33		0.758									0.627
Q34										0.741	0.685
Q35										0.776	0.757
Q36										0.737	0.698
Q37	0.797										0.764
Q38	0.751										0.702
Q39	0.716										0.650
Q40	0.790										0.756
Q41	0.738										0.649

Results and discussion

This study endeavors to develop a set of scales to effectively assess the relationship between knowledge

interaction capabilities, open innovation ecological networks, and firms' innovation performance. The reliability and validity of the scales were verified by analyzing data from a sample of high-tech enterprises in Zhejiang Province, China. The results show that the scales designed in the study have good reliability and validity, can reliably measure the relevant constructs, and can provide a solid foundation for subsequent empirical research.

This study can also provide valuable reference experience for other research teams to conduct similar studies in related fields. In practical application, the scale can help business managers more accurately assess and improve the knowledge interaction capabilities within the organization and its external environment. Enterprises can use this tool to identify their strengths and weaknesses in all aspects of knowledge acquisition, assimilation, integration, application, and sharing, and develop targeted improvement strategies accordingly.

However, there are some limitations in the research process. First, self-report bias may overestimate the inter-variable correlations, especially when assessing innovation performance, and the tendency of social approbation tends to lead to response bias; second, the regional specificity - Zhejiang's innovation ecosystem, which is characterized by dense industrial clusters and government-led digital transformation - may limit the study's conclusions from being generalizable to regions with significant differences in institutional environments generalizability; in addition, the questionnaire survey relying only on the scale may not fully capture all the complex interaction dimensions in the open innovation ecosystem, and the time-limited nature of the cross-sectional data makes it challenging to capture the dynamic evolution of the open innovation ecosystem network (OIE), and in particular lacks the explanatory power of the technology iterations in the fast-cycle industries such as AI and semiconductors.

Future research can deepen the exploration through a mixed research methodology. It could use in-depth interviews and longitudinal case tracking to conduct semi-structured interviews with innovation ecosystem managers and select representative companies to conduct a 3-5 year tracking study to carve out the evolution of the topology of the OIE network during the period of technological paradigm change.

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Enhancing Adolescent Oral Health Education Through Gamification

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Abstract. Educational card games provide an engaging approach to oral health education, yet misconceptions about dental hygiene persist among young adolescents. This study developed and evaluated an educational card game aimed at improving understanding of dental health concepts in children aged 12 to 15. A pre-experimental design was used with 30 participants, incorporating game elements such as cavity, treatment, and steal cards to simulate real life dental care scenarios. Pretest and posttest assessments measured knowledge improvement, alongside student engagement ratings. Results showed a significant increase in posttest scores (M = 12.933, SD = 2.677) compared to pretest scores (M = 10.233, SD = 3.277), with strong effect sizes (Cohen's d = -0.862; rank biserial correlation = -0.837). Students reported high engagement and improved understanding, though misconceptions about tooth function and structure remained. Findings suggest educational card games are effective for enhancing oral health knowledge. Future research should explore long term retention and refine game mechanics to address conceptual misunderstandings, potentially integrating digital or multimedia elements for greater impact.

***Index Terms*—Oral health, dental care, gamification, game-based learning.**

I. INTRODUCTION

Gamification has become a valuable tool in education, making learning interactive and engaging. It is reported that the approach can reinforce key concepts through repetition and interaction, making complex topics more accessible to learners [1]. In oral health education, it can address knowledge gaps and misconceptions while improving retention [2].

Studies show that educational card games enhance knowledge retention and engagement more effectively than traditional teaching methods, especially in the context of biology education [3]. Card games in health education, like "Health Goal," provide an interactive and engaging way for students to learn essential concepts about food safety, health, and nutrition. By incorporating game-based learning, these educational tools enhance knowledge retention, encourage critical thinking, and get student more involved in learning.[4]

Focusing on early adolescence, various health education topics should be of concern due to physical changes including the development of permanent teeth and an increased risk of dental issues. Poor oral hygiene practices, such as irregular brushing, make adolescents more susceptible to cavities and gum disease. Implementing school based oral health education can help improve hygiene habits and prevent long term dental problems. [5]. Among those aspects, dental health is pointed out as essential. One of the reasons is the fact that adolescence is a crucial period for oral health education, as permanent teeth have no natural replacements. Many children are unaware of the number of teeth they have, the role of fluoride and calcium, and the effects of poor hygiene. Research supports the effectiveness of card games in health education [6]

Card games have proven to be an effective tool in oral health education, offering an engaging and interactive way to enhance students' understanding of dental hygiene and health. According to research, incorporating games into dental education encourages active learning, making complex concepts more accessible and enjoyable. For example, studies on dental technology education highlight that game-based pedagogy improves student engagement and learning outcomes by combining knowledge with fun, making the educational process more effective [7]. Additionally, card games specifically targeting children's oral health, like those used to teach about tooth brushing and healthy habits, have been shown to significantly improve children's attitudes and behaviors toward dental care. These games not only enhance knowledge but also empower children to take responsibility for their oral health [8]. Furthermore, these activities can help address disparities in oral health education by providing an enjoyable and memorable way to learn, especially for children from low-literacy backgrounds, ultimately improving their dental outcomes [9].

Even though the existing card games can be useful in

helping young people understand complex concepts, their application in oral health education remains underexplored. A study by Alazmah (2016) highlights the need for more child involvement in research design, suggesting that integrating interactive tools like card games could enhance engagement and understanding in this field [10]. Research indicates that misconceptions about oral health are prevalent among adults in rural areas, with many perceiving their oral health as good despite issues like tooth loss and toothache. This misperception can lead to inadequate oral hygiene practices and a lack of necessary dental care [11]. Additionally, studies have shown that rural communities often have a low level of oral health awareness and practice, emphasizing the importance of targeted educational interventions [12]. Therefore, this present study aims to develop a card game to promote young people's understanding of dental care using interactive rules and cost-effective materials, including types of teeth, factors causing tooth decay and elements promoting healthy dental condition. The game is designed to be implemented among children aged 15 or under, as this period is critical for dental development and habit formation. During this stage, children transition from baby teeth to permanent teeth, making it essential to broaden understanding of oral hygiene practices. Instructing them through a game-based learning activity about tooth structure and function, decay prevention, and healthy habits can potentially contribute to reducing risks of oral diseases in adulthood.

II. Methodology

This study utilized a pre-experimental design to evaluate the effectiveness of a card game intervention in enhancing students' understanding of dental health concepts. The participants consisted of 30 students from a local community, aged between 12 and 15 years. The selection was based on availability and willingness to engage in the educational activity. The intervention was designed as an interactive card game that simulated the natural progression of dental development while reinforcing knowledge of tooth types, functions, and oral health care.

The game involved a structured sequence where players transitioned from primary teeth (milk teeth) to permanent teeth (incisors, canines, premolars, and molars), following the order in which teeth typically emerge and develop. Players were required to name the tooth type aloud when playing a card, reinforcing learning through active recall. Special cards such as cavity cards, treatment cards, and steal cards introduced strategic elements that reflected real-life dental care scenarios. Cavity cards negated a previously played tooth card, treatment cards allowed players to protect their teeth from decay, and steal cards enabled players to take a tooth card from another participant as depicted in Fig. 1. The objective of the game was to be the first player to place all their cards, while the last player with remaining cards was considered the loser.

To assess the impact of the intervention, data collection involved both a pretest and post-test, consisting of a 20-item multiple-choice questionnaire that measured students' knowledge of tooth structures, functions, developmental sequences, and oral hygiene practices. Additionally, a five-item Likert scale survey was administered to evaluate participants' engagement, learning experience, and perceived application of knowledge gained from the game. For data analysis, descriptive statistics were used to compare mean scores and standard deviations between the pretest and post-test. A paired samples t-test was conducted to determine whether the intervention led to a statistically significant improvement in students' knowledge. Given that the data deviated from normality, a Wilcoxon signed-rank test was also performed to confirm the results. Effect sizes were computed using Cohen's d for the t-test and the matched rank biserial correlation for the Wilcoxon test to assess the practical significance of the findings. In addition to measuring overall improvements, an analysis of misconceptions was conducted by identifying questions where fewer than 50% of students answered correctly in both the pretest and post-test. Lastly, student satisfaction ratings were analyzed by calculating mean scores and standard deviations to determine the effectiveness of the game in terms of engagement and knowledge retention. This study was conducted with careful attention to ethical considerations. Participants were clearly informed about the purpose of the study, the tasks involved, and their right to withdraw at any time without consequence. Participation was entirely voluntary, and no identifying information was collected, ensuring that all responses remained anonymous. The confidentiality of participants was respected throughout the research process.

Fig. 1. Students Engaged in the Educational Card Game on Dental Health.

III. Results and Discussion

The descriptive statistics for the pretest and post-test scores are presented in Table I. The mean score for the pretest was 10.233 (SD = 3.277), while the mean score for the post-test increased to 12.933 (SD = 2.677). This suggests an improvement in scores following the intervention. The standard error (SE) was lower for the post-test (0.489) compared to the pretest (0.598), and the coefficient of variation was also reduced from 0.320 to 0.207, indicating less variability in post-test scores.

TABLE I
STATISTICS FOR PRETEST AND POST-TEST SCORES

	N	Mean	SD	SE	Coefficient of variation
Pretest	30	10.233	3.277	0.598	0.320
Post-test	30	12.933	2.677	0.489	0.207

A paired samples t-test was conducted to examine whether there was a statistically significant difference between the pre-test and post-test scores. The results of the Student t-test showed a significant improvement in scores from pre-test (M = 10.233, SD = 3.277) to post-test (M = 12.933, SD = 2.677), $t(29) = -4.723$, $p < .001$, indicating a statistically significant increase in performance. Cohen's d effect size was calculated as -0.862, suggesting a large effect size. However, the Shapiro-Wilk test, conducted to assess the normality assumption, indicated that the pretest and post-test scores had a W value of 0.920 with a p-value of 0.027. Since the p-value was below 0.05, this suggests that the data deviates from a normal distribution, which necessitated the use of the Wilcoxon signed-rank test as a non-parametric alternative. The results of the Wilcoxon test indicated a significant difference ($W = 33.000$, $z = -3.871$, $p < .001$) with a matched rank biserial correlation effect size of -0.837, reinforcing the findings from the t-test (Table II).

The results from both the parametric and non-parametric analyses indicate a statistically significant improvement in post-test scores compared to the pretest, demonstrating the effectiveness of the card game intervention in enhancing students' understanding, engagement, and application of oral health knowledge. The increase in mean scores suggests that the game positively impacted participants' learning outcomes. Additionally, the reduction in the coefficient of variation implies that the intervention contributed to a more consistent understanding across participants, minimizing disparities in knowledge levels. The large effect sizes reported in both the t-test and Wilcoxon test further reinforce the practical significance of the card game in improving students' comprehension and retention. The significant deviation from normality, as indicated by the Shapiro-Wilk test, highlights the importance of using both parametric and non-parametric methods to validate the findings, ensuring robustness in the statistical analysis.

TABLE II
PAIRED T-TEST AND WILCOXON SIGNED-RANK TEST

Measure 1		Measure 2	Test	Statistic	z	df	p	Effect Size
Pretest	-	Post-test	Student	−4.723		29	< .001	−0.862
			Wilcoxon	33.000	−3.871		< .001	−0.837

Beyond assessing factual recall, this section examines students' conceptual understanding of tooth functions and oral health. While the pretest and post-test results indicate an overall improvement, certain application-level questions remain challenging, highlighting areas where deeper learning is needed. The questions that students struggled with, particularly those related to tooth function and structure, align with the debriefing session following the game. This session is designed to encourage students to reflect on their gameplay and connect it to real-world dental knowledge. However, the results suggest that while the game effectively reinforced factual recall, it may not have been as effective in helping students apply their knowledge to functional and conceptual questions.

For instance, Question 10 (Which type of tooth is primarily responsible for biting and cutting food?) had a low accuracy rate in both the pretest (20%) and post-test (43%). The correct answer, incisors, was frequently confused with canines or molars, suggesting that students may not have fully grasped the distinct roles of each type of tooth. Similarly, in Question 12 (Which type of tooth is used for tearing and gripping food such as meat?), around 70% of the students struggled to correctly identify canines, often selecting molars or premolars instead. This indicates a gap in understanding the specialized function of different teeth. Moreover, Question 13 (What is the difference between molars and premolars?) required students to distinguish between these two tooth types based on their root structure and function. The results revealed that 73% of the students in the pretest and 60% in the post-test failed to recognize that molars have 2-3 roots while premolars typically have 1-2 roots. The confusion may stem from the gameplay mechanics, where players focus on sequencing tooth development rather than discussing their structural differences, which in fact appear on the cards. Additionally, Question 14 (Which group of teeth is most prone to cavities?) showed that 67% of the students in the pretest and 57% in the post-test were unaware that molars are the most susceptible to decay due to their deep grooves and role in chewing food, often selecting premolars or incisors instead.

Despite these challenges, the game successfully corrected a common misconception regarding the number of milk teeth. In Question 6 (How many milk teeth do children typically have?), over 95% of the students initially believed there were 24 instead of the correct 20. However, this misunderstanding was largely resolved in the post-test as over 87% provided the correct answer, indicating that the intervention effectively reinforced foundational knowledge. To enhance the educational impact, future implementations of the game should incorporate a more structured debriefing session that explicitly reinforces the functions, structure, and vulnerabilities of different teeth. Encouraging guided discussions, real-world examples, and multimedia resources could help bridge the gap between factual recall and conceptual application. Future research could also explore whether modifying the game mechanics to include functional prompts—such as requiring players to explain the role of each tooth when playing a card—could lead to greater conceptual understanding.

TABLE III
STUDENT SATISFACTION RATINGS

	Valid	Missing	Mean	Std. Deviation
Engagement and enjoyment	30	0	4.267	1.143
Types of teeth	30	0	4.300	0.877
Oral health care	30	0	4.167	0.874
Proper tooth brushing	30	0	4.067	1.112
Practical application	30	0	4.067	0.980

Additionally, according to Table III, participants' satisfaction results indicated a generally positive response to the game, with all categories scoring above 4.0 on average. The highest-rated aspect was learning about types of teeth (M = 4.300, SD = 0.877), followed by engagement and enjoyment (M = 4.267, SD = 1.143), suggesting that participants found the game both informative and enjoyable. Oral health care (M = 4.167, SD = 0.874) and proper tooth brushing (M = 4.067, SD = 1.112) also received high ratings, indicating that the game effectively reinforced knowledge about dental hygiene practices. Lastly, practical application (M = 4.067, SD = 0.980) suggests that participants felt confident in applying their new knowledge in real-life oral care routines. These findings highlight the game's effectiveness in enhancing engagement and learning about oral health.

Our educational card game and the "Smart Dental Card Game Model" share the goal of improving oral health knowledge but differ in their approach and target audience. While our game is designed for adolescents aged 12 to 15, incorporating elements like cavity, treatment, and steal cards to simulate real-life dental care scenarios, the "Smart Dental Card Game Model" is aimed at younger elementary school children, using a board game format with keyword-based learning. Both studies found significant improvements in participants' dental health knowledge, though our research highlighted persistent misconceptions about tooth function and structure. In contrast, the "Smart Dental Card Game Model" demonstrated not only increased knowledge but also a reduction in debris index scores, indicating improved oral hygiene habits. These findings suggest that while our game engages older students with interactive scenarios, younger children may benefit more from a structured, foundational approach that reinforces practical hygiene behaviors.[13]

Despite the promising results, this study has several limitations. First, the small sample size of 30 participants limits the generalizability of the findings to a wider population. Additionally, as a pre-experimental study, the lack of a control group prevents a direct comparison of the intervention's effectiveness against traditional teaching methods. The short duration of the study also does not allow for an assessment of long-term knowledge retention. Furthermore, self-reported engagement and learning outcomes may be influenced by participant bias. As a result, future research should employ a larger, more diverse sample and include a control group to strengthen the validity of the findings. Longitudinal studies could assess the retention of knowledge over time to determine the sustained impact of game-based learning. Additionally, incorporating qualitative methods, such as interviews or focus groups, could provide deeper insights into students' experiences and perceptions of the intervention. Exploring the integration of digital or augmented reality elements may further enhance engagement and learning outcomes in oral health education.

IV. Conclusion

Despite increase awareness efforts, many students continue to demonstrate limited understanding of basic dental health concepts, which can contribute to poor oral hygiene habits later in life. Traditional teaching methods may lack engagement, prompting educators to explore innovative strategies such as game based learning. However, research on the specific impact of card game on dental knowledge, particularly in younger populations, remains limited. The results indicate that the card game intervention effectively enhanced students' understanding of dental health, as reflected in the significant improvement in post-test scores. The large effect sizes highlight the practical impact, while the reduced coefficient of variation suggests more consistent knowledge retention. Additionally, students reported high engagement and found the game useful for learning tooth types, oral hygiene, and brushing techniques. However, despite the overall improvement, some misunderstandings persisted, particularly in application-based questions related to the function and structure of different teeth. Students struggled to correctly identify the roles of incisors, canines, molars, and premolars, as well as the susceptibility of certain teeth to decay, indicating that while the game reinforced factual knowledge, its effectiveness in facilitating conceptual application was more limited. While the results are promising, future research should explore the long-term retention of knowledge gained through this intervention and assess its effectiveness in different populations or educational settings. Additionally, incorporating qualitative feedback from students may provide deeper insights into how game-based learning influences motivation and understanding. To address lingering misconceptions, future implementations should include a structured debriefing session that explicitly connects game mechanics to real-world dental functions and care practices, ensuring a more comprehensive learning experience.

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Masculinity representation in TV series: a CDA analysis of “Cherry Magic Japan” and “Cherry Magic Thailand”

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Abstract. This study examines the representation of masculinity in *Cherry Magic Japan* and *Cherry Magic Thailand*, focusing on how linguistic and discursive strategies construct gender identity. Through the seme-uke dynamic, both adaptations reflect soft masculinity while adhering to yaoi conventions. Using Critical Discourse Analysis (CDA) applied to a textual analysis of the two series, this study explores linguistic features revealing the various characteristics of the forms of masculinities embodied by the main characters.

Both versions portray seme (or phra ek) characters as strong and confident, contrasting with the uke (or nai ek), who are depicted as fragile and emotionally expressive. While no explicit linguistic markers directly feminize the uke characters, their speech patterns and discursive positioning construct them as sensitive, fragile figures, in need of protection. This analysis found that *Cherry Magic Japan* and *Thailand* reproduced some norms of the yaoi conventions such as the seme/uke stereotyped dynamics, but still offer new patterns of masculinities at the same time. The findings suggest that the adaptation of yaoi culture into television series has contributed to the evolution of masculinity ideologies within this media genre.

***Index Terms*—BL series, Discourse, Japan, Masculinity, Thailand**

I. INTRODUCTION

Boys Love (บอยเลิฟ) or is a kind of narrative media which was born in Japan in the 1970s. Originally, it primarily consisted of manga written by women for women, serving as an escape from patriarchy (ระบบชายเป็นใหญ่), which is a social system where the men have more power than women in different ways. As BL developed, some of its opponents began referring to it as 'yaoi', a sarcastic acronym for YAma nashi (山なし, no climax), Ochi nashi (落ちなし, no fall), Imi nashi (意味なし, no meaning), and the female readers as “fujoshi (腐女子)” or rotten girls, and in Thai as Y girls (or สาววาย). Later, the appellation Boys Love, referring to original and/or professional and industrial works then emerged. These manga depicted male-male relationships, it could be romantic or even sexual relationship. Its female-female relationships counterpart is called “yuri” (ユリ), meaning lys flower in Japanese, but its social characteristics are significatively different [1]. Despite controversies, such as the yaoi ronsô (yaoi controversy) in the 1990s in Japan, which centered on the representation of gay men in yaoi manga [2], the Boys Love manga have then gained popularity, they were edited in manga, in specialized magazines and even exported abroad, in South Korea, Taiwan, the Philippines, and also in Thailand. In the case of Thai social context, Orathai Piayura sees that Y literature develops in a man-dominated context where women occupy a subordinate place, and “could (at times) be read as an attempt to subvert patriarchal, heteronormative power structures” and can “influence gender and sexual discourses among Thailand’s newer generations” [3].

According to the tradition, Boys Love characters have to be two males, who will eventually fall in love with each other. According to the yaoi tradition, one of them is called the seme (or พระเอก) and has the dominant role during the sexual intercourse. He tends to be stronger and manlier than the uke (or นายเอก) who is more often portrayed as fragile, or even feminine. This duality of masculinities has to reproduce the heteronormative man/woman dynamics, to offer a space for heterosexual women to subvert the patriarchal discourse [4]. On the contrary, female characters are more rare in yaoi narratives, despite most of writers and readers (at least for the yaoi comics in the twentieth century) are women [5].

The history of Boys Love encountered a new chapter in Thailand, especially since the year 2014 when the first Boys

Love series was produced: *Love Sick* (รักวุ่น วัยรุ่นแสบ) was released that year on MCOT [6], the story of two male high school students who had to fake a relationship but eventually ended in love together. The important point of this series is that it started a new phenomenon that further developed in Thailand but also in other Asian countries such as Japan, South Korea, Taiwan, the Philippines and even somehow in Laos, which is the BL series industry. In Thailand, BL series are becoming more and more popular, at the point that in 2020, the Thai government had the plan to make it a part of "Thai soft power". Nowadays, Thailand is the biggest producer of BL series in Asia, and its shows are exported and consumed in many other Asian countries.

However, Thai BL series are more than just entertainment media. Their popularity has given them considerable influence, allowing them to shape the perceptions of their audiences, and thus spread a certain discourse about various social matters such as masculinity (ความเป็นชาย), which is a rich topic for the BL studies since the essence of the genre is the representation of almost only male-male relationships. Since BL series have encountered a worldwide success and are now consumed by a large audience, they provide an important field of study for the social sciences, offering insights into how this emerging media reshapes notions of masculinity and gender norms.

Just like other forms of media, BL series provide a discourse that can diffuse certain ideologies about what masculinity is or should be. For example, Marthinus Conradie's critical discourse analysis of *For Him Magazine* shows how this publication provides advice to men regarding the sexual behaviors they should adopt [7]. Worapong Chairerk and Patcharina Anunsiriwat conducted a similar study, analyzing the representation of masculinity in the Thai magazine *GM* [8]. Hongsheng Sui and Yating Yu's CDA-oriented research on Chinese news media describes non-masculine behaviors of men as undesirable [9]. However, although gender studies have already begun to investigate the BL series industry, comparative research based on discourse analysis is still lacking. Therefore, this article aims to explore the representation of masculinity(ies) in BL series, through a comparative study based on a comparative case study. The main objective of this contribution is to approach BL series within a regional scale and see how remakes and TV shows of a same genre contribute to create intertextual masculinities patterns.

II. Methodology

The aim of our article is to investigate the linguistic construction of the masculinity of the main characters of *Cherry Magic*. This research will be qualitative research of a corpus of two selected TV series, conducted through a critical discourse analysis (CDA), which "is a type of discourse analytical research that primarily studies the way social power abuse, dominance, and inequality are enacted, reproduced, and resisted by text and talk in the social and political context" [10]. Since masculinity is a social construction (see hereafter), CDA is a useful tool to see how language shapes this gender, and thus helps us to analyze how TV series serve as a vehicle for masculinity standards. This research will mostly be a textual analysis based on the verbal communication between the characters, focusing on speech and conversations that concern the masculinity features of the main characters. Nevertheless, if non textual information are relevant, they will be analyzed as well.

The selected corpus is constituted by a Japanese drama adaptation of the manga *Cherry Magic! Thirty Years of Virginity Can Make You a Wizard?!* (*30歳まで童貞だと魔法使いになれるらしい*) written by Toyota Yuu, and the Thai remake of this drama:

- *Cherry Magic Japan* (30歳まで童貞だと魔法使いになれるらしい), Yuasa Hiroaki et al. (dir.), TV Tokyo, 2020.
- *Cherry Magic Thailand* (30 ยังซิง), Nuttapong Mongkolsawas (dir.), GMM25, 2023.

These series were selected because they allow for a comparative study of the discursive construction of masculinity in Japanese and Thai media, highlighting the need for more comparative research within BL studies. Since no official scripts are available for these series, this research was conducted by watching the entire series, selecting, transcribing in Thai or Japanese, and translating into English the pieces of dialogue related to masculinity.

In each of those series, two main couples composed of two male characters will be studied: Kurosawa (seme/phra ek) and. Adachi (uke/nai ek), in *Cherry Magic Japan*, and Karan (seme/phra ek) and Achi (uke/nai ek) for *Cherry Magic Thailand*. This research will analyze the masculinity features of the main characters focusing on some defined aspects of the main characters, namely: their physical appearance; their personality; their language behavior; their job; their social relationship.

III. Theorical framework

Masculinity is a gender construct that refers to a performance rather than a biological state, or, as Eckert and McConnell-Ginet state "not something we are born with, and not something we have, but something we do" [11]. Masculinity is therefore a performance enacted by individuals who seek to be identified as men, but masculinity is not a synonym for "biological male". As Kiesling explains, "Men and masculinities are different things, and while they are connected, all things that men do are not masculine, and all things masculine are not necessarily done by men" [12]. This performance is a social practice driven by the desire of men to be perceives as men: "In a short (and overgeneralized) statement, men are socialized to desire to be men. This is an important point, because it allows us to

argue that men actively try to be men through their social performances, rather than acting as a Skinnerian rat" [13]. Moreover, there are many forms of masculinities [14], and relationships exist between those forms of masculinities or what Connell call "gender politics within masculinity", namely the power relationships between different groups of men, and the potential intimidation and/or dominance in those hierarchies [15].

Gender as a performance manifests in various ways, including discursive and linguistic practices. Language, therefore, serves as a tool in the construction of gender identities (Butler, 2006; Jami, 2008). For instance, men are identified as such and perceived as powerful partly due to the way they speak and structure their discourse [16]. Additionally, language not only differentiates between masculinity and femininity but also makes distinctions among various types of masculinities: "there is great variation in how men use language – more variation, in fact, between some types of men than between men and women" [17].

Lakoff 's Language and Woman's Place explores how women are expected to use language, how their linguistic patterns reinforce their subordinate position in society, and how they are spoken about by both men and other women [18]. Similarly, different types of masculinities correspond to different linguistic performances. For example, hegemonic masculinity (ความเป็นชายที่เป็นอำนาจนำ) is the dominant form of masculinity in a given society and is the standard that men are implicitly or explicitly encouraged to embody. It cannot be defined by a fixed set of characteristics, as what is considered hegemonic varies according to sociocultural context. Connell describes it as "the masculinity that occupies the hegemonic position in a given pattern of gender relations, a position always contestable" [19]. Hegemonic masculinity thus holds a higher status than other forms of masculinity and asserts dominance over women in power relationships. Connell further defines it as "the configuration of gender practice which embodies the currently accepted answer to the problem of the legitimacy of patriarchy, which guarantees (or is taken to guarantee) the dominant position of men and the subordination of women" [20]. It can be added that media, including pop culture, play a role in the construction and diffusion of (hegemonic) masculinity norms. For instance, as Mie Hiramoto observes, Japanese pop culture actively shapes and reinforces these norms: "ways in which a medium of Japanese pop culture like anime constructs hegemonic heterosexuality (as well as hegemonic masculinity), and the ways in which these are made identi1able to the audience" [21].

However, although hegemonic masculinity implies the existence of other, potentially subordinate, forms of masculinity, it is often conflated with the broader concept of masculinity itself, as if the two were synonymous [22]. Moreover, what qualifies as hegemonic masculinity can vary from a culture to another. Not all forms of masculinity entail power or dominance, and only a small number of men actually feel that they hold power—whether physical, economic, or social—or that they are dominant figures [23]. BL series provide examples of alternative forms of masculinities.

Gender studies also examine alternative forms of masculinity that are less associated with dominance. In the East Asian pop-cultural environment, a new form of masculinity known as soft masculinity (ความเป็นชายที่อ่อนโยน) has recently emerged. As observed by Sun Jung in the pan-Asian context of globalization and the influence of Japanese pop culture, soft masculinity is a more feminized form of masculinity that does not seek to dominate others. It originates from shôjo and yaoi manga cultures and the bishônen aesthetic [24].

IV. Results and Discussion

Kurosawa and Karan: archetypes of ideal and non hegemonic men

Kurosawa and Karan are the seme (or phra ek) characters respectively of the Japanese and the Thai versions of *Cherry Magic*. Regarding physical appearance, Kurosawa is described by other characters as a handsome man. In the first episode, he is introduced as "最高の爽やかイケメン" (EP1, 4'12), and another character comments, "笑顔眩し" (his smile is bright) (EP1, 4'36). His male colleagues also acknowledge his attractiveness, referring to him as an "イケメン" (handsome man) (EP7, 5'57). Even Adachi confesses that, in his eyes, "黒沢っていつも完璧ってイメージだからさ" (EP7, 11'48). Kurosawa himself recognizes that he has a great physique (*EP8, 4'50*), although he sees it as a disadvantage at times, as some people judge him solely based on his appearance. They somehow match with the archetype of the popular man, which involves strategies (including linguistic ones) to conform with social expectations. As Mie Hiramoto observed in her study of intertextual discourse in Japanese anime, the concept of conventional popularity reinforces associations between normative masculinity and the language of power: "ideas of a conventional popularity, the conventional ideas of what it means to be a popular person within a particular social group, support associations of normative roles and forms with the language of power" [25].

A similar observation can be made for Karan. Achi describes him as "รูปหล่อ ขี้มหวาน ทำอาหารเป็น แบบนี้โครจะเพอร์เฟกต์ โลกนี้ยุติธรรม" (EP2, 9'50), or by the female old neighbor of Achi: "ตายจริง หล่อ ท่าทางดูดี โอ้ยเห็นอชิมีเพื่อนที่พึ่งพาได้แบบนี้ป้าก็คอยสบายใจหน้อยนะ นึกว่าจะพวกป้ำ ๆ เป๋อ ๆ เหมือนแกนะ (Oh my, he is handsome and good-looking, oh I am relieved that you have reliable friends like this Achi, I thought it was a clumsy one like you)" (EP4, 5'25). Even male characters presumed to be heterosexual admire his physical attributes. When Rock sees him naked during the onsen scene, he comments, "หุ่นพี่ดีจังเลย" (your body is so good) (EP3). Likewise, heterosexual

men from Nakhon Si Thammarat who see him for the first time ask, "ไอ้หน้าหล่อนี่เป็นใคร" (who is this handsome guy?) (EP11, 27'47).

Physically, the seme characters are fit and athletic. the first episode of each version, on the day the uke discovers his magic power, he meets the seme at the office in front of a crowded elevator. Kurosawa and Karan suggest taking the stairs instead, but Adachi and Achi refuse. Achi, for example, answers: "แรงจะหมดแล้วก่อนทำงาน (My energy will be completely drained before work)" (EP1, 15'43). From the very first moments of the series, this establishes that the seme characters are not only more popular and successful at work and in their social life but also physically stronger than their uke counterparts. Some elements have been added in *Cherry Magic Thailand* to highlight Karan's physical strength. In the Thai version, the company organizes a team-building trip for employees. During a tug-of-war game, Karan's dominance is highlighted as he leads his team to victory, demonstrating both physical power and leadership (EP3, 12'05). In the same trip, a scene where the characters reveal their naked bodies occur, this scene will be analyzed hereafter.

In terms of career, the *seme* character in both the Thai and Japanese versions of the series is a top employee at the company. Kurosawa is introduced in the first episodes of *Cherry Magic* as the company's best employee, receiving multiple awards for his work performance and earning the admiration of his colleagues.

Achi's perception of Karan suggests that he views his male colleague as a symbol of perfection. He is convinced that Karan is hiding his disappointment when he tells him that they will not celebrate Songkran together. This leads Achi to use his magical power to read Karan's mind, even though it irritates him:

> "ผมแค่อยากรู้ว่า จริง ๆ แล้วการันต์คิดยังไงอยู่ [I just want to know what you really think]
> ที่อชิพูดมาทั้งหมด มันหมายถึงว่าอชิไม่เชื่อผม [Everything you said means you don't trust me]
> ผมไม่แน่ใจจริง ๆ ว่าคำว่าไม่เป็นไรของการันต์มันแปลว่าอะไร [I'm not sure for real of what the word "it's okay" means for you]" (EP10, 28'00);

showing how masculinity is both a performance and an interpretation by the others.

However, Karan was telling the truth. Achi might have assumed that Karan was performing a form of "tough masculinity," but in reality, he was sincere in expressing his emotions. In fact, both Kurosawa and Karan display vulnerability. The term "brave" is even used to describe Karan's behavior. In Episode 6, after Karan refuses to spend the night with a client who touches him inappropriately during dinner, some of his male colleagues criticize him behind his back. They argue that a "real man" should accept a woman's advances and that it should not be a big deal for Karan (EP6, 9'50). In contrast, Achi perceives Karan as brave (กล้า) for rejecting the client (EP6, 12'49). This contrast demonstrates how masculinity is a discursive construct: one action can be interpreted differently depending on the gender paradigm through which it is viewed.

A similar observation applies to Kurosawa in *Cherry Magic Japan*. His vulnerabilities are even perceived as attractive by the uke characters. For instance, Kurosawa becomes jealous when Rokkaku, a male colleague of Adachi, comes to stay overnight at Adachi's apartment, ruining Kurosawa's plans to spend the evening alone with him. Adachi realizes Kurosawa's jealousy and comments, "黒澤、可愛いかも" (Kurosawa might be cute)" (EP6, 14'13).

Although Kurosawa (and Karan) can be seen as possessive, they break away from traditional hegemonic masculinity by not pursuing romantic relationships solely for sexual gratification. In the second episode of both versions, the uke is invited to sleep at the seme's home, creating an intimate but non-sexualized situation.

In the Japanese version, Adachi, using his supernatural ability, sees Kurosawa imagining him in the pajamas he bought for him, finding him attractive. This moment reflects the male gaze—Adachi is objectified through Kurosawa's vision, reinforcing elements of hegemonic masculinity and heteronormative desire. Kurosawa's internal monologue supports this interpretation: "こんなご褒美いいのか (Will I be rewarded like this?)" (EP2, 4'13).

Here, Adachi is metaphorically framed as a reward, a prize, which momentarily aligns Kurosawa with a predatory role, a dangerous male who could be able to assault a sleeping less masculine character. Adachi's reaction reinforces this tension—when he pretends to be asleep, he becomes very afraid while he is hearing Kurosawa approach: "え、ちか！やばい…やばいやばいやばい！ (Eh! He's close! Holy shit!!)" (EP2, 6'24) While Adachi instinctively expects a physical advance, Kurosawa ultimately does nothing but saying him good night, subverting the trope of the sexually assertive seme.

A similar dynamic unfolds in the Thai version, where Achi sees himself through Karan's perspective, wearing the pajamas Karan bought for him. However, this scene adds another layer by incorporating a one-sided telepathic dialogue, emphasizing Achi's anxious anticipation of what Karan could do to him:

> "หน้าอชิตอนหลับนี้ น่ารักจัง อยากจ้องแบบรี้มาตลอดชีวิตเลย (Achi's face while sleeping is so cute, I could stare at him all my life)
> เดี๋ยว ๆๆๆๆ ขนาดนี้หรอ (Wait wait, at this point?)
> จะทำไรดีมั้ยอะ (Should I do something?)
> จะทำไรอีกอะ (What are you gonna do now!?)
> ไม่ดีมั่ง ถ้าอชิจับได้ จะโดนรังเกียจหรือเปล่า (I shouldn't, if Achi catches me, will he hate me?)
> คิดจะทำไรเนี่ย ต้องเป็นเรื่องไม่ดีแน่ ๆ (What do you think you're gonna do? It must be something bad.)
> แต่ถ้าไม่ทำตอนเนี่ย คงไม่มีโอกาสอะละ จะมีตอนไหนที่อชิเมือนหลับอยู่ใกล้อีก เอาละ อชิกี่ไม่รู้หรอก
> เอ้ย จะจูบหรอวะ (Ey! Will he kiss me?)" (EP2, 7'20)

More than Adachi did, Achi explicitly expresses that he was expecting a "kiss" or a more assertive action, describing it as "something bad". Yet, Karan, like Kurosawa, does

nothing and simply tells him good night. Despite the comedic elements (such as the exaggerated background music, Achi's eyes band, etc.), this scene also carries a deeper cultural commentary. The contrast between expected hegemonic masculinity constructed by an intertextual discourse of hegemonic masculinity built in the Thai mainstream narratives [26] (where the seme would dominate the uke physically) and actual behavior (where the seme respects boundaries) acts as a critique of traditional masculinity.

Moreover, they comfortably take on household tasks that are traditionally associated with women. In the second episode, after Adachi and Achi wake up, they discover that Kurosawa and Karan have prepared breakfast for them, which is moreover delicious. This shows us how their masculinity is portrayed—not as only hegemonic or domineering, but as caring and nurturing, challenging conventional gender expectations in both their relationships and broader social dynamics.

Therefore, we can conclude that Kurosawa and Karan are not part of the hegemonic masculinity, but rather embody a form a "new masculinity", which features include "economic achievement, intelligence, interpersonal skills, emotionally sensitive and self-expressive with women…" [27], in opposition with the traditional and hegemonic masculinity.

Adachi and Achi: typical uke/nai ek characters

First of all, we can observe that the power relationship between the two male leads of each series develops sine the very first episode of each show, through the self-depreciation of the nai ek when comparing himself to the phra ek. In the Thai version of *Cherry Magic*, Achi himself thinks on the day of his own birthday, when he brings Karan a piece of cake made by his colleagues, that "เรานี่เป็นคนตัวเล็ก ๆ ฮ่ะ เวลาอยู่ใกล้การันต์ ขนาดวันเกิดเราเอง เขาก็ยังดูสำคัญกว่าอีก (I feel so small when I'm next to Karan. Even on my own birthday, he still seems more important than me.)" (EP1, 22'10). This illustrates how masculinities can be understood in relations to other, and these relations often follow a hierarchical dynamic. Kurosawa/Karan is portrayed as the ideal man, admired by colleagues and embodying a bunch of traits associated with hegemonic masculinity. In contrast, Adachi/Achi represents a form of subordinate masculinity, as they lack the characteristics typically expected of the "perfect man." The following sections will examine how this dominance-subordination dynamic is further developed within both series.

Traditionally, the uke character is portrayed as less masculine than the seme and is often associated with femininity. Although both Adachi and Achi embrace a form of "new" and soft masculinity, they are still depicted as more feminine than Kurosawa and Karan.

Their feminine traits include:

- A less muscular physique (especially visible in the case of Achi)
- Fragility and clumsiness
- Kindness and emotional openness
- Lower career status compared to the seme character

There is a kind of physical dominance of the seme over the uke, reflected in their body characteristics. Achi is portrayed as clumsy, lacking confidence, and unathletic. In the first episode, he struggles to take the stairs to reach his office, just as Adachi does in the Japanese version. When he reads on the Internet about what happens to people when they turn 30, he sees that he will start experiencing back pain—something he is already feeling, subtly implying that he falls short of societal expectations of male physicality at his age (EP1, 9'20). When he compares his body to Karan's, he mumbles, "และหุ่นเราเหมือนกับก้อนเต้าหู้ (and my body is like tofu)" (EP3). However, despite this portrayal, the actor playing Achi (New Thitipoom Techaapaikhun) has a visibly muscular physique, indicating that even "soft masculinity" retains elements of traditional masculinity. Similarly, in episode 11, Achi admits he is so bad at soccer that he needs little kids to teach him. This scene was added in the Thai version, while in the Japanese original, Adachi is also depicted as clumsy and unathletic.

The onsen scene, where Achi compares his body to Karan's, was also an addition in the Thai version. One possible explanation is that revealing the character's body serves as a way to establish his "gay archetype," a classification of gay men based on their physical appearance. The MA thesis of Krittapol Sutheepattarakool explained that Kao (played by New Thitipoom Techaapaikhun), the nai ek of the Thai BL series series *Kiss Me Again* featuring the same ship as *Cherry Magic Thailand*, had a "หน้าตาดี ผิวขาว ปากแดง แก้มแดง (Jock) (good-looking, white skin, red lips, red cheeks (Jock))". Meanwhile, Pete, the phra ek of this series played by the actor Tay Tawan Vihokratana was qualified as "หน้าตาดี ผิวสองสี สมส่วน (Average) (good-looking, not very dark skin, lean" [28]. Displaying both characters' bodies in Cherry Magic Thailand can thus be understood as a strategy to reinforce masculinity hierarchies. In Thai BL conventions, darker skin and muscularity are associated with the sexually active role, further confirming the dominant/submissive dynamic between Karan and Achi—not only visually but also through dialogue and interaction.

Nevertheless, scenes existing in the Japanese original version show that Adachi is clumsy and not very sportive as well. In both versions, a scene show that their fragility makes them depending on the seme character: when Adachi and Fujisaki (EP4) and Achi and Pai (EP3) are assaulted by a group of hostile and aggressive men, the seme character come to save them as the uke one could not defend himself. Additionally, another sentence pronounced by a random male colleague indicates that Adachi is perceived as younger than Kurosawa (EP7, 6'08). This reproduces a common male-female dynamics present in more traditional dramas and lakhons.

Another key aspect is their kind-hearted nature. Kurosawa, after being comforted by Adachi, reflects on the qualities that made him fall in love with him: "しょっちゅう寝癖がついてて、自分のことはだらしないのに、仕事は丁寧で、人がいいから [...] (because he often comes to work with a bedhead, he is clumsy with himself, he is

careful with his job, he's a nice person […])" (EP7, 13'28), and a bit later "本当にやさしくていいやつで (He's really a kind and nice guy" (EP7, 14'58). In the Thai version, Karan also confesses what he likes in Achi after he recomforted him: "อยู่ดี ๆ ก็รู้สึกว่า ทำอะไรก็น่านัก (whatever he does, he looks cute)" (EP6, 15'03); "ที่สำคัญคือ อชิใจดีกับทุกคนจริง ๆ และยิ่งเราสังเกตก็ยิ่งได้รู้ว่า อชิกำลังทำให้ทุกอย่างให้บริษัทเราเพิ่ม โดยที่ไม่มีใครรู้ตัวเลยสักนิด (what's important is that Achi is kind with everyone, and the more I observe, the more I discover that Achi does everything for our company to develop, without anyone noticing it)" (EP6, 15'25). The cuteness (the bedhead can be viewed as cute), the kindness and the efforts of the uke to take care of the company as if it was his house is mentioned in both case. However, the Thai version invites us even more to do a comparison between the care that Achi takes to the company and his potential role as a housewife, because Karan concludes his monolog with "ใครจะดูแลอชิแหละ (who will take care of Achi?)" (EP6, 16'03), as if Karan needed to protect Achi while the latter was taking care of their house, reproducing heteronormative roles. In the fourth episode, Achi becomes sick, and Karan's older sister suggests that Karan move into Achi's house to take care of him. At first, Achi feels uncomfortable about inconveniencing Karan, but when his fever worsens and he becomes bedridden, he eventually asks: "อย่าหายไปไหนนะ (Please, stay here)" (EP5, 2'17). The use of the imperative, softened by the particle นะ [ná], shows that Achi is requesting help rather than issuing a strict command, which can be interpreted as a plea for protection. Later, when Karan sits by his bedside, their dynamic is further reinforced through their dialogue. Karan says: "ผมขอดูหน่อย (Let me see.)" (EP5, 4'19). This phrase, framed within a medical discourse, emphasizes Achi's need for care and assistance, reinforcing his fragile and dependent position as the uke. Karan's choice of language, particularly his use of the polite personal pronoun ผม (phŏm), maintains a level of gentleness and neutrality within their interaction. Later, during his trip to Nakhon Si Thammarat at the end of the series, Achi confesses to Karan: "ผมคงอ่อนแอจริง ๆ นะ (I may really be weak.)" (EP11, 35'24), confirming his need for the phra ek's protection, through both the adjective "weak" and the use of "นะ".

As he struggles to adapt to his new environment, this statement can be seen as another implicit request for Karan's support, further solidifying their caregiver-patient dynamic.

During their first official date, we learn more about the roles of Karan and Achi in the dynamics of their relationship. The salesman of the shop Karan buys Achi an expensive shirt for their first date "เวลาที่มีผู้ชายซื้อเสื้อให้ มันแปลว่า เขาอยากจะเป็นคนถอดเองครับ" (EP7, 14'50). This suggests that, from the salesman's perspective, what matters is not whether the relationship is heterosexual or homosexual, but rather the nature of the man's role. He could have used the neutral term คน (person), but instead, he deliberately says ผู้ชาย (man), implying a specific expectation of masculinity. Karan, therefore, is expected to assume the "man's role" (ผู้ชาย) in the relationship, whether his partner is male or female. Other aspects of their date reinforce traces of heteronormativity.

For instance, Karan, who was previously identified as the "man" in the relationship, is the one who pays for everything during their date. This line does not exist in the Japanese version, as this scene was added in the Thai adaptation. Nonetheless, in both cases, the uke characters function in contrast to the seme characters: they are portrayed as less masculine and in need of protection, reinforcing a trope commonly found in yaoi conventions.

However, a form of homosociality can be observed in the way the seme characters address their male partners. Kurosawa, for example, uses a more casual syntax when speaking to Adachi, omitting grammatical particles and adopting a neutral verbal form: "そっか、安達もラグナファンだったか[...]え？" (EP2, 3'30). This speech pattern suggests a friendly, informal relationship. By contrast, in the Thai version, Karan uses a more formal language level: he refers to himself using the pronoun ผม (standard and polite male first-person pronoun) and addresses Achi by his name, อชิ. While comparing the degrees of politeness between Japanese and Thai speech is complex, Karan's language use appears more formal than Kurosawa's.

Generally, men tend to use less polite speech than women, and they are even less polite when speaking to other men rather than to women [29]. However, this is not simply because men benefit from being impolite—rather, politeness (or its absence) is part of how they perform masculinity. Two hypotheses can explain this phenomenon: politeness is associated with femininity, and thus perceived as less masculine or even effeminate; politeness is linked to weakness, as it can be interpreted as a lack of power [30]. From this perspective, Kurosawa's speech patterns make him appear more masculine than Karan, yet still modern, in accordance with Marie Abbott's classification of male archetypes [31].

V. Conclusion

Language is a crucial tool in constructing the masculine identity of the characters in *Cherry Magic Japan* and *Cherry Magic Thailand*, shaping both how the male protagonists define themselves and how others describe them. Through this CDA case study, this article has been able to investigate how, through linguistic strategies, the main characters of *Cherry Magic* embody certain forms of idealized masculinities. The adjectives used to characterize the seme and uke reveal different degrees of masculinity, revealing semantics strategies to characterize their behaviors and physical appearances. For example, while Karan is frequently described as "หล่อ" (handsome), Achi is more often referred to as "น่ารัก" (cute). These words, of course, serve to orient the viewer's perception of the characters: being handsome or cute is subjective, but verbalizing these concepts makes them undeniable within the diegetic world.

Speech acts also help distinguish these varying expressions of masculinity. Whereas Adachi and Achi are

generally shy, sensitive, and self-deprecating, moments where Kurosawa and Karan expose their vulnerabilities or cry become significant plot events, reinforcing their usual portrayal as strong figures. Additionally, politeness serves as another key factor in understanding how these characters construct their masculinity through their social interactions.

Cherry Magic Thailand is a remake of the Japanese BL series *Cherry Magic Japan*, in which masculinity is constructed through a contrast between the seme (a physically strong, admired, and brave man) and the uke (a more fragile and shy man). However, both archetypes also incorporate elements of soft masculinity. The adaptation of a BL manga into two television series in different cultural contexts allows us to explore the concept of "nationless masculinity," a term that Sun Jung borrows from Iwabuchi to describe how soft masculinity functions as a "pan-Asian phenomenon". This concept helps explain how Thai BL series have become integrated into East Asian popular culture. Through this comparative analysis, we can see that Thai BL main characters loans the standards from Japanese BL characters, which are themselves both influenced by the shôjo and yaoi manga tropes born in Japan, then appropriated by the K-Pop industry, and eventually become a pan-Asian phenomenon [32].

In addition, hegemonic masculinity still exists in these series, even though it is not embodied by the main protagonists but by side ones. We could mention the bunch of aggressive men attacking the uke and his colleague at night in a scene present in both the series. In the Thai version, when Achi goes to the South to help the inauguration of a new branch of his company, his new colleagues are all heterosexual married men, playing soccer, liking to drink beer, spreading a heteronormative discourse (but they perfectly accept male-male relationships). Therefore, Cherry Magic Japan and Thailand depict a fictional world where many forms of masculinities are performed, but the narrative is focused on the new and soft masculiniti(e)s rather than the traditional and hegemonic ones.

Since the representation of masculinity in TV series (and more globally in mass media) is a vast topic that constantly evolves and might be different in a sociocultural context to another, this article was not able to cover all the possible configurations of this issue. Further research could investigate how linguistic strategies in the Japanese version and in the Thai one reflects different cultural standards, for example by studying those TV series provide a model for the male-male relationships, or even for the ideal representation of the work in a company. Other aspects beyond language should be analyzed too, such as the visual representations of the masculinity, paratextual construction of masculinity, etc.

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